X. COURSE SYLLABI

D. ELECTRICAL ENGINEERING COURSES

Course Title: EEEN 2111: Circuits I Lab
Also listed as COEN 2111: Circuits I Lab

Semester Credit Hours: 1 (0,3)

I. Course Overview

This course covers experimental aspects of the topics covered in GEEN 2314: 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 GEEN 2314: 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 all electrical engineering majors.

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
- GEEN 2314: 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 (3 hours per week): **Class:** 0
Lab: 3

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

Semester Credit Hours: 3 (2,2)

I. Course Overview

This course is a continuation of GEEN 2314: 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 GEEN 2314: 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 all electrical engineering majors.

V. Required Prerequisites

Successful completion of:

- MATH 2332: Differential Equations
- GEEN 2314: Circuits I
- EEEN 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 ability to 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: EEEN 3331: Digital Systems
Also listed as COEN 3323: Digital Systems

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 all electrical engineering majors.

V. Required Prerequisites

Successful completion of:

- GEEN 2314: Circuits I
- EEEN 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
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: EEEN 3341: Signals and Systems
Also listed as COEN 3322: 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 electrical engineering majors.

V. Required Prerequisites

Successful completion of:

- EEEN 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: **EEEN 3361: Electromagnetic Fields and Waves**

Semester Credit Hours: 3 (3,0)

I. Course Overview

This course presents a study of electromagnetic fields and their relationship to problem solving in engineering. The course of study begins with the development of an understanding of the basics to development of the ability to integrate the basic knowledge. It proceeds to the ability to use that knowledge to solve electromagnetic field problems using analysis, modeling, and simulation.

II. PMU Competencies and Learning Outcomes

Skills in understanding and applying knowledge of electromagnetic fields and waves, as taught in this course, are major components world wide of professional competence for engineers. Throughout the semester, students are encouraged to apply critical thinking and problem solving skills in discussions, assignments, and projects. Professional leadership and a team approach are stressed and modeled throughout lectures, discussions, and projects. Active communication skills are encouraged through discussions and through assignments and student presentations. Students are led to develop awareness of the professional role and responsibilities of engineers in society. Effective use of technology is integral in the development of skills in analyzing, modeling, and simulating solutions to electromagnetic field problems.

III. Detailed Course Description

This course constitutes an overview of the subject of electromagnetic fields: performing their analysis, acquiring and understanding of their underlying principles, and understanding the components of identifying and solving electric and magnetic field problems. The course progresses from identification to understanding through progressively modeling and simulating fields and waves as students learn to simulate and solve electromagnetic problems.

IV. Requirements Fulfilled

This is a required course for majors in electrical engineering.

V. Required Prerequisites

- PHYS 1422: Physics for Engineers II
- MATH 1324: Calculus III
- MATH 2331: Linear Algebra

VI. Learning Outcomes

A. To apply vector analysis to the simulation, modeling and solution of electromagnetic field problems

B. To model, simulate and analyze static electric field problems

C. To model, simulate and analyze static magnetic field problems

D. To apply the principle of images

E. To learn and integrate electromagnetic fields and circuit theory

F. To learn principles of time-varying fields and Maxwell's equations

G. To understand the principles of electromagnetic waves

H. To learn the basics of transmission lines, antennas, and waveguides

I. To integrate and apply the above in the solving of a two-dimensional electrostatic problem

VII. Assessment Strategy

The assessment strategy measures students' understanding of electromagnetic fields and waves, their analysis, related concepts, and their use in problem solving.

- Class participation is monitored as an indicator of each student's level of involvement and understanding of the learning process.
- Homework assignments are utilized to provide feedback to students and to indicate individual progress in achievement of understanding.
- Computer programming assignments are used to measure students' ability to apply technological tools and knowledge in problem solving
- A mid-term examination is used to indicate students' level of mastery.
- A student project is assigned, due before the final examination, to encourage student initiative and to measure each student's mastery of skills and ability in the application of principles. The project incorporates in-class presentation and written report. Communication skills are assessed.
- 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 class assignment 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. Preparation for class is by reading the text and additional resources and by completion of assignments so that topics may be discussed in class.

Classroom Hours (3 hours per week) **Class:** 3
Lab: 0

IX. Topics to Be Covered

A. Vector analysis
B. Static electric fields
C. Circuit theory
D. Static magnetic fields
E. Time varying fields
F. Maxwell equations
G. Electromagnetic waves
H. Transmission lines
I. Introduction to antennas and waveguides

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 problems is required, for example, use of an engineering calculator or use of the university computer labs. Completing assignments and examinations require use of a personal computer and/or university computer labs. Use of the Internet may be indicated to support global understanding of the subject and problem applicability.

XII. Special Projects / Activities

This course incorporates a student project and presentation in which students are required to apply the ability to analyze electric and magnetic fields and to simulate, model and solve a two-dimensional example based on principles learned.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Cheng, David K. *Fundamentals of Engineering Electromagnetics.*
_____: Addison-Wesley, 1993 (or latest edition of book).
ISBN:

B. Alternative Textbooks

None

C. Supplemental Print Materials

As notified by the instructor.

D. Supplemental Online Materials

As notified by the instructor.

Course Title: **EEEN 3391: Probability and Random Signal Analysis**

Semester Credit Hours: 3 (3,0)

I. Course Overview

This course coves probability, statistics, random variables, random signals, introduction to random processes, correlation functions and analysis of linear system response to random inputs and disturbances. Engineering applications to signal processing and linear system analysis also are included.

II. PMU Competencies and Learning Outcomes

Knowledge of probability theory, statistics, and random signal analysis are fundamental to electrical engineering, particularly to signal processing and the analysis and design of communication systems. 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 active learning sessions and homework assignments. Professional demeanor and a team approach to understanding problems are practiced throughout lectures and discussions. Professional 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, including the utilization of the MATLAB® application software package with tool boxes, is integral to the development of the knowledge and skills acquired in this course.

III. Detailed Course Description

In this course students acquire knowledge of the applied mathematics involved and develop skills in working with random signals and systems. Students are led from the basics of probability theory, random variables, and statistics through increasing understanding to the analysis of random signals and stochastic processes occurring in electrical engineering applications.

IV. Requirements Fulfilled

This is a required course for majors in electrical engineering.

V. Required Prerequisites

EEEN 3312: Circuits II

VI. Learning Outcomes

- To acquire the ability to formulate and solve problems involving random data, random signals and systems.
- To learn to describe and estimate random data with probability and statistics.
- To learn to model random signals and systems with probability, random variables and stochastic processes.
- To learn to analyze random signals and systems.
- To learn to design filters for processing signals and optimizing system response.
- To understand system design that maximizes signal-to-noise ratios.

VII. Assessment Strategy

The assessment strategy measures students' understanding of the applied mathematics and the utilization of the math to analyze random signals and systems.

- Class participation is monitored as an indicator of each student's level of involvement, understanding, and commitment.
- Homework assignments are utilized to provide feedback to students and to indicate individual progress in achievement of understanding.
- Communication skills are measured through the student's in-class participation in discussions, written assignments, and presentation of material during active learning sessions in the class.
- Examinations □ both announced and unannounced □ are used to indicate the student's progress in mastery of course content.
- An end-of-semester final examination is used to measure the student's mastery in understanding and application of the knowledge, analysis 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, active problem-solving learning sessions in class, homework problem assignments to be completed outside of class, and examinations.

Classroom Hours (3 hours per week) **Class:** 3
Lab: 0

IX. Topics to Be Covered

A. Introduction to probability
   1. Relative frequency (intuitive) approach
   2. Axiomatic (formal) approach
B. Random variables
   1. Probability distribution functions
   2. Probability density functions
   3. Mean values and moments
C. Multiple random variables
   1. Statistical independence
   2. Correlation
D. Statistical sampling and estimation
   1. Sample mean and sample variance
   2. Sampling distributions and confidence intervals
   3. Curve fitting and linear regression
E. Random processes
   1. Probability models
   2. Measurement of process parameters
F. Correlation functions
   1. Autocorrelation functions
   2. Cross-correlation functions
G. Spectral density ─ frequency domain representation of random processes
   1. Relationship to the Fourier transform
   2. Relationship to the autocorrelation function
   3. White noise
H. Linear system response to random signal inputs or disturbances
   1. Time domain analysis
   2. Frequency domain analysis
   3. Introduction to optimal linear system response

X. Laboratory Exercises

There is no laboratory for 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 assignments and in-class work is required, for example, use of a scientific calculator or use of the university computer labs. Use of the Internet may be indicated as notified by the instructor to support global understanding of applications. For some homework problems, the MATLAB® application software package, which is available with all the MATLAB® tool boxes in the Engineering Dedicated Computer Labs, is required.

XII. Special Projects / Activities

No special projects are planned. Completion of several, normally weekly, homework assignments is required.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Cooper, George R. and Clare D. McGillem. *Probabilistic Methods of Signal and System Analysis*, 3rd Edition. ______: Oxford University Press, 1999.
ISBN:

B. Alternative Textbooks

None

C. Supplemental Print Materials

1. Stark, Henry, and John W. Woods. *Probability and Random Processes with Applications to Signal Processing*, 3rd Edition. ________: Prentice-Hall, Inc., 2002.
   ISBN:
2. Other print materials as notified by the instructor.

D. Supplemental Online Materials

As notified by the instructor.

E. Other

MATLAB®

Course Title: EEEN 3421: Electronics I
Also listed as COEN 3421: Electronics I

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 electrical engineering majors.

V. Required Prerequisites

Successful completion of:

- GEEN 2314: Circuits I
- EEEN 2111: Circuits I Lab

Completion of concurrent registration for:

- EEEN 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: **EEEN 3422: Electronics II**

Semester Credit Hours: 4 (3,3)

I. Course Overview

This course is the second of two courses in the use of electronic devices in analog and digital circuits. Its lecture component covers analysis and design of operational amplifier circuits, D/A and A/D conversion, CMOS logic circuits, filters, oscillators and multivibrator circuits, power amplifiers, and pulse and switching circuits. Its laboratory component covers the design and analysis of electronic circuits for digital and analog applications to a set of prescribed criteria.

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 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 is the second of two courses in the use of electronic devices in analog and digital circuits. Lecture component covers analysis and design of operational amplifier circuits. D/A and A/D conversion. CMOS logic circuits, filters, oscillators and multivibrator circuits, power amplifiers, and pulse and switching circuits. Laboratory component covers the design and analysis of electronic circuits for digital and analog applications to a set of prescribed criteria.

IV. Requirements Fulfilled

This course is required for majors in electrical engineering.

V. Required Prerequisites

- EENG 3421: Electronics I

VI. Learning Outcomes

- To be able to design application circuits using op-amps.
- To be able to analyze circuits involved in D/A or A/D conversion.
- To be able to use CMOS logic for digital circuit applications.
- To be able to analyze and design oscillators and multivibrator circuits.
- To be able to use electronic devices in waveform-shaping and rectification circuits.
- To be able to accurate define and analyze different filter circuits.
- To be able to accurate define and analyze different classes of power amplifiers.

VII. Assessment Strategy

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

- Class participation helps indicate to the instructor and the student his or her level of involvement and understanding.
- Homework assignments provide feedback to students and indicate individual progress in meeting course goals.
- Design problems ─ conducted both experimentally in the lab and theoretically using PSPICE ─ provides students with advanced design and analysis experiences individually or in groups. These problems focus on advanced critical thinking and problem solving skills
- Mid-term examinations indicate the student's developing level of mastery of course topics.
- A final examination measures the student's understanding and application of the knowledge integral to the course.
- An end-of-semester lab practical exam measures the student's understanding and application of 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, students keep 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 completing assignments so that the topics may be discussed in class.

Classroom Hours (6 hours per week)	**Class:** 3
	Lab: 3

IX. Topics to Be Covered

A. Op-amp circuits
B. A/D and D/A conversion
C. CMOS logic circuits
D. Filter circuits
E. Oscillator circuits
F. Multivibrator circuits
G. Waveform-shaping circuits
H. Power amplifiers

X. Laboratory Exercises

All laboratory exercises are designed to provide students with expertise needed to design, implement, and analyze analog and digital circuits to meet the criteria expressed in an open-ended problem.

XI. Technology Component

Students are expected to have a computer account with BLACKBOARD or another appropriate server so that the instructor and the students can communicate via e-mail. 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 computer. Students utilize the application software packages (MATLAB and PSPICE) in homework problems and labs.

XII. Special Projects / Activities

A student project is not required for this class.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Sedra, Adel, and Kenneth Smith. *Microelectronic Circuits*, 5th Edition.
____: Oxford University Press, 2004.
ISBN:

B. Alternative Textbooks

None.

C. Supplemental Print Materials

None.

D. Supplemental Online Materials

None.

D. Other

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: **EEEN 4311: Design Methodology and Project Management**

Semester Credit Hours: 3 (3,0)

I. Course Overview

This course presents an overview of engineering design designed to prepare students for ASSE 4311: Learning Outcome Assessment III, the final capstone course for engineering majors. Its subject matter is the entire product design process including project planning, quality function deployment, design specification, concept generation and selection, system and subsystem design, the role of engineering economics, the profession's codes and standards, and project management.

II. PMU Competencies and Learning Outcomes

Engineering design and project management, as taught in this course, are major components world-wide of professional competence for engineers. Throughout the semester, students are encouraged to apply critical thinking and problem solving skills in the design process. Teamwork and leadership are stressed through the lectures, class work, and in the practice of student design teams. Oral and written communication skills (through class discussions and through the team approach and presentations) are integral to student learning in the course, as are understanding and effective use of design and information processing technology.

III. Detailed Course Description

In this course, students learn the importance of the design process in engineering. The design process is introduced and is taught through its components. Students make use of the design process to define and solve real-world engineering problems. Skills developed and used in the class include describing the design process for both product and system development, writing design specifications for problems, developing a project plan, applying concept generation, applying decision making tools, use of the Quality Function Deployment process, recognizing and discussing ethical issues, and developing an understanding of the role of professional codes and standards and their part in product safety, quality, and reliability.

IV. Requirements Fulfilled

This course is required for majors in electrical engineering.

V. Required Prerequisites

- EEEN 3391: Probability and Random Signal Analysis
- GEEN 3211: Engineering Economy

VI. Learning Outcomes

- To learn the engineering design process.
- To apply the engineering design process.
- To apply Quality Function Deployment in the design process.
- To apply concept generation and decision making tools in the design process.
- To recognize and discuss ethical issues of professional engineering from a global as well as project focus.
- To recognize and discuss product liability issues.
- To utilize engineering economics concepts within the design process.
- To describe, discuss, and apply professional codes and standards.
- To develop and use team skills and leadership in the process of engineering design and project management.

VII. Assessment Strategy

The assessment strategy measures students' understanding of the engineering design process and their ability to apply the design process in project management. Components assessed include:

- Understanding of quality function deployment
- Concept generation and decision making abilities
- Ability to apply the principles of engineering economics
- Recognition and understanding of ethical issues
- Recognition and understanding of product liability issues
- Understanding and use of professional codes and standards for a global marketplace
- Ability to develop, work, and lead project management in a team environment.

Active class discussion participation is used to indicate each student's level of involvement and understanding. Weekly written assignments are graded to give feedback to students and to indicate individual's progress in achievement of understanding. Mid-term examination is used to indicate students' level of mastery.

A written report of team project development is used to indicate students' level of understanding, ability to integrate learning, and ability to communicate professionally. A team project presentation indicates student initiative, team skills, and ability to communicate effectively and professionally. Peer evaluation of project is used to provide feedback from peers and to promote communication abilities.

The instructor's evaluation of the project measures mastery of skills and abilities as integrated in the project and as communicated by the student. A final examination indicates the student's degree of maturity in understanding and application of the information and abilities addressed in the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. The students' preparation for the capstone experience is enhanced through progressive skill building in active oral and written communication, decision making, problem solving, teamwork, professional demeanor, and leadership. In cooperation with the instructor, each student selects one evaluation instrument and one written report 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, team development, and a team project. Students are expected to attend class and to participate actively in discussions and team 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 (3 hours per week)	**Class:** 3 **Lab:** 0 **Team project development:** (Outside of class)

IX. Topics to Be Covered

A. Engineering design process
B. Project planning and management
   1. Generation of concept
   2. Writing of target and final design specifications
   3. Identification of critical path
   4. Quality function deployment
C. System management
D. Decision making strategies
E. Development of professional engineering world view
   1. Role of engineering design in a global context
   2. Ethical issues
   3. Product liability issues
   4. Importance of professional codes and standards
F. Effective interpersonal and professional communication skills
G. Team approach to design and management

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

Students are expected to have a computer account with BLACKBOARD or another appropriate server so that the instructor and the students can communicate via e-mail. Media assisted instruction is a tool in this class. Appropriate technology for collection, analysis, and interpretation of data is required, including use of the Internet as a tool, use of an engineering calculator, and use of the university labs. Completing assignments and examinations require use of a personal computer and/or university computer labs. Research assignments require that students also use the Internet as a technology resource.

XII. Special Projects / Activities

This course incorporates a student-designed project in which an actual product is conceived, designed, and produced. The student design project is completed as part of a student team, with the advice and oversight of the instructor and an advisory team of industry and faculty representatives. Project management principles as taught in the course are to be incorporated in the development and completion of the project.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Dieter, George. *Engineering Design: A Materials and Processing Approach*, 3rd Edition. ___: McGraw-Hill, 2000 .
ISBN:

B. Alternative Textbooks

None.

C. Supplemental Print Materials

As notified by the instructor.

D. Supplemental Online Materials

As notified by the instructor.

Course Title: **EEEN 4331: Microprocessors**

Semester Credit Hours: 3 (2,3)

I. Course Overview

This course presents the development of microprocessor systems, with an introduction to assembly language programming. Instruction includes hardware-software interactions, programming techniques, and control of real-time hardware. Through the classes and labs, students are led to integrate knowledge into hands-on design and control applications.

II. PMU Competencies and Learning Outcomes

The ability to design, assemble, and test microprocessor systems, as taught in this course, is a major component world wide of professional engineering expertise. Throughout the semester, students are encouraged to develop and use critical thinking and problem solving skills as they work with hardware and software technologies. As students progress through class assignments, class discussions, lab exercises, and projects, students are encouraged in development of team leadership qualities and professional active communication skills. As they progress to design capabilities, students are led to develop growing awareness of the engineer's ethical role in a global society. Effective hands-on use of the most modern technology is integral to the development of the knowledge, skills, and professionalism acquired in this course.

III. Detailed Course Description

In this course, students learn the components of microprocessors and learn to design and assemble microprocessor systems with applications to real-world engineering environments. Instruction covers microprocessor architecture and assembly language programming, hardware-software interactions, programming techniques, and control of real-time hardware. Students are led to consider the leadership role and societal responsibilities inherent in a professional, ethical, engineering approach to use of microprocessor systems.

IV. Requirements Fulfilled

This is a required course for majors in electrical engineering.

V. Required Prerequisites

EEEN 3331: Digital Systems

VI. Learning Outcomes

- To learn the components of basic microcomputer architecture.
- To learn to program a microcomputer in assembly language.
- To develop the skill to design standard interfaces for microprocessors.
- To learn to contribute effectively as a member of an engineering team.
- To develop an understanding of ethical issues and the engineer's responsibility in society.

VII. Assessment Strategy

The assessment strategy measures students' understanding of microcomputer fundamentals, microprocessor architecture, assembly language, microcomputer interfacing. Through their various assignments and discussions, students are expected to demonstrate a growing understanding of awareness of themselves as professional engineers.

- 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.
- Student projects are required as measures of student's ability to integrate knowledge acquired and apply it in real-world examples.
- Computer programming skills are measured to indicate students' understanding of appropriate computer technologies and their applications in microprocessor systems.
- Communication skills are measured through the student's in-class participation in discussions, written assignments, and student projects.
- Examinations are used to indicate student's progress in mastery of course content and hands-on lab expertise.
- A final examination measures the student's mastery in understanding and application of the knowledge, the design skills, and the professionalism taught in the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. The 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 class team member, problem solving, use of appropriate technology, 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, homework assignments including computer programming to be completed outside of class, student projects, lab exercises, and examinations. Preparation for class includes reading the text and additional resources and completing assignments so that the topics can be discussed in class. These are expected as indicators of students' commitment to professional growth.

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

IX. Topics to Be Covered

A. Microcomputer fundamentals
   1. Number systems
   2. Codes
   3. Digital circuits
   4. Memory devices

B. Microprocessors
   1. Elements
   2. Structures
   3. Operation
   4. Memory
   5. Bus architecture
   6. Instruction set

C. Microcomputer programming
   1. Assembly language
   2. Arithmetic operations
   3. Decisions
   4. Loops
   5. Tables
   6. Lists
   7. Subroutines
   8. Interrupts

D. Microcomputer Interfacing
   1. Input/output modes
   2. Serial and parallel interfaces
   3. Synchronous and asynchronous communication

E. Development of a professional engineering viewpoint

X. Laboratory Exercises

Weekly lab exercises supplement instruction in the classroom and provide each student with hands-on utilization of microprocessor knowledge and skills.

XI. Technology Component

A. Computer Account

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 or use of the university computer labs. A Motorola 68HC11 Development Board is required for student assignments. Use of the Internet may be indicated as notified by the instructor to support global awareness of applications.

B. Lab Work

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 design and assembly project as a part of this course. Projects are expected to demonstrate the student's ability to utilize knowledge acquired in an application of professional quality.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Tocci, Ronald J. and Frank J. Ambrosio. *Microprocessors and Microcomputers: Hardware and Software*, 6th Edition. _____: Prentice Hall, 2003.
ISBN:

B. Alternative Textbooks

None.

C. Supplemental Print Materials

None.

D. Supplemental Online Materials

As notified by the instructor.

E. Other

Motorola 68HC11 Development Board.

Course Title: **EEEN 4341: Communication Systems**

Semester Credit Hours: 3 (2,3)

I. Course Overview

This course presents a study of telecommunications theory and practice. Students develop competency in information theory; signals; systems; and analog modulation; digital data transmission; and error correcting codes. Methods of instruction include lecture, class discussion, and out-of-class assignments.

II. PMU Competencies and Learning Outcomes

Skills in understanding and practice of telecommunications theory, as taught in this course, are major components world wide of professional competence for engineers. Throughout the semester, students are encouraged to apply critical thinking and problem solving skills in the class discussions, assignments, and lab work. Professional demeanor and a team approach are taught and modeled throughout lectures, discussions, and lab. Professional 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 class.

III. Detailed Course Description

This course constitutes and overview and practice in the field of telecommunications theory. Students are introduced to communication systems. Topics include information theory; amplitude modulation; angle modulation systems; sampling and pulse code modulation; digital data transmission; effects of noise; error correction codes.

IV. Requirements Fulfilled

This is an elective course for majors in electrical engineering.

V. Required Prerequisites

- EEEN 4341: Communication Systems
- EEEN 4391: Advanced Applied Mathematics

VI. Learning Outcomes

- To learn the elements of a communication system.
- To learn basic information theory.
- To develop knowledge of amplitude modulation systems.
- To develop knowledge of angle modulation systems.
- To understand and apply error correcting codes.
- To develop knowledge of digital transmission systems.

VII. Assessment Strategy

The assessment strategy measures students' understanding of the field of telecommunications theory, its inclusive components, and their ability to apply the knowledge acquired.

- Class participation is monitored as an indicator of each student's level of involvement and understanding.
- Homework and lab assignments are utilized to provide feedback to students and to indicate individual progress in achievement of understanding.
- A mid-term examination is used to indicate students' developing level of mastery.
- 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. Students' preparation for the capstone experience is enhanced through progressive skill building in active listening, oral, and written communication, decision making, problem solving, professional demeanor and commitment. In cooperation with the instructor, each student selects one assignment to become a part of the student's portfolio.

VIII. Course Format

The course consists of lectures, class discussions, written assignments to be completed outside of class, lab assignments and practice, and examinations. Preparation for class includes reading the text and additional materials and completing assignments so that they may be discussed in class. These are expected as indicators of students' commitment to professional growth.

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

IX. Topics to Be Covered

A. Introduction to communication systems
B. Amplitude modulation
C. Angle modulation
D. Sampling and pulse code modulation
E. Principles of digital data transmission
F. Effects of noise on system performance
G. Introduction to information theory
H. Error correcting codes

X. Laboratory Exercises

Weekly lab exercises supplement instruction in the classroom and provide each student with hands-on utilization of communication system hardware and measurement instrumentation.

XI. Technology Component

A. Computer Account

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 or use of the university computer labs. Students utilize the application software package MATLAB in homework problems and special projects. Use of the Internet may be indicated to support global understanding of the subject and its applications.

B. Lab Work

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

XII. Special Projects / Activities

A student project is not required for this class.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Carlson, A. Bruce, Crilly, Paul B., Rutledge, Janet C. *Communication Systems*, 4th Edition. ____________: McGraw-Hill, 2002.
ISBN:

B. Alternative Textbooks

None.

C. Supplemental Print Materials

1. Lahti, B.P. *Modern Digital and Analog Communication Systems*, 3rd Edition, Oxford: __________, 1998.
   ISBN:
2. Couch, II, Leon W. *Digital and Analog Communication Systems*, 6th Edition. ______________: Prentice-Hall, 2001.
   ISBN:

3. *Schaum's Mathematical Handbook*, McGraw-Hill (or)
4. Zwillinger, Daniel. *CRC Standard Mathematical Tables and Formulae.*

D. Supplemental Online Materials

None.

E. Other

1. Scientific calculator
2. Engineering paper
3. MATLAB