This document covers the required courses in electrical engineering curriculum which were taught during the Fall 2009 semester.

The goal of this document is to identify the support the listed courses provide through associated student learning objectives for the ABET Engineering Criterion 3 Outcomes a through k. This support is provided in the following table.

Following sections also provide the list of student learning objectives (SLO) associated with each course, and the support provided by these SLOs for specific ABET Engineering Criterion 3 outcome.

**EAC Criterion 3 Program Outcomes**

Engineering programs must demonstrate that their students attain the following outcomes:

a) An ability to apply knowledge of mathematics, science, and engineering
b) An ability to design and conduct experiments, as well as to analyze and interpret data
c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d) An ability to function on multidisciplinary teams
e) An ability to identify, formulate, and solve engineering problems
f) An understanding of professional and ethical responsibility
g) An ability to communicate effectively
h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i) A recognition of the need for, and an ability to engage in life-long learning
j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
EECS Course Support for ABET Engineering Criterion 3 Outcomes:

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<th>Course Code</th>
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<th>ABET EAC Criterion 3 Outcomes</th>
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STUDENT LEARNING OBJECTIVES

The student will be able to...
1. Identify the stages of team development and give examples of team behavior that are characteristic of each stage.
2. Function effectively on a team, with effectiveness being determined by instructor observation, peer ratings, and self-assessment.
3. Write an effective technical report for a term project.
4. Propose a solution or critique a proposed solution to an engineering problem, identifying possible negative global or societal consequences and recommending ways to minimize or avoid them.
5. Understand the impact of engineering solutions on a diverse society
6. Use state-of-the-art methodologies, techniques, and paradigms.
7. Understand the need for engineering solutions in underdeveloped countries.
8. Use online resources to obtain current literature on engineering components.

ABET OUTCOMES SUPPORTED

Outcome d
Supported by SLOs 1 and 2
Outcome g
Supported by SLO 3
Outcome h
Supported by SLOs 4 and 5
Outcome j
Supported by SLO 6

INSTRUCTOR
Dr. Molyet
The student will be able to...

1. Conduct an experiment to learn the logic design and prototyping process in order to acquire requisite hands-on skills and report the results through a well-defined and formatted written document.
2. Document the data acquired from an experiment, compare to the expected theoretical values and discuss any differences.
3. Design a digital module with combinational and sequential logic components to be able to address any problem in the applicable domain and report the results in a typical engineering design document.
4. Build a prototype of a digital logic circuit and demonstrate that it meets performance specifications, which are limited to functional correctness and resource minimization; i.e., minimal product-of-sums or sum-of-products only for combinational design only.
5. Document the data acquired from an experiment, compare to the expected theoretical values and discuss any differences.
6. Write an effective technical report for lab experiments.
7. Use state-of-the-art combinational and sequential logic design methodologies, techniques, and paradigms.
8. Use tools including a scope and a logic analyzer to prototype, debug and test a combinational and sequential logic circuit at the gate level utilizing the MSI/LSI technology
9. Use online resources to obtain current literature on engineering components.

Outcome b
Supported by SLOs 1 and 2
Outcome c
Supported by SLOs 3, 4, and 5
Outcome g
Supported by SLO 6
Outcome k
Supported by SLOs 7, 8 and 9

INSTRUCTOR

Dr. Molyet
STUDENT LEARNING OBJECTIVES

The student will be able to...
1. Program a simple machine using microcode to implement specific instructions
2. Write programs using assembly language demonstrating an ability to use subprogram linkages, basic processor functions, and control structures.
3. Understand modern computer architecture enhancements and be able to compare and contrast processors.
4. Understand the memory hierarchy and its importance and impact on processor performance.
5. Know and discuss the major features of RISC and CISC architectures.

INSTRUCTOR

Dr. Heuring
The student will be able to...

1. Describe the meaning of an embedded system, the reasons for the importance of embedded systems, and how computer engineering uses or benefits from embedded systems.
2. Understand how assembly language programs convert into executable code through assembler, linker, locator and loader for an embedded system environment.
3. Write assembly code for an embedded system to function as system kernel, to perform setup, initialization, and built-in system testing.
4. Understand role of modern computer engineering hardware and software tools in system development and how to use these tools to support the design methodology.
5. Develop an understanding of a microprocessor at a level to be able to design a microcontroller that has a microprocessor with read-only/random-access memory and basic input/output, and to comprehend the boundary between hardware and software.
6. Design a memory subsystem with both read-only memory and random-access memory for a microprocessor, develop read-only memory compliant random-access memory testing program in relevant assembly language, and program read-only memory with the memory testing program.
7. Design an interface for a programmable input/output device such as universal synchronous-asynchronous receiver-transmitter and develop the device driver code in assembly/machine language.
8. Design an interface for a programmable interrupt controller and develop the code for device drivers in assembly/machine language.
9. Prototype a minimal system complete with microprocessor, both read-only and random-access memory, read-only memory resident random-access memory testing program, and system startup code developed in assembly or machine language.

ABET OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 3, 4, and 5
Outcome c
Supported by SLOs 6, 7, and 8
Outcome k
Supported by SLOs 2 and 9

INSTRUCTOR

Dr. Serpen
The student will be able to...

1. Describe representation and classification of the signals and systems.
2. Understand linear, time-invariant, causal systems and apply the convolution integral for continuous signals.
3. Compute the trigonometric and exponential Fourier series expansion of periodic signals.
4. Compute and plot the Fourier transform for simple aperiodic continuous-time signals including the use of various properties of the Fourier transform.
6. Analyze complex system using state variable formulation and solving state equations.
7. Convert a continuous-time signal to the discrete time domain and reconstruct using the sampling theorem.
8. Compute both the z-transform and inverse z-transform of discrete-time signals, including the use of the various properties of the z-transform.
9. Use MATLAB software to implement some of the signal processing and system analysis techniques taught in this course.

ABET OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 1 through 8
Outcome k
Supported by SLO 9

INSTRUCTOR

Dr. Salari
STUDENT LEARNING OBJECTIVES

The student will be able to...
1. ...

ABET OUTCOMES SUPPORTED

Outcome a
Supported by SLOs

INSTRUCTOR

Dr. Heuring
STUDENT LEARNING OBJECTIVES

The student will be able to...

1. Understand the qualitative and quantitative properties of semiconductor materials that are used in fabrication of electronic circuit components.
2. Understand the mechanisms of motion of electric charges in semiconductor materials.
3. Learn the concepts of large and small signals, and the application areas of corresponding electronic component models.
4. Gain the present day understanding level of the processes which govern the behavior of pn-junctions.
5. Apply the large signal method of analysis to nonlinear electric circuits (and systems).
6. Learn the properties and operation modes of the four types of FETs.
7. Apply the large signal method of analysis to electronic circuits that contain FETs.
8. Apply the SPICE simulation method of analysis to electronic circuits that contain FETs.
9. Apply the approximate large signal method of analysis to electronic circuits that contain BJTs.
10. Students will be able to design BJT inverter circuits with a required noise margin and fan-out.
11. Learn how to design the BJT inverter circuit: (a) of minimum size, (b) with equal rise and fall times, and (c) that has a required logic threshold voltage value.
12. Learn the ways of lowering power dissipation in digital electronic circuits.
13. Learn the trade-off between power dissipation and time delay of digital electronic circuits.
14. Analyze static (and the dynamic) combinational logic circuits with the goal of determining the Boolean function implemented by the circuit.
15. Design circuits of combinational static CMOS gates, so that they implement a desired Boolean function.
16. Understand the influence of adjusting transistor aspect ratios on the dynamic performance of logic gates,
17. Design the transistor aspect ratios of a given static CMOS gate, so that the gate has the same rise and fall times as the reference inverter.
18. Understand the three established principles of encoding the logic/numeric values in memory cells: state of a bistable circuit, electrical charge on a capacitance, and a FET’s threshold voltage value.
19. Understand the basic technological challenge to each of the three encoding principles: power dissipation, leakage of electrical charge, extra high voltages involved in changing the threshold voltage of FETs.
20. Understand the complexity of modern memory arrays and their design challenges.
21. Work with the TTL family legacy circuits,
22. Understand the merit of ECL circuits in today’s multi GHz communication systems.
23. Learn the basic principle of D/A conversion,
24. Learn one simple A/D conversion approach.
25. Complete the lab assignment on D/A and A/D conversion.

ABET OUTCOMES SUPPORTED

Outcome b
Supported by SLOs 23, 24, and 25
Outcome c
Supported by SLOs 10, 11, 15, and 17
Outcome j
Supported by SLO 12 and 20
Outcome k
Supported by SLOs 5, 7, 8, and 9

INSTRUCTOR

Dr. Johnson
The student will be able to...

1. Understand the incremental modeling process, and produce useful incremental models for MOSFET's and BJT's at midband and high frequency.
2. Be familiar with the properties of four basic analog amplifier topologies (CE, CB, CC, and differential pair).
3. Produce useful incremental models for broadband analog amplifiers in their midband, low-frequency, and high-frequency regions.
4. Calculate amplifier transfer functions, and input and output resistances.
5. Calculate, interpret and communicate the low- and high-frequency response behaviors of broadband amplifiers using Bode plots and suitable approximations.
6. Characterize the effects of midband negative feedback on broadband amplifiers at the system (block diagram) level.
7. Identify and model the midband effects, including impedance modification, of series-series, shunt-shunt, shunt-series, and series-shunt negative feedback on broadband amplifiers.
8. Succinctly state the basic concepts of the course using one or two sentences per concept.

ABET OUTCOMES SUPPORTED

Outcome a
Supported by SLO's 1, 3, 4, 5, and 7
Outcome e
Supported by SLO's 2, 5, 6, and 8
Outcome k
Supported by SLO's 5, 6, and 7

INSTRUCTOR

Dr. King
STUDENT LEARNING OBJECTIVES

The student will be able to...

1. Understand the basic properties of magnetic materials and how to analyze magnetic circuits.
2. Perform analysis of transformer models and applications.
3. Understand fundamental concepts of rotating machines and use of energy and co-energy functions.
4. Understand synchronous motors and generator analysis and applications.
5. Understand basics of dc motors and generators
6. Understand induction motor analysis and applications, both 3-phase and 1-phase.

ABET OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 1 through 6
Outcome e
Supported by SLOs 1 through 6
Outcome h
Supported by SLOs 2 and 4
Outcome k
Supported by SLOs 1 through 6

INSTRUCTOR

Dr. Stuart
STUDENT LEARNING OBJECTIVES

The student will be able to...

1. Perform transformer connections and measure parameters.
2. Measure machine parameters and understand operation.
3. Understand machine operating principles and characteristics.
4. Understand operating principles of different types of dc motors and applications.
5. Understand operating principles of different types of dc generators and applications.
6. Understand operating principles of different types of induction motors and applications.

ABET OUTCOMES SUPPORTED

Outcome a  
Supported by SLOs 1 through 6

Outcome b  
Supported by SLOs 1 through 6

Outcome e  
Supported by SLOs 1 through 6

Outcome g  
Supported by SLOs 1 through 6

Outcome k  
Supported by SLOs 1 through 6

INSTRUCTOR

Dr. Stuart
STUDENT LEARNING OBJECTIVES

The student will be able to...

1. Learn /review the basics of harmonic waves and the phasor technique.
2. Learn the basics of transmission lines and propagation of harmonic signals on them, relevant parameters, and equations. Be able to apply the knowledge in basic analysis and design problems.
3. Learn the basics of the Smith Chart as tool for transmission line calculations and presentation, and be able to apply use the chart for basic parameter calculation and analysis of transmission lines.
4. Learn/review vector algebra, vector analysis, and orthogonal coordinate systems basics and apply the knowledge in solving relevant problems.
5. Learn/review important results and concepts, such as Coulomb’s law, Gauss’ law, Maxwell’s equations, electric field boundary conditions, and electrostatic potential, and be able to apply them in basic electric field and potential calculations.
6. Learn/review the basics of materials and their electrical properties, as well as the related concepts of resistance, capacitance, and electrostatic energy. Be able to apply the knowledge in basic analysis and design problems.
7. Learn/review important results and concepts, such as magnetic forces and torques, Biot-Savart’s and Ampere’s laws, magnetic field boundary conditions, vector magnetic potential, and be able to apply them in basic magnetic field and potential calculations.
8. Learn/review the basics of materials and their magnetic properties, as well as the related concepts of inductance and magnetic energy. Be able to apply the knowledge in basic analysis and design problems.
9. Learn/review Maxwell’s equations for time-varying fields, and the related results and concepts such as Faraday’s law, electromagnetic induction, charge-current continuity relation, displacement current, and electromagnetic potentials, and be able to apply them in basic calculations.
10. Learn/review the basics of the materials electromagnetic properties, as well as the principles of transformers, electromagnetic generation and actuation, and free-charge dissipation in conductors.
11. Learn the basics of the propagation of electromagnetic waves in free space as described by the Maxwell equations and the resulting wave equation.

ABET OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 1, 2, 4, 6, 7, 8, 9, and 10

Outcome k
Supported by SLOs 3 and 5

INSTRUCTOR

Dr. Georgiev
The student will be able to...

1. Students will be able to design a complex system (or component or process) to realistic performance specifications in compliance with applicable engineering standards and multiple realistic constraints, and report the results through a comprehensive and professional technical write-up and oral/poster presentation.

2. Students will be able to propose a solution or critique a proposed solution to an engineering problem, identifying possible negative regional, national, global or societal consequences and recommending ways to minimize or avoid them.

3. Students will be able to build a prototype of a design and demonstrate that it meets performance specifications.

4. Students will be able to list and discuss several possible reasons for deviations between predicted and measured results from an experiment or design, and choose the most likely reason and justify the choice.

5. Given a job-related scenario that requires a decision with ethical implications, the student will be able to identify possible courses of action and discuss the pros and cons of each one, pick the best course of action and justify the decision.

6. Students will be able to write an effective technical correspondence (i.e. abstract, executive summary, project report) or give an effective oral presentation.

7. Students will be able to find relevant sources of information about a specified topic in the library and on the World Wide Web (or perform a full literature search).

8. Students will be able to function effectively on a team project, with individual effectiveness being determined by instructor observation, peer ratings, and self-assessment.

ABET OUTCOMES SUPPORTED

Outcome b  
Supported by SLOs 3, 4, and 8

Outcome c  
Supported by SLOs 1, 2, and 7

Outcome d  
Supported by SLOs 3, 4, and 8

Outcome f  
Supported by SLO 5

Outcome g  
Supported by SLO 6

Outcome j  
Supported by SLOs 1, 2, and 7

INSTRUCTOR

Dr. Johnson
The student will be able to...

1. Design arithmetic circuits such as adders, multipliers and dividers.
2. Design a system from problem specifications with minimum hardware and minimum computation time.
3. Apply digital system design principles and descriptive techniques.
4. Analyze and design functional building blocks and control and timing concepts of digital systems.
5. Understand timing simulation to measure delays and study signals subject to timing constraints.
6. Identify a problem, formulate, design and solve the problem.
7. Present results to the class using power point and able to defend their work.
8. Utilize programmable devices such as FPGAs to implement digital system design.
9. Model and simulate a digital system using hardware description language like VHDL.
10. Distinguish among various forms of verifications.

ABET OUTCOMES SUPPORTED

Outcome a Supported by SLO 1
Outcome c Supported by SLOs 2, 3, and 4
Outcome e Supported by SLOs 5 and 6
Outcome g Supported by SLO 7
Outcome k Supported by SLOs 8, 9, and 10

INSTRUCTOR

Dr. Jamali