SYLLABUS
ECE321 Electronics I

Winter 2008

Catalog

Introduction to solid state electronics, leading to the physical properties and characteristics of solid state electronic devices: diodes, bipolar junction transistors and field effect transistors. Analysis and design of analog systems and operational amplifier based amplifiers, active filters, oscillators and rectifier topologies. Application of a computer-aided design (CAD) tool, such as SPICE. Prerequisite: ECE222.

Coordinator

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Credits

4

Textbook(s)

Microelectronic Circuit Design (3rd Edition), Richard C. Jaeger & Travis N Blalok McGraw-Hill (2006) ISBN: 978-0-07-5319163-8, (required); [incl suppl probs]

Reference(s)

The Spice Book, *Andrei Vladimirescu*, Wiley, 1994, ISBN 0-471-6926-9, 1st Ed.
SPICE, *G.W.Roberts & A.S.Sedra*, OUP, 1997, other similar Spice support text, e.g. Tuinenga, Banzhaf, Rashid, Keown, Hambley “Electrical Engineering, 3e” Appendix D, (all P-H) [Optional]

Prerequisites

By course number:

- ECE222

By topic:

- Linear circuit analysis: Norton/Thevenin, node/mesh analysis
- Ideal operational amplifiers and circuits
- Transfer functions and circuit responses in the time and frequency domains
- Spice, (or similar circuit simulator)

Corequisites

By course number:

- ECE301 (Mon 10.00-12.50; Tues 13.00-15.50)

Grading

- Eight weekly assignments (8 x 2.5% = 20%)
- Two mid-term tests (2 x 20%) & one final exam (20%)
- Seven ECE301 experiments (20%)

Grading Scale

Letter Grade	Range
A	90+
A-	85 - 90
B+	80 - 85
B	75 - 80
B-	70 - 75
C+	65 - 70
C	60 - 65
C-	55 - 60
D+	50 - 55
D	45 - 50
D-	40 - 45
F	40-

Course Outcomes

- Ability to analyze and design analog amplifiers & systems.
- Understand the principles of solid-state material properties (energy band structures, conductivity through drift and diffusion, PN-junctions)
- Ability to analyze and design diode circuits for power conversion and wave-shaping.
- Understand the semiconductor principles of Bipolar Junction Transistor (BJT) and Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET) operation.
- Ability to analyze and design single-BJT amplifiers (in all three topologies) and switches (including biasing.)
- Ability to analyze and design single-MOSFET amplifiers (in all three topologies) and switches (including biasing.)
- Ability to use circuit simulation tools for the design and analysis of OPAMP, diode, BJT, and MOS circuits.

Course/Program outcome mapping

Structure

- Two 110 minute lecture periods per week.
- Weekly homework and reading assignments
- Two mid-term tests and one final exam
- (Occasional in-class “pop” quizzes possible)
- ECE301 lab (separate registration) grades included
- (“On-line” project/assignment/questionnaire)

Topics

I. **Introduction to Electronics.** Signal classification & spectrum; amplifiers, circuit models, & frequency response; digital logic inverter; ideal op-amp review. (2 hours)

II. **Analog Amplifiers and Systems.** Amplification; biasing, distortion, frequency

response, 2-port models, matching. (4 hours)

III. **Solid-state Electronics.** Semiconductors: drift & diffusion currents; covalent bonds, doping, & energy band models; mobility & resistivity; PN junction; MOSFET structure & operation; BJT structure & operation. (6 hours)

IV. **Diodes.** Diode characteristics; diode models; zener diodes ; rectification ; clipping & clamping; op-amp superdiode. (8 hours)

V. **Bipolar Junction Transistors.** BJT characteristics & operation regions; BJT switch & inverter; single-stage amplifier topologies; DC analysis & biasing; small signal operation & models; high-frequency effects & CE frequency response; Spice model. (8 hours)

VI. **MOSFETs.** MOSFET characteristics & operation regions; MOSFET switch & amplifier; DC analysis & biasing; small signal operation & models; single-stage amplifier topologies; high-frequency effects & CS frequency response; CMOS inverter, Spice model. (6 hours)

Assignments

Problems assigned odd-numbered lectures, due at next odd-numbered lecture, returned next lecture. (Assign #7 avail for collection Office Fri 14th March)

Final exam:
Mon 17th March
17.30 – 19.20
covers
lectures 13-17

Week	Reading	Homework problems	ECE301 Lab
1 Jan 7	1. Intro; Ch 1 2. Ch 2.1 - 2.6		Lab organization mtg
2 Jan 14	3. Ch 2.7 - 2.11 4. Ch 3.1 - 3.5	1. Chapters 1 & 2	Expt 1: LTSpice Intro.
3 Jan 21	MLK Day 5. Ch 3.7 - 3.10	2: Sections 3.1 – 3.10	
4 Jan 28	6. Ch 3.11 - 3.13 7. Ch 3.14 – 3.18	3. Sections 3.11 – 3.18	Expt 2: Audio Equalizer
5 Feb 4	8 Ch 4.1 – 4.2 9. Ch 4.3 – 4.7	4. Sections 4.1 – 4.7	Expt 3: Diode Charac
6 Feb 11	Mid-term test: lectures 1 - 7 10. Ch 4.8		Expt 4: Diode Circuits
7 Feb 18	11. Ch 4.9 – 4.10 12. Ch 5.1 – 5.5	5. Sections 4.8 – 4.10	Expt 5: MOSFETs
8 Feb 25	13. Ch 5.7 – 5.7 14. Ch 5.8 – 5.10	6. Sections 5.1 – 5.7	Expt 6: BJT Biasing
9 Mar 3	Mid-term test: lectures 8 - 12 15. Ch 5.11 – 5.12	7. Sections 5.8 - 5.12	Expt 7: BJT Amplifiers
10 Mar 10	16. Ch 10.1 – 10.5 17. Ch 10.6 – 10.7	8. Chap 10, due at final	

Prepared by: James E. Morris *Updated: Jan 3rd, 2008*

Notes: Course information (outline, assignments, textbook errata, selected answers to problems) at: http://www.ece.pdx.edu/~jmorris/ece321. On-line course website at www.aris.mhhe.com (Section code: 6A3-6A-7BA)

Teaching Assistants

ECE321:

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