This document covers the required courses in computer science and 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 Accreditation Commission (EAC) and Computing Accreditation Commission (CAC) Criterion 3 Outcomes. This support is indicated 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 EAC and CAC 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 EAC Criterion 3 Outcomes is detailed in the following table:

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CSE undergraduate degree program EAC Criterion 3 subcommittees are formed as below:

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CAC Criterion 3 Program Outcomes
The program has documented measurable outcomes that are based on the needs of the program’s constituencies.

The program enables students to achieve, by the time of graduation:

a) An ability to apply knowledge of computing and mathematics appropriate to the discipline
b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution
c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
d) An ability to function effectively on teams to accomplish a common goal
e) An understanding of professional, ethical, legal, security and social issues and responsibilities
f) An ability to communicate effectively with a range of audiences
g) An ability to analyze the local and global impact of computing on individuals, organizations, and society
h) Recognition of the need for and an ability to engage in continuing professional development
i) An ability to use current techniques, skills, and tools necessary for computing practice.

j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoff involved in design choice.
k) An ability to apply design and development principles in the construction of software systems of varying complexity.

EECS Course support (through SLOs) for CAC Criterion 3 Outcomes

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The CSE undergraduate degree program faculty formed the following subcommittees to assess ABET CAC Criterion 3 outcomes a through k.
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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.

EAC 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 SLOs 6, 7, and 8

CAC OUTCOMES SUPPORTED

Outcome d
Supported by SLOs 1 and 2
Outcome e
Supported by SLOs 6, 7, and 8
Outcome f
Supported by SLO 3
Outcome g
Supported by SLOs 4 and 5

INSTRUCTOR

Dr. Molyet
Dr. Kang (LCCC)
STUDENT LEARNING OBJECTIVES

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.

EAC OUTCOMES SUPPORTED

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

CAC OUTCOMES SUPPORTED

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

INSTRUCTOR

Dr. Molyet
STUDENT LEARNING OBJECTIVES

The student will be able to...

1. Use Eclipse as an Integrated Development Environment (IDE).
2. Take a problem and develop a structure to represent objects and algorithms to perform operations.
3. Apply standards and principles to write truly readable code.
4. Test the program and, if necessary, find mistakes in the program and correct them.
5. Learn the fundamentals of input and output using the java.io library.
6. Design a class that serves as a program module or package.
7. Understand and demonstrate the concepts of object-oriented design, polymorphism, information hiding, and inheritance.
8. Develop applications using simple graphical user interfaces.
9. Become familiar with some of the common classes available in the Java language.

EAC OUTCOMES SUPPORTED

Outcome k
Supported by SLOs 1 through 9

CAC OUTCOMES SUPPORTED

Outcome i
Supported by SLOs 1 through 9

INSTRUCTOR

Dr. Ledgard
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.

EAC OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 1 and 2

Outcome e
Supported by SLO 2

CAC OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 1 and 2

Outcome c
Supported by SLO 2

INSTRUCTOR

Dr. Heuring
Brent Nowlin (LCCC)
The student will be able to...

1. Articulate the major areas of system software and programming.
2. Explain the objectives and functions of modern operating systems, analyze the tradeoffs inherent in operating system design, and identify some of the devices and resources an OS would manage.
3. Articulate the responsibilities and services provided by modern operating systems, and explain the range of requirements that an operating system has to address.
4. Articulate, compare and contrast, and know the data structures for supporting the primary O/S concepts of: interrupts and interrupt processing, concurrent processes, threads, synchronization, the memory hierarchy, memory management and virtual memory, scheduling, system state, user protection, and structuring of an operating system.
5. Utilize common programming tools and environments in the implementation of system level software.
6. Code algorithms that interact with “lower level” system details and the operating system interface.
7. Design and implement program solutions for larger and more detailed projects.

Outcome a
Supported by SLOs 1, 2, 3, 4, 6, and 7

Outcome c
Supported by SLOs 6 and 7

Outcome k
Supported by SLOs 4, 5, 6, and 7

Outcome a
Supported by SLOs 1, 2, 3, 4, 6, and 7

Outcome b
Supported by SLOs 2, 3, and 4

Outcome c
Supported by SLOs 6 and 7

Outcome i
Supported by SLOs 4, 5, 6, and 7

Outcome j
Supported by SLOs 1, 2, 4, 5, 6, and 7

Instructor
Dr. Miller
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.

EAC 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

CAC OUTCOMES SUPPORTED

Outcome a
Supported by SLO 3
Outcome c
Supported by SLOs 6, 7, and 8

Outcome i
Supported by SLOs 2, 4, and 9

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

1. Define the meaning of a protocol, and understand the elements of a protocol, and the concept of layering, understand the role of the various protocols in facilitating the transfer of data across a communication network, appreciate the role of the ISO seven layer model, describe the 7 layers of the OSI model, identify the major functions of each layer, appreciate the role of the TCP/IP five layer model, describe the 5 layers of the TCP/IP model, identify the major functions at each layer, and be able to compare and contrast the ISO and TCP/IP models.

2. Describe how bits are represented as a signal on a physical medium, which includes being able to: explain the difference between digital and analog signaling, explain the functions of encoding/decoding and modulation/demodulation, explain the purpose and usage of spread spectrum, explain synchronous and asynchronous communications, explain the use of start/stop bits, bit ordering/sequencing, multiplexing, framing, and frame relay.

3. Understand the various types of transmission media, and the characteristics of signals propagated through different transmission media, including concepts of attenuation and noise, and how bandwidth affects the operation of communication systems.

4. Demonstrate understanding of the basic concepts of error detection and correction at the data link layer and below, and the use of error checking and flow control protocols.

5. Demonstrate understanding of the differences between circuit switching and packet switching, understand the basic concepts of LAN and WAN technologies and topologies, describe how LANs, MANs, and WANs operate, and have knowledge of the IEEE 802 family of protocol standards.

6. Evaluate and apply formulae to practical communication problems concerning signaling, bandwidth, noise, symbols, error detection and correction, error control and flow control, as well as learn to analyze the performance, spectral efficiency and cost of the various options for transmitting data message signals.

7. Engage in engineering design of data communications system components.

**EAC OUTCOMES SUPPORTED**

Outcome a
Supported by SLOs 1 through 5

Outcome e
Supported by SLOs 3, 4, and 6

Outcome k
Supported by SLOs 2, 6, and 7
CAC OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 1 through 6
Outcome c
Supported by SLO 6
Outcome j
Supported by SLOs 2, 3, 4, and 6

INSTRUCTOR

Dr. Miller
STUDENT LEARNING OBJECTIVES

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.

EAC OUTCOMES SUPPORTED

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

CAC OUTCOMES SUPPORTED

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

INSTRUCTOR

Dr. Salari
Dr. Kang (LCCC)
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.

EAC OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 1 through 4
Outcome b
Supported by SLO 25
Outcome c
Supported by SLOs 10, 11, 15, and 17
Outcome j
Supported by SLO 12, 13, 16, 17, 20, and 22
Outcome k
Supported by SLOs 5, 6, 7, 8, 9, 10, 11, and 15

CAC OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 1 through 4
Outcome c
Supported by SLOs 10, 11, 15, and 17
Outcome i
Supported by SLOs 5, 6, 7, 8, 9, 10, 11, and 15

INSTRUCTOR
Dr. Johnson
Dr. Kang (LCCC)
STUDENT LEARNING OBJECTIVES

The student will be able to...

1. Devise a variety of simple proofs.
2. Define what a Regular Language is and construct a finite state machine to recognize it.
3. Construct equivalent representations among Regular Languages, Regular Expressions, and Regular Grammars.
4. Develop a grammar defining the syntax of common programming languages.
5. Be able to formulate the equations for a simple stack-based machine.
6. Identify syntactic aspects of real programming languages that cannot be defined with a Context Free Grammar.
7. Understand the simple primitive mechanisms needed for all computations.
8. Identify the characteristics of problems for which no computational solution exists.
9. Identify problems that, for practical purposes, are not solvable in a reasonable time.

EAC OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 1 through 9

CAC OUTCOMES SUPPORTED

Outcome a
Supported by SLOs 1 through 9

INSTRUCTOR

Dr. Ledgard
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/and 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.

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**EAC OUTCOMES SUPPORTED**

Outcome b
Supported by SLOs 3, 4, and 8

Outcome c
Supported by SLOs 1, 2, 3, 7, and 8

Outcome d
Supported by SLOs 3, 4, and 8

Outcome f
Supported by SLOs 2, 5, 6, and 8

Outcome g
Supported by SLOs 6 and 8

Outcome i
Supported by SLO 7

Outcome j
Supported by SLOs 1, 2, and 7

Outcome k
Supported by SLO 3
CAC OUTCOMES SUPPORTED

Outcome c
Supported by SLOs 1, 3, and 4
Outcome d
Supported by SLO 8
Outcome e
Supported by SLOs 2 and 5
Outcome f
Supported by SLOs 6 and 8
Outcome h
Supported by SLO 7
Outcome i
Supported by SLO 3

INSTRUCTOR

Dr. Johnson
Dr. Kang (LCCC)