This document covers the required courses in electrical engineering curriculum which were taught during the Spring 2010 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 table below.

**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.

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.
EECS Course Support for ABET EAC Criterion 3 Outcomes:

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
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Electrical Engineering undergraduate degree program subcommittees charged with assessment of outcomes are listed in the following table:

<table>
<thead>
<tr>
<th>ABET EAC Criterion 3 Outcomes</th>
<th>EE UG Degree Program Subcommittees</th>
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<tbody>
<tr>
<td>a, e</td>
<td>Molyet (chair)</td>
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<tr>
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<td>Jha</td>
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<td>Kim</td>
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<td>b, c, k</td>
<td>Niamat (chair)</td>
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<td>d, g</td>
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<td>Wang</td>
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<td>i, j</td>
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<td>h, f</td>
<td>Georgiev (chair)</td>
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<td>Shenai</td>
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<td></td>
<td>Johnson</td>
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Instructors of courses being used for assessment during the 2010 Spring semester are listed in the following table:
<table>
<thead>
<tr>
<th>Number</th>
<th>Course Name</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>1530</td>
<td>Introduction to Programming</td>
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<tr>
<td>2000</td>
<td>EECS Professional Development</td>
<td>Heuring</td>
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<tr>
<td>2300</td>
<td>Electric Circuits</td>
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<td>Signals and Systems</td>
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<td>4000</td>
<td>Senior Design Project</td>
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<td>Feedback Control Systems</td>
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<tr>
<td>4360</td>
<td>Communication Systems</td>
<td>Kim</td>
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</table>
STUDENT LEARNING OBJECTIVES

The student will be able to...
1. Implement an elementary algorithm by writing a program in the C++ language.
2. Understand the concept of a variable and the assignment operator.
3. Understand simple data types.
4. Understand the array data structure.
5. Understand flow of control in a program.
6. Ability to program using branching statements.
7. Ability to program using looping statements.
8. Develop and implement a program illustrating the fundamental concepts of the object-oriented paradigm.

ABET OUTCOMES SUPPORTED

Outcome k
Supported by SLOs 1 through 8

INSTRUCTOR

Dr. Standley
STUDENT LEARNING OBJECTIVES

The student will be able to...

1. Understand the differences between patent, copyright, and trademark protection.
2. Understand modern issues in privacy – understand an issue and discuss as a paper.
3. Develop an appreciation of professional registration and life-long learning.
4. Write a business plan for a hypothetical startup company.
5. Discuss in class both expected behavior in a work environment as well as professional code of ethics.

ABET OUTCOMES SUPPORTED

Outcome f  
Supported by SLO 1
Outcome g  
Supported by SLO 4
Outcome i  
Supported by SLO 3
Outcome j  
Supported by SLOs 1 and 2

INSTRUCTOR

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

1. Define voltage, current, energy and power in the context of an electric circuit
2. Define the terminal behavior of the basic linear circuit elements
3. Apply Kirchoff’s laws to the systematic formulation of a set of circuit equations
4. Apply Thevenin’s and Norton’s theorems to circuit analysis
5. Apply the voltage divider, current divider, superposition, and maximum-power transfer theorems to circuit analysis
6. Perform ac steady state circuit analysis using phasors
7. Calculate complex power in an ac system
8. Do transient analysis of first order circuits
9. Analyze a balanced 3-phase circuit
10. Recognize physical circuit elements in the lab and assemble a circuit from a schematic diagram
11. Experimentally measure voltage, current and power
12. Produce a written lab report in a standard format, which includes a brief discussion of relevant theory

ABET OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 1 through 9
Outcome e
Supported by SLOs 10 and 11
Outcome g
Supported by SLO 12

INSTRUCTOR

Dr. Roger J. King
The student will be able to ...
1. The student will be able to represent and classify signals and systems.
2. The student will be able to represent and apply singularity functions.
3. The student will be able to obtain the response of a continuous, linear, time-invariant, causal system by using convolution.
4. The student will be able to obtain the Fourier series expansion of a periodic signal and apply it to continuous, linear, time-invariant systems.
5. The student will be able to obtain and plot the Fourier transform for simple aperiodic continuous-time signals.
6. The student will be able to utilize the Laplace transform method to solve continuous, linear, time-invariant systems and to obtain transfer functions.
7. The student will be able to analyze continuous, linear time-invariant systems using state variable formulation and solve the resulting state equations.
8. The student will be able to convert a continuous-time signal to the discrete-time domain and reconstruct it using the sampling theorem.
9. The student will be able to utilize the z-transform method to solve linear discrete-time systems and to obtain transfer functions.
10. The student will be able to use MATLAB and Simulink to solve continuous and discrete-time systems.

ABET OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 1 through 9
Outcome k
Supported by SLO 10

INSTRUCTOR

Dr. Richard Molyet
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 BJT.
10. 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. Experimentally measure incremental gains and resistances of analog amplifiers at midband
2. Experimentally measure and plot frequency response curves of analog amplifiers
3. Produce a written lab report in a standard format, which includes a brief discussion of relevant theory
4. Make meaningful evaluations of the degree of experimental correlation with the results of SPICE simulations and/or calculations based upon simplified models
5. Correctly use the basic analog laboratory instruments

ABET OUTCOMES SUPPORTED

- Outcome b
  Supported by SLOs 1, 2, 4, and 5
- Outcome g
  Supported by SLO 3
- Outcome k
  Supported by SLOs 4 and 5

INSTRUCTOR

Dr. Roger J. King
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
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.

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

Outcome k
Supported by SLOs 3 and 5
Dr. Georgiev
STUDENT LEARNING OBJECTIVES

The student will be able to...

1. 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. 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. Find relevant sources of information about a specified topic in the library and on the World Wide Web (or perform a full literature, patent, and product search).
4. Function effectively on a team project, with individual effectiveness being determined by instructor observation, peer ratings, and self-assessment.
5. Build a prototype of a design and demonstrate that it meets performance specifications.
6. 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.
7. Given a job-related scenario that requires a decision with ethical implication, 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.
8. Write an effective technical correspondence (i.e. abstract, executive summary, project report) or give an effective oral presentation.

ABET OUTCOMES SUPPORTED

Outcome b
Supported by SLOs 4 through 6
Outcome c
Supported by SLOs 1 through 3
Outcome d
Supported by SLOs 4 through 6
Outcome f
Supported by SLO 7
Outcome g
Supported by SLO 8
Outcome j
Supported by SLOs 1 through 3

INSTRUCTOR

Dr. Shenai
STUDENT LEARNING OBJECTIVES

The student will be able to...

1. The student will be able to formulate mathematical models for linear, time-invariant electrical, mechanical and electromechanical systems.
2. The student will be able to construct block diagram and signal flow graph representations of linear, time-invariant systems.
3. The student will be able to reduce block diagram and signal flow graph representations to a single transfer function.
4. The student will be able to determine applications of closed loop systems.
5. The student will be able to analyze and design control system specifications in the time domain.
6. The student will be able to determine the stability of control systems.
7. The student will be able to determine the relation between characteristic equation root location and control system performance.
8. The student will be able to analyze the frequency response characteristics of a control system.
9. The student will be able to use MATLAB and Simulink to analyze open and closed loop control systems.

ABET OUTCOMES SUPPORTED

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

INSTRUCTOR

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

1. Determine the spectral contents of time-domain signal by applying Fourier analysis.
2. Describe and analyze the mathematical techniques of generation, transmission and reception of analog modulation signals.
3. Convert analog signals to digital format using sampling and quantization techniques.
4. Describe and analyze the methods of transmission of digital data using baseband and carrier modulation techniques.
5. Evaluate the performance of digital data transmission in the presence of additive white Gaussian noise.
6. Use software to implement the communication system and analyze its performance.

Outcome a
Supported by SLOs 1, 2, 3, 4, and 5

Outcome k
Supported by SLO 6

Dr. Junghwan Kim