# EEE 102L Analog/Digital Electronics Laboratory

## Service Course

**2004 – 2006 Catalog Data:** EEE 102L. Analog/Digital Electronics Laboratory. Introduction to analog/digital electronics, diodes, FET's, BJT's, DC biasing, VI characteristics, single stage amplifiers, power supplies and voltage regulators, power electronic devices, OP-amps, active filters, A/D and D/A converters. PSPICE used extensively. Note: Cannot be taken for credit by E&EE Majors. Prerequisite: ENGR 017. Corequisite: EEE 102. 1 unit.

**Text:** Jaeger, R.C., Microelectronic Circuit Design, 2nd Edition, McGraw-Hill, 2004, ISBN 0-07-232099-0

**Support Software:** Herniter, M.E., Schematic Capture with Cadence PSpice, Prentice-Hall, 2nd Edition, 2003, ISBN 0-13-048400-8.

## Course Goals:

1. To reinforce learning in the accompanying EEE 102 course through hands-on experience with electronic circuit analysis, design, construction, and testing.
2. To provide the student with the capability to use LabVIEW and PSpice software as tools in electronic circuit analysis and design, and in future courses, design projects, and professional work assignments.

## Prerequisites by Topic:

1. General knowledge of a structured programming language (i.e. C++).
2. Basic physical concepts of electricity and magnetism.
3. Basic circuit analysis concepts and procedures.

## Topics Covered/Class Schedule/Evaluation:

### Topics

1. Introduction to Software Tools and Workstation Equipment: Introduction to PSpice Schematic Circuit Construction and Analysis; Introduction to LabVIEW Virtual Instrument Workstation Operation and A/D Conversion
2. Solid State Diodes and Diode Circuits: Diode Characteristics in Forward and Reverse Bias Conditions; Power Supplies and Wave Shaping Circuits
3. Field Effect Transistors: FET Characteristics; Operating Regions and Characteristics of NMOS Devices; MOSFET Biasing Circuits, Analysis, Design, Construction, Testing, and Simulation
4. Bipolar Junction Transistors: Operating Regions and Characteristics of the BJT; Forward-Active Region Analysis and Design; BJT Biasing Circuits, Analysis, Design, Construction, Testing, and Simulation
5. Small-Signal Modeling and Linear Amplification: The BJT Common-Emitter Amplifier Analysis, Design, Construction, Testing and Simulation
6. Operational Amplifiers: The Differential Amplifier; Frequency Response; Input/Output Impedance; Instrumentation Amplifiers; Common Mode Signal Analysis; Active Filters

### Course Outline

| *Week* | *Topic* | *Lab #* | *Report Due* |
|---|---|---|---|
| 1 | Introduction to the Lab | none | |
| 2 | Introduction to PSpice | 1 | |
| 3 | Introduction to LabVIEW VI Operations | 2 | |
| 4 | Diode Characteristics 1 | 3 | R (Labs 1 & 2) |
| 5 | Diode Characteristics 2 | 3 | |
| 6 | Diode Circuits 1 | 4 | |

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|---|---|---|---|
| 7 | Diode Circuits 2 | 4 | |
| 8 | Field Effect Transistor Characteristics | 5 | R (Labs 3 & 4) |
| 9 | FET Bias Circuits | 5 | |
| 10 | Bipolar Junction Transistor Characteristics | 6 | |
| 11 | BJT Bias Circuits | 6 | |
| 12 | C-E Amplifier Design and Simulation | 7 | R (Labs 5 & 6) |
| 13 | C-E Amplifier Construction & Testing | 7 | |
| 14 | Op-Amp Instrumentation Amplifier | 8 | |
| 15 | Op-Amp Bandpass Filter | 8 | |
| Exam Week | | | R (Labs 7 & 8) |

## Evaluation

*Laboratory Reports: Eight formal laboratory reports are required. Note that they are due two at a time according to the schedule above. The first six count 10 points each; the last two count 20 points each for a total of 100 points. Reports will be graded based upon written quality, format, content, and correct data analysis. Late reports will have 1 point deducted for the first week that they are late, and will NOT be accepted for credit after that week.*
***Plagiarized reports will NOT be accepted.***

## Science and Design Content Distribution

Design – 1 unit or 100%

## Contribution of Course to the Professional Education Component:

1. Laboratory exercises include practical electronic circuit design and analysis problems with realistic source and load constraints. Actual circuit construction and testing are emphasized equally with simulation
2. LabVIEW and PSpice analysis and design applications introduce students to major professional engineering software tools.

## Relationship of Course to Program Outcomes:

1. #4 Knowledge of Engineering core: This course adds electronic circuit analysis and design applications to fundamental concepts of circuit analysis, and computer programming.
2. #7 Use of contemporary tools for analysis and design: This course applies computer methods using PSpice and LabVIEW software tools to electronic circuit analysis and design.

**Course Coordinator:** John Oldenburg, EEE **Date:** January 15, 2005