E. COMPUTER ENGINEERING COURSES

COEN 2111: Circuits I Lab
COEN 2311: Circuits I
COEN 3312: Circuits II
COEN 3322: Signals and Systems
COEN 3323: Digital Systems
COEN 3421: Electronics I
COEN 4322: Digital Signal Processing
COEN 4331: Network Theory

Course Title: COEN 2111: Circuits I Lab

Semester Credit Hours: 1 (0,3)

I. Course Overview

This course covers experimental aspects of the topics covered in COEN 2311: Circuits I. Topics include basic bread-boarding techniques and circuit construction; use of multimeters, oscilloscopes, power supplies, and function generators; DC and AC voltage and current measurement techniques; troubleshooting techniques; and comparison of experimental and simulated circuits.

II. PMU Competencies and Learning Outcomes

Skills in design, construction, measurement, and analysis of DC and AC circuits are major components of professional competence for electrical and computer engineers. Throughout the semester, students are encouraged to apply critical thinking and problem solving skills in laboratory exercises and projects. Professional communication skills (written and oral) are encouraged through lab participation and assignments. Effective use of the most modern technology is integral to the development of the knowledge and skills acquired in this class.

III. Detailed Course Description

This course covers experimental aspects of the topics covered in COEN 2311: Circuits I. Topics to be covered include basic bread-boarding techniques and circuit construction; use of multimeters, oscilloscopes, power supplies, and function generators; DC and AC voltage and current measurement techniques; troubleshooting techniques; and comparison of experimental and simulated circuits.

IV. Requirements Fulfilled

This is a required course for majors in computer engineering

V. Required Prerequisites

Successful completion of:

- MATH 1324: Calculus III
- PHYS 1422: Physics for Engineers II

Completion of or concurrent registration for:

- MATH 2332: Differential Equations
- COEN 2331: Circuits I

VI. Learning Outcomes

At the end of this course, students will:

- Be able to accurately measure current, voltage, energy, and power in DC and AC circuits
- Be able to experimentally determine time constants from RC and RL circuits
- Measure an unknown circuit and create an accurate model of its performance from these measurements
- Be able to analyze DC and AC circuits using MATLAB and PSPICE and compare these results to those experimentally measured.

In addition to these outcomes, students develop an understanding of the relationship between the experimental reality and simulation of DC and AC circuits.

VII. Assessment Strategy

The assessment strategy measures students' understanding of circuit theory and apply the knowledge acquired in the analysis and design. This is achieved in the following ways:

- Lab exercises are used to help indicate to the instructor and the student his or her level of involvement and understanding.
- Lab projects are used to provide feedback to students and to indicate individual progress in meeting course goals
- Lab exams are used to indicate students' developing level of mastery of the topics of the course
- An end-of-semester lab practical exam is used to measure the student's mastery in understanding and application of the knowledge integral to the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. In addition, students keep an engineering notebook which accurately reflects all activities done in the course.

VIII. Course Format

The course is taught in a studio format where students alternate between lecture, simulation, and experiment. Preparation for lab by reading the laboratory assignment and doing the pre-lab assignments is required so that students come to class ready to do the required work. This also indicates a student's commitment to professional growth.

Classroom Hours: **Class lecture: 0 hour per week**
Lab Session: 3 hours per week

IX. Topics to be Covered

A. Basic bread boarding techniques and circuit construction.
B. Importance and use of engineering notebooks.
C. Introduction to multimeters, power supplies, oscilloscopes, and function generators.
D. Voltage and current measurements
E. Simulation of DC and AC circuits using PSPICE®.
F. Analysis of DC and AC Circuits using MATLAB® and PSPICE®.
G. Troubleshooting techniques for DC and AC circuits
H. Design of circuits using op-amps
I. Creation of equivalent circuit models via voltage and current measurements

X. Laboratory Exercises

The main focus of this course is laboratory exercises and projects. Labs are followed the topics to be covered and consists of each of the following: background information, pre-lab exercises, in-lab exercises, and post-lab questions and exercises. All of this information is kept in an engineering notebook.

XI. Technology Component

Students in this class are expected to have a computer account with the appropriate server to enable class communications. Media assisted instruction is a tool in this class. Use of appropriate technology for analysis of data and completion of problems is required, for example, use of a scientific calculator, use of student owned laptop. Students utilize the application software packages (MATLAB and PSPICE) in lab.

XII. Special Projects/Activities

A student project is not required for this class.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Robert A. Witte, *Electronic Test Instruments: Analog and Digital Measurements*, Second Edition, Prentice Hall PTR, 2002

B. Alternative Textbooks

None

C. Supplemental Materials

1. Scientific calculator
2. Laptop Computer
3. MATLAB® and PSPICE® access
4. Engineering notebook

Course Title: COEN 2311: Circuits I
Also listed as GEEN 2314: Circuits I

Semester Credit Hours: 3 (3,1)

I. Course Overview

This course covers important theory in DC and AC circuits analysis. Topics include a review of the solution of simultaneous equations; Kirchoff's Current and Voltage Laws; nodal and mesh circuit analysis; superposition; source transformations; Thevenin and Norton Equivalent circuits; ideal op-amps; and RC, RL, and RLC circuits.

II. PMU Competencies and Learning Outcomes

Skills in understanding of DC and AC circuit theory are major components of professional competence for electrical and computer engineers. Throughout the semester, students are encouraged to apply critical thinking and problem solving skills in the class discussions and assignments. Professional communication skills (written and oral) are encouraged through discussions and assignments. Effective use of the most modern technology is integral to the development of the knowledge and skills acquired in this class.

III. Detailed Course Description

This course covers important theory in DC and AC circuits analysis. Topics include a review of the solution of simultaneous equations; Kirchoff's Current and Voltage Laws; nodal and mesh circuit analysis; superposition; source transformations; Thevenin and Norton Equivalent circuits; ideal op-amps; and RC, RL, and RLC circuits.

IV. Requirements Fulfilled

This is a required course for majors in computer engineering

V. Required Prerequisites

Successful completion of:

- MATH 1324: Calculus III
- PHYS 1422: Physics for Engineers II

Concurrent registration for:

- COEN 2111: Circuits Lab

Completion of or concurrent registration for:

- MATH 2332: Differential Equations

VI. Learning Outcomes

At the end of this course, students will:

- Be able to accurately define current, voltage, energy, and power in DC and AC circuits
- Be able to solve for current, voltage, stored energy, and power in DC and AC circuits using the following techniques: Kirchoff's current and voltage laws; node voltage analysis; mesh current analysis; superposition; and source transformations.
- Be able to define time constants for RC and RL circuits
- Be able to calculate the total response of RC, RL, and RLC circuits

In addition to these outcomes, students develop an intuitive understanding of DC and AC circuits such that they can use this intuition in the analysis and design of circuits

VII. Assessment Strategy

The assessment strategy measures students' understanding of circuit theory and apply the knowledge acquired in the analysis and design. This is achieved in the following ways:

- Class participation is used to help indicate to the instructor and the student his or her level of involvement and understanding.
- Homework assignments are used to provide feedback to students and to indicate individual progress in meeting course goals
- Mid-term examinations are used to indicate students' developing level of mastery of the topics of the course
- An end-of-semester final examination is used to measure the student's mastery in understanding and application of the knowledge integral to the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. In cooperation with the instructor, each student select two design assignments to become a part of the student's portfolio.

VIII. Course Format

The course consists of lectures, class discussions, homework assignments to be completed outside of class, and examinations. Students prepare for class by reading the text and additional materials and by completion of assignments so that they may be discussed in class are expected as indicators of students' commitment to professional growth. In addition, a recitation session is used to give students practice and supervised instruction in the analysis of DC and AC circuits.

Classroom Hours: **Class lecture: 3 hours per week**
Recitation Session: 1 hour per week

IX. Topics to be Covered

A. Definition of physical quantities: current, voltage, energy, and power
B. Basic circuit components
C. Voltage and current laws
D. Nodal and mesh analysis
E. Superposition and source transformation
F. Thevenin and Norton equivalent circuits
G. Operational amplifiers
H. Capacitors and inductors
I. RL and RC circuits
J. RLC circuits

X. Laboratory Exercises

There are no laboratory exercises associated with this course. Students receive this experience in COEN 2111: Circuits I Lab.

XI. Technology Component

Students in this class are expected to have a computer account with the appropriate server to enable class communications. Media assisted instruction is a tool in this class. Use of appropriate technology for analysis of data and completion of problems is required, for example, use of a scientific calculator, and use of student owned laptop. Students utilize the application software packages (MATLAB and PSPICE) in homework problems.

XII. Special Projects/Activities

A student project is not required for this class.

XIII. Textbooks and Teaching Aids

A. Required Textbook

William Hayat, Jack Kemmerly, and Steven Durbin, *Engineering Circuit Analysis*, Sixth Edition, McGraw-Hill, 2002

B. Alternative Textbooks

None

C. Supplemental Textbooks

John O'Malley, *Schaum's Outline of Basic Circuit Analysis*, Second Edition, McGraw-Hill, 1992.

D. Supplemental Materials

1. Scientific calculator
2. Laptop Computer
3. MATLAB® and PSPICE® access either on laptop or in a general purpose computer lab
4. Engineering paper
5. CRC Standard Mathematical Tables and Formulae, Daniel Zwillinger

Course Title: COEN 3312: Circuits II
Also listed as EEEN 3312: Circuits II

Semester Credit Hours: 3 (2,2)

I. Course Overview

This course is a continuation of COEN 2311: Circuits I. Topics include a review of DC and AC circuit analysis techniques; complex numbers and phasors; use of phasors in the analysis of AC circuits; AC power concepts; polyphase circuits; magnetically coupled circuits; applications of Laplace and Fourier transforms in circuit analysis; s-domain circuit analysis; Bode plots; and filters.

II. PMU Competencies and Learning Outcomes

Skills in understanding of DC and AC circuit theory are major components of professional competence for electrical and computer engineers. Throughout the semester, students are encouraged to apply critical thinking and problem solving skills in the class discussions and assignments. Professional communication skills (written and oral) are encouraged through discussions and assignments. Effective use of the most modern technology is integral to the development of the knowledge and skills acquired in this class.

III. Detailed Course Description

Topics include a review of DC and AC circuit analysis techniques (covered in COEN 2311: Circuits I).; complex numbers and phasors; use of phasors in the analysis of AC circuits; AC power concepts; polyphase circuits; magnetically coupled circuits; applications of Laplace and Fourier transforms in circuit analysis; s-domain circuit analysis; Bode plots; and filters.

IV. Requirements Fulfilled

This is a required course for majors in computer engineering

V. Required Prerequisites

Successful completion of:

- MATH 2332: Differential Equations
- COEN 2311: Circuits I
- COEN 2111: Circuits I Lab

VI. Learning Outcomes

At the end of this course, students will:

- Be able to accurately define impedance and admittance; instantaneous, average, and reactive power; the power factor for a given load; mutual and self inductance; poles and zeros in circuit transfer functions; and resonance frequency.
- Be able to analyze AC circuits using phasors, Laplace transforms, and Fourier Transforms.
- Be able to calculate the rms value of a time-varying waveform
- Be able to calculate instantaneous power, average power, reactive power, and the power factor of a load in normal and polyphase circuits
- Be able to analyze circuits containing ideal transformers
- Be able to calculate the frequency response of AC circuits

VII. Assessment Strategy

The assessment strategy measures the student's understanding of circuit theory and apply the knowledge acquired in the analysis and design. This is achieved in the following ways:

- Class participation is used to help indicate to the instructor and the student his or her level of involvement and understanding.
- Homework assignments are used to provide feedback to students and to indicate individual progress in meeting course goals
- Design problems using PSPICE are used to provide students with advanced design and analysis problems, done either individually or in groups, that focus on advanced critical thinking and problem solving skills
- Mid-term examinations are used to indicate students' developing level of mastery of the topics of the course
- An end-of-semester final examination is used to measure the student's mastery in understanding and application of the knowledge integral to the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. In cooperation with the instructor, each student selects two design assignments to become a part of the student's portfolio.

VIII. Course Format

The course consists of lectures, class discussions, homework assignments to be completed outside of class, and examinations. Students prepare for class by reading the text and additional materials and by completion of assignments so that they may be discussed in class are expected as indicators of students' commitment to professional growth.

Classroom Hours:	**Class lecture: 2 hours per week** **Recitation Session: 2 hours per week**

IX. Topics to be Covered

A. Sinusoidal steady-state analysis
B. Power calculations in AC circuits
C. Polyphase circuits
D. Magnetically coupled circuits
E. Complex frequency and the Laplace Transform
F. S-domain circuit analysis
G. Frequency response of AC circuits
H. Two-port networks
I. Fourier circuit analysis

X. Laboratory Exercises

There are no laboratory exercises associated with this course.

XI. Technology Component

Students in this class are expected to have a computer account with the appropriate server to enable class communications. Media assisted instruction is a tool in this class. Use of appropriate technology for analysis of data and completion of problems is required, for example, use of a scientific calculator, and use of student owned laptop. Students utilize the application software packages (MATLAB and PSPICE) in homework problems.

XII. Special Projects/Activities

A student project is not required for this class.

XIII. Textbooks and Teaching Aids

A. Required Textbook

William Hayat, Jack Kemmerly, and Steven Durbin, *Engineering Circuit Analysis*, Sixth Edition, McGraw-Hill, 2002

B. Alternative Textbooks

None

C. Supplemental Textbooks

Mahmood Nahvi and Joseph A. Edminister, *Schaum's Outline of Electric Circuits*, Fourth Edition, McGraw-Hill, 2002

D. Supplemental Online Materials

1. Scientific calculator
2. Laptop computer
3. MATLAB and PSPICE access either on laptop or in a general purpose computer lab
4. Engineering paper
5. CRC Standard Mathematical Tables and Formulae, Daniel Zwillinger

Course Title: COEN 3322: Signals and Systems
Also listed as EEEN 3341: Signals and Systems

Semester Credit Hours: 3 (3,0)

I. Course Overview

This course presents instruction in electrical signals and systems. Subject matter includes types of signals and systems, signal and system modeling, Fourier Series, Fourier Transform and applications, Laplace Transform and applications, state variable techniques, discrete time signals and systems.

II. PMU Competencies and Learning Outcomes

Understanding and use of electrical signals and systems as taught in this course are major components of professional competence for engineers globally. Throughout the semester, students are helped to apply critical thinking and problem solving skills in discussions, assignments, and projects. Professional leadership and teamwork are stressed and modeled throughout discussions and projects. Active communication skills are encouraged through discussions and through written assignments. Students are led to develop awareness of the professional role of engineers. Effective use of technology is integral in the analysis and design of signals and systems in the course.

III. Detailed Course Description

This course teaches the analysis and design of electrical circuits, devices, and systems. Students are introduced to types of signals, types of systems, the properties of systems, and convolution. Fourier series, transforms, and applications are covered. Laplace transforms and applications are covered. State variable techniques and z-transforms are taught. Problems are presented to help students identify real-life problems and formulate solutions using the skills developed in the course.

IV. Requirements Fulfilled

This is a required course for all computer engineering majors.

V. Required Prerequisites

Successful completion of:

- COEN 3312: Circuits II

VI. Learning Outcomes

In this course, students learn:

- To model linear systems and composite signals.
- To model systems using time domain techniques.
- To apply the Fourier Series to signals.
- To apply the Fourier Transform to signals.
- To use the Laplace Transform to model systems.
- Applications of the Laplace Transform.
- To apply State Variable techniques to linear systems.
- Discrete time signals and systems.

VII. Assessment Strategy

The assessment strategy measures the student's understanding of types of signals and systems, time domain modeling, Fourier Series, Fourier Transform and applications, the Laplace Transform and applications, the ability to apply State Variable techniques to linear systems, and understanding of discrete time signals and systems.

- Class participation is used to indicate each student's level of involvement and understanding of the learning process
- Homework assignments are graded to give feedback to students and to indicate individual's progress in achievement of understanding
- A mid-term examination is used to indicate students' level of mastery
- A student project is assigned, due before the final exam, to encourage student initiative and to measure each student's mastery of skills and ability in the application of principles.
- An end-of-semester final examination is used to indicate the student's maturity in understanding and application of the information and abilities addressed.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. Students' preparation for the capstone experience is enhanced through progressive skill building in active oral and written communication, decision making, problem solving, professional demeanor and commitment. In cooperation with the instructor, each student selects one assignment or project to become a part of the student's portfolio.

VIII. Course Format

The class consists of lectures, class discussions, written assignments to be completed outside of class, examinations, and a student project. Students are expected to attend class and to participate in discussions and problem solving assignments. Students prepare for class by reading the text and additional resources and by completion of assignments so that they may be discussed in class are expected as indicators of students' commitment to professional growth.

Classroom Hours:	**Class: 3 hours per week** **Project development: Time each week as needed outside of class**

IX. Topics to be Covered

A. Signal and system modeling
B. Time domain modeling of systems
C. Fourier Series
D. Fourier Transform and applications
E. Laplace Transform and applications
F. State variable techniques
G. Z-Transforms
H. Problem solving using the above
I. Consideration of professional ethics, codes, and standards

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

Students are expected to have a computer account with the appropriate server to enable class communications. Media assisted instruction is a tool in this class. Appropriate technology for analysis of data and completion of designs is required, for example, use of an engineering calculator, and use of the university computer labs. Completing assignments and examinations requires use of a personal computer and/or university computer labs. Use of the Internet may be indicated to support global understanding of applicability of skills.

XII. Special Projects/Activities

This course incorporates a student project in which students are required to apply the ability to analyze electrical circuits, devices, and systems. The project requires problem solving and the experimental design of circuits, devices, and systems to achieve an applicable solution.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Ziemer, Tranter, and Fannin, *Signals and Systems: Continuous and Discrete*, 4thed., Prentice Hall, 1998.

B. Alternative Textbooks

None

C. Supplemental Materials

1. *CRC Standard Mathematical Tables and Formulae*, CRC Press
2. *Schaum's Outline Mathematical Handbook*, McGraw-Hill
3. Engineer's computation pad

Course Title: COEN 3323: Digital Systems (with Lab)
Also listed as EEEN 3331: Digital Systems (with Lab)

Semester Credit Hours: 3 (2,3)

I. Course Overview

This course addresses the understanding and design of digital systems. Topics progress through Boolean algebra and logic gates; combinational logic; sequential logic and synchronous sequential logic systems; and design of logic circuits.

II. PMU Competencies and Learning Outcomes

Knowledge of digital systems and skill in their design, as taught in this course, are major components world wide of professional engineering practice. Throughout the semester, students are assisted to develop this knowledge and skill. Students are encouraged in development of professional engineering competencies including critical thinking skills, problem solving skills, and application of these in class discussions, assignments, and lab exercises. Professional demeanor and a team approach to understanding problems are practiced throughout lectures and discussions. Professional active communication skills (written and oral) are encouraged through discussions and assignments. Students are led to develop awareness of the professional role and responsibilities of engineers in a global society. Effective use of the most modern technology is integral to the development of the knowledge and skills acquired in this course.

III. Detailed Course Description

This course presents students with knowledge and design applications in the field of Digital Systems. Students are led from the basics of Boolean algebra and logic gates through increasing understanding to the design of logic circuits.

IV. Requirements Fulfilled

This is a required course for majors in computer engineering

V. Required Prerequisites

Successful completion of:

- COEN 2311: Circuits I
- COEN 2111: Circuits I Lab

VI. Learning Outcomes

In this course, students:

- Acquire the ability to formulate and solve problems involving Boolean algebra.
- Learn to design digital systems using simple logic elements.
- Learn to apply Karnaugh Maps to digital logic systems.
- Develop understanding of digital codes and number systems.
- Develop understanding of sequential logic circuits and their applications.

VII. Assessment Strategy

The assessment strategy measures a student's understanding of digital systems and their design.

- Class participation is monitored as an indicator of each student's level of involvement, understanding, and commitment
- Homework and lab assignments are utilized to provide feedback to students and to indicate individual progress in achievement of understanding.
- A student project and report are required as measures of the student's ability to integrate knowledge acquired and apply it in real-world examples.
- Communication skills are measured through the student's in-class participation in discussions, written assignments, and presentation of the student report.
- Examinations are used to indicate student's progress in mastery of course content and lab expertise
- An end-of-semester final examination is used to measure the student's mastery in understanding and application of the knowledge and design skills in the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. Student's preparation for the capstone experience is enhanced through progressive skill building in active listening, oral and written communication, decision making individually and as a team member, problem solving, and professional viewpoint. In cooperation with the instructor, each student selects one assignment to become a part of the student's professional portfolio.

VIII. Course Format

The class consists of lectures, class discussions, written assignments to be completed outside of class, lab assignments, a student project and report, and examinations.

Classroom Hours: **Class: 2 hours per week classroom lecture**
Lab: 3 hours per week

IX. Topics to be Covered

A. Introduction to digital concepts
B. Number systems
   1. Operations
   2. Codes
C. Logic gates
D. Boolean Algebra and logic simplification
E. Karnaugh Maps
F. Combinational logic
G. Sequential logic circuits
H. Memory and storage
I. Introduction to microprocessors
J. Integrated circuit technologies

X. Laboratory Exercises

Weekly lab exercises supplement instruction in the classroom and provide each student with hands-on utilization of digital system hardware and measurement instrumentation. Weekly labs are performed on topics as follows:

A. Instruments and measurements
B. Logic gates and Boolean laws
C. DeMorgan's Theorems
D. Combinational logic circuits
E. Universal property of NAND and NOR gates
F. Adders and multiplexeres
G. Encoders and decoders
H. Seven-segment display
I. Comparators
J. Look-ahead carry adders
K. Arithmetic logic unit
L. Latches and flip-flops
M. Counters
N. Shift registers

XI. Technology Component

A. Students in this class are expected to have a computer account with the appropriate server to enable class communications. Media assisted instruction is a tool in this class. Use of appropriate technology for assignments and in-class work is required, for example, use of a scientific calculator, and use of the university computer labs. Use of the Internet may be indicated as notified by the instructor to support global understanding of applications.

B. Lab work for this course is completed using the lab exercises and appropriate technology in the PMU Digital Systems and Computer Architecture Laboratory. The lab experience is designed to integrate knowledge and theory into applied practice.

XII. Special Projects/Activities

Students complete a project and present a project report (written and oral presentation). The project should demonstrate the student's ability to utilize the knowledge acquired in an application of professional quality.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Thomas L. Floyd, *Digital Fundamentals*, 8th ed., Prentice Hall, 2003

B. Alternative Textbooks

None

C. Supplemental Print Materials

As notified by the instructor.

D. Supplemental Online Materials

As notified by the instructor.

Course Title: COEN 3421: Electronics I (with Lab)
Also listed as EEEN 3421: Electronics I (with Lab)

Semester Credit Hours: 4 (3,3)

I. Course Overview

This course is the first of two courses in the use of electronic devices in analog and digital circuits. The lecture component covers device physics and modeling of op-amps, diodes, FETs, and BJTs; single and multi-stage amplifiers; differential amplifiers; feedback; frequency response; Bode plots. Laboratory component covers generation and acquisition of signals; current, voltage, and impedance measurements; transfer function measurement; and spectrum measurements and analysis.

II. PMU Competencies and Learning Outcomes

Skills in analyzing and designing analog and digital circuits are major components of professional competence for electrical and computer engineers. Throughout the semester, students are encouraged to apply critical thinking and problem solving skills in the class discussions, assignments, and lab activities. Professional communication skills (written and oral) are encouraged through discussions and assignments. Effective use of the most modern technology is integral to the development of the knowledge and skills acquired in this class.

III. Detailed Course Description

This course is the first of two courses in the use of electronic devices in analog and digital circuits. The lecture component covers device physics and modeling of op-amps, diodes, FETs, and BJTs; single and multi-stage amplifiers; differential amplifiers; feedback; frequency response; Bode plots. Laboratory component covers generation and acquisition of signals; current, voltage, and impedance measurements; transfer function measurement; and spectrum measurements and analysis.

IV. Requirements Fulfilled

This is a required course for all computer engineering majors.

V. Required Prerequisites

Successful completion of:

- COEN 2311: Circuits I
- COEN 2111: Circuits I Lab

Completion of concurrent registration for:

- COEN 3312: Circuits II

VI. Learning Outcomes

At the end of this course, students will:

- Be able to accurately define current, voltage, and power gain in amplifiers
- Be able to accurate calculate the current-voltage characteristics of diode, FETs, and BJTs
- Be able to define the small-signal characteristics of FETs and BJTs
- Be able to use small-signal circuit models of FETs and BJTs in the analysis of circuits
- Be able to calculate the frequency response of circuits
- Be able to analyze circuits using diodes, FETs, and BJTs using modern electronics instrumentation

VII. Assessment Strategy

The assessment strategy measures the student's understanding of electronics and apply the knowledge acquired in the analysis and design of circuits. This is achieved in the following ways:

- Class participation is used to help indicate to the instructor and the student his or her level of involvement and understanding.
- Homework assignments are used to provide feedback to students and to indicate individual progress in meeting course goals
- Design problems – conducted both experimentally in the lab and theoretically using PSPICE® – are used to provide students with advanced design and analysis problems, done either individually or in groups, that focus on advanced critical thinking and problem solving skills
- Mid-term examinations are used to indicate students' developing level of mastery of the topics of the course
- An end-of-semester final examination is used to measure the student's mastery in understanding and application of the knowledge integral to the course.
- An end-of-semester lab practical exam is used to measure the student's mastery in understanding and application of the knowledge integral to the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. In cooperation with the instructor, each student selects a design problem to become a part of the student's portfolio. In addition, each student keeps an engineering notebook which accurately reflects all activities done in the lab portion of this course.

VIII. Course Format

The course consists of lectures, class discussions, homework assignments to be completed outside of class, laboratory exercises and projects, and examinations. Students prepare for class by reading the text and additional materials and by completion of assignments so that they may be discussed in class are expected as indicators of the student's commitment to professional growth.

Classroom Hours: **Class: 3 hours per week**
Lab: 3 hours per week

IX. Topics to be Covered

A. Introduction to electronics: signals and amplifiers
B. Operational amplifiers
C. Diodes
D. MOS field-effect transistors (MOSFETs)
E. Bipolar junction transistors (BJTs)
F. Single-stage amplifiers
G. Differential and multistage amplifiers

X. Laboratory Exercises

All laboratory exercises are designed to provide students with expertise needed to make measurements from analog and digital circuits using diodes, FETs, and BJTs. In addition a problem is assigned to focus on the design, implementation, and analysis of circuits to electronic applications.

XI. Technology Component

Students in this class are expected to have a computer account with the appropriate server to enable class communications. Media assisted instruction is a tool in this class. Use of appropriate technology for analysis of data and completion of problems is required, for example, use of a scientific calculator, and use of student owned laptop. Students utilize the application software packages (MATLAB and PSPICE) in homework problems and in labs.

XII. Special Projects/Activities

A student project is not required for this class.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Adel Sedra and Kenneth Smith, *Microelectronic Circuits*, Fifth Edition, Oxford University Press, 2004

B. Alternative Textbooks

None

C. Supplemental Print Materials

1. Scientific calculator
2. Laptop Computer
3. MATLAB and PSPICE access either on laptop or in a general purpose computer lab
4. Engineering notebook

Course Title: COEN 4322: Digital Signal Processing

Semester Credit Hours: 3 (2,3)

I. Course Overview

The course presents an overview of the nature of signals, the algorithms and techniques used to process those signals and the applications to which digital signal processing can be usefully put.

II. PMU Competencies and Learning Outcomes

Students of COEN 4322: Digital Signal Processing develop the required mathematics to understand, implement and apply appropriate algorithms for signal processing as well as an understanding of the nature of signaling. This course is primarily theoretical and conceptual in nature with a strong practical implementation component. Students are expected to be able to design and implement solution to signal processing problems and to communicate those solution to their peers and to lay clients. Students are expected to work both individually and in groups to achieve common objective. Students have the opportunity to enhance their adaptability, group effectiveness and communication skills.

III. Detailed Course Description

COEN 4322: Digital Signal Processing is concerned with developing and understanding of the concepts underlying digital signal processing. The concept, structure, organization and characteristics of signals are discussed with an examination of the spectrum of periodic signals and the frequency domain and the distinction between signal and noise, the causes of noise and the effects of noise and other factors on signal quality. Techniques for processing signals are examined including filtering and non-filtering processes. Architecture and algorithms for signal processing are presented; graphical and spectral analysis, fast Fourier transforms and the underlying concepts of digital signal processors. Example applications for digital signal processing are presented including communication signal processing, speech signal processing and sound signal processing.

IV. Requirements Fulfilled

This is a required course for all computer engineering majors. It may be used as an elective in the computer science degree program. This course should be taken in the senior year.

V. Required Prerequisites

COEN 3322: Signals and Systems

VI. Learning Outcomes

In this course, students learn:

- To develop an understanding of the nature of signals and the limitations that media characteristics place on the utility of those signals.
- To develop expertise in the design and implementation of applications for the solution of digital signal processing problems.
- To become familiar with a variety of common DSP developmental tools.
- To be able to discuss the strengths and limitations of DSP applications in solving signaling problems with both professional peers and lay clients..
- To develop improved communication and group effectiveness skills.

VII. Assessment Strategy

The course grade involves an assessment of student performance on examinations that focus on the understanding of various concepts and constructs underlying Digital Signal Processing, and the communication of those concepts and the characteristics of designed solutions to DSP problems to an audience. Course grades are based on:

- Weekly assigned homework to motivate students to do the work and earn credit accordingly.
- Weekly, in-class presentations by students related to independent literature research on aspects of the course material and classroom discussion and critique of the presentation.
- Two in-class examinations to assess the student's accumulative mastery of content covered prior to the time of the examination.
- Three major programming assignments to test the student's understanding of the major concepts introduced during the course. Each programming assignment is assessed through instructor and peer review during in-class presentations.
- A comprehensive final examination to assess the student's accumulative mastery of course material.

The final grade is based on 10% credit for the homework, 10% for the presentations and participation in classroom discussion, 20% on in-class examinations, 40% on programming assignments and 20% for the final examination.

Students are required to maintain a journal of thoughts and commentaries during the course. The journal contains daily entries including the identification of areas of interest and concern, notes on the preparation of presentation and comments and analysis of classmate's presentations. The journal is reviewed weekly by the instructor to provide feedback to the students.

Final grades and the student and instructor observations from reflective notebooks are included in the student's portfolio for use in the final assessment capstone course. The intent is to document the student's maturation as he proceeds through the curriculum.

VIII. Course Format

This course is a combination of lecture/discussion and laboratory use. Students are expected to attend two hours of lecture/discussion per week and to be available in a dedicated laboratory facility for three hours per week during which they should expect to undertake significant independent experimentation with DSP development tools.. Once a week students should have at least 30 minutes of collaborative problem solving activity.

Classroom Hours (5 hours per week) **Class: 2**
Lab: 3

Web supplement: Course home page (the university's Web tool, WebCT or Blackboard) should contain the following:

- Course syllabus.
- Course assignments.
- Sample solutions to examinations (after graded and returned).
- Course calendar (an active utility).
- Course e-mail (an active utility).
- Course discussion list (an active utility).
- Student course performance (an active utility**).**

IX. Topics to be Covered

A. Signal analysis
   a. Signals
   b. The spectrum of periodic signals
   c. Frequency domain
   d. Noise
B. Signal processing systems
   a. Systems
   b. Filters and non-filters
   c. Correlation
   d. Adaptation
   e. Biological signal processing
C. Architectures and algorithms
   a. Graphical techniques
   b. Spectral analysis
   c. Fast Fourier transform
   d. Digital filters
   e. Function evaluation algorithms
   f. Digital signal processors
D. Applications
   a. Communication signal processing
   b. Speech signal processing

X. Laboratory Exercises

There is a three-hour per week laboratory component to this course. The laboratory is not a structured time, but an opportunity for the students to work with DSP tools and hardware. There is no designated curriculum for laboratory exercises.

XI. Technology Component

This course makes use of the university's wireless access infrastructure. The course relies on the university and the students having access to professional grade application development environments for the students to use. The course's laboratory component requires dedicated signal processing hardware and tools within one of the university provided computer laboratories.

XII. Special Projects/Activities

Students are required to keep a "reflective notebook" in which, after each class, they enter their own assessments of what they learned, and what questions remain from the class. From each exercise set, each student selects one problem, which the student thinks best reflects the way the mathematical topic is used in a technical context. A detailed solution to the problem is included in the student's reflective notebook.

Students are expected to develop three DSP assignments during the semester that include software engineering design, implementation and documentation. These assignments are group assignments determined through negotiation between the group and the instructor. The laboratory time provided in the course provides the majority of the time required for implementation with additional hours outside laboratory time available for the students on a group basis as required.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Proakis, J.G. & Manolakis, D., *Digital Signal Processing: Principles, Algorithms and Applications* (3rd Ed.), (1995) Prentice-Hall
ISBN: 0-133-73762-4

B. Alternative Textbooks

None

C. Supplemental Print Materials

None

D. Supplemental Online Materials

As available from publisher.

Course Title: COEN 4331: Network Theory

Semester Credit Hours: 3 (3,0)

I. Course Overview

This course examines the structural and theoretical issues underlying networks. Data communication principles and protocols, network structures and open systems are discussed.

II. PMU Competencies and Learning Outcomes

This course concentrates on theoretical and technical issues. Students in this course enhance their interpersonal and group effectiveness skills.

III. Detailed Course Description

COEN 4311: Network Theory is concerned with the structure of data communications; from the electric interface, flow control, medium access control protocols, through data transmission and network protocols, packet switching and frame relay protocols, and includes an examination of network standards, and open systems.

IV. Requirements Fulfilled

This course is an available elective for all degree programs in the College of Information Technology. It should be taken no earlier than the senior year.

V. Required Prerequisites

ITAP 2431: Network Management

VI. Learning Outcomes

In this course, students learn:

- To develop an understanding of physical, theoretical and structural issues related to the construction of computer networks.
- To develop an understanding of the principles of electronic communication and the practical application to the organization and management of networks.
- To develop improved communication and collaborative skills in meeting security threats as a team member or team leader.

VII. Assessment Strategy

This course is designed to introduce students to the physical, theoretical and practical principles underlying computer networks. Course grades are be based on:

- Weekly assigned homework to motivate students to do the work and earn credit accordingly.
- Weekly readings in current network literature.
- Four academic writing assignments related to specific networking issues.
- Two in-class exams to assess the student's accumulative mastery of content covered prior to time of exam.
- A comprehensive final exam to assess the student's accumulative mastery of course material.

The final grades is based on 20% credit for the homework, 20% for the weekly readings, 20% for the academic writing assignments, 20% on in-class exams and 20% for the final examination.

VIII. Course Format

This course is primarily a lecture course. Students are expected to attend three hours of lecture per week.

Classroom Hours (3 hours per week) **Class: 3**
Web supplement: Course home page (the university's Web tool, WebCT or Blackboard) should contain the following:

- Course syllabus.
- Course assignments.
- Keys to exams (after students have completed them).
- Course calendar (an active utility).
- Course e-mail (an active utility).
- Course discussion list (an active utility).
- Students course marks. (an active utility).

IX. Topics to be Covered

A. Open standards OSI/ TCP, ISO/RM
B. Electrical interface, transmission media
C. Data representations
D. Error control/ flow control
E. Data link protocols
F. Commercial grade transmission protocols
G. Packet switching and frame relay
H. Addressing, routing and congestion control
I. Data/voice and video transmission issues
J. Session and presentation protocols
K. Application protocols

X. Laboratory Exercises

There are no lab exercises for this course.

XI. Technology Component

This course makes use of the university's wireless access infrastructure during the class/lecture sessions. In addition, the course makes use of WebCT and other interactive communication tools to enhance communication between the instructor and the students.

XII. Special Projects/Activities

There are no special projects for this course.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Data and Computer Communications, Stallings, W. (2000)
Prentice-Hall, Upper Saddle River, NJ
ISBN: 0-13-084370-9

B. Alternative Textbooks

Data Communications, *Computer Networks and Open Systems*, Halsall, F. (1996)
Addison Wesley Longman
ISBN: 0-201-42293-X

Computer communications and Networking Technologies, Gallo, M.A. & Hancock, W.M. (2002), Thomson/Course Technology
ISBN: 0-534-37780-7

C. Supplemental Print Materials

As available from publisher.

D. Supplemental Online Materials

As available from publisher.