Bachelor of Science in Electrical Engineering (BSEE)
Essential Ideas

Mission Statement

The mission statement for the Electrical Engineering program as modified and adopted by the engineering faculty on July 9, 2002 and reviewed and endorsed by the School of Engineering Industrial Advisory Council on December 4, 2002 is given below.

The mission of the Electrical Engineering program is to provide the student with a foundation in engineering and the underlying mathematics and sciences. The graduate of this program will have a mastery of engineering science and design to enable him/her to pursue a successful career in electrical engineering and related professions, and graduate studies.

To achieve this mission within the context of a comprehensive liberal arts college that emphasizes small classes and attention to individual needs, the following educational objectives have been established:

1. To provide the students with the mathematical, computational, engineering, and communications skills necessary for the pursuit of a successful electrical engineering career.
2. To ensure that the students receive a broad engineering education so that they can communicate and interact effectively with engineers in different areas of specialization.
3. To foster the students' abilities to formulate problems, find practical and responsible engineering solutions, and understand the impact of the solutions within a global/societal context in a collaborative environment.
4. To develop the students' ability to design an engineering system, component, or process that meets a desired need while encompassing economic, ethical, environmental, and human issues.
5. To develop the students' ability to design and conduct experiments, to analyze and interpret data, and to communicate the results effectively.
6. To develop the students' ability to use modern engineering tools and techniques and to understand the role that computers play in the design process.
7. To instill in the students a knowledge of diverse cultures, ethical and contemporary issues, and involvement in professional and community activities.
8. To prepare the students for life-long learning and encourage and promote professional registration.

Program Outcomes

The Program Outcomes that have been established from the Program Educational Objectives have been identified to meet all ABET EC-2000 Accreditation criteria. An assessment process is also in place that measures the achievement of the Program Outcomes. The Program Outcomes listed below are expected of all graduates of the Electrical Engineering program.

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;

d) an ability to function in 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 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;

l) an ability to analyze and design complex electrical and electronic devices;

m) an ability to analyze and design software and systems containing hardware and software components.

Student Outcomes (a) – (k) are identical to those specified in ABET EC-2000 criterion 3. Outcomes (l) and (m) will meet the ABET programmatic requirements for Electrical Engineering programs (criterion 8). The assessment process that will be used to ensure that all graduates meet these student outcomes is very complicated and is fully described in the ABET accreditation self-study report. Table 1 shows a summary of the methods that will be used to assess compliance with Program Outcomes.

Table 1 - Methods Used to Assess Compliance with Program Outcomes

METHODS USED TO ASSESS PROGRAM OUTCOMES	a	b	c	d	e	f	g	h	i	j	k	l	m
Assignment of grades by professors.	X	X	X	X	X	X	X	X		X	X	X	X
Conduct Course-Instructor surveys in every course.	X	X	X	X	X	X							
Conduct Senior Project surveys	X	X	X		X	X	X	X	X		X	X	X
Conduct surveys of graduating seniors.	X	X	X	X	X	X	X	X	X	X	X	X	X
Perform Longitudinal Student Tracking Analysis	X	X	X	X	X		X	X		X	X	X	X
Review actual student work by faculty sub-committees	X	X	X	X	X		X				X	X	X
Conduct alumni surveys.	X	X	X	X	X	X	X	X	X	X	X	X	X
Seek input on academic matters from our Industrial Advisory Council.	X	X	X	X	X	X	X	X		X	X	X	X
Request input on academic and related matters from ABET evaluators.	X	X	X	X	X	X	X	X	X	X	X	X	X
Maintain records of student progress through the curriculum.	X	X	X	X	X		X	X		X	X	X	X
Maintain records of employment after graduation.	X	X	X	X	X	X	X	X	X	X	X	X	X
Maintain records of students pursuing graduate or professional school.	X	X							X			X	X
Maintain records on student performance on FE exam.	X				X	X							

The Program Outcomes expected of all graduates are:

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;
d) an ability to function in 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 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;
l) an ability to analyze and design complex electrical and electronic systems;
m) an ability to analyze and design software and systems containing hardware and software.

Transformed Curriculum

After careful study of the ABET accreditation criteria and the engineering curricula of our peer institutions the faculty believes that it can deliver a national exemplar Electrical Engineering program (that meets all ABET accreditation requirements) consisting of a total of 39 CU (assuming that labs are counted as 1/2 CU). The breakdown of the resulting curriculum is as follows:

Mathematics/Science/Computer Science	10 CU
Humanities and Social Sciences	6 CU
Engineering Science	8 CU
Engineering Specialization	11 CU
Capstone Design	1 CU
Engineering Experimental Experience	3 CU
	---
	39 CU

An alternative was also explored where the laboratory activities are integrated with the engineering science and engineering specialization courses. This option resulted in a total of 36 CU. However, an economic analysis showed that this option would be more expensive than the one proposed and, as a result, was not pursued any further. Counting labs as ½ CU will be consistent with the traditional ABET definition of 1-credit lab meeting at least 3 hours per week.

A) Mathematics/Natural Sciences/Computer Science (10 CU)

Calculus A, B, C
Advanced Engineering Math 1 & 2
Discrete Structures
General Physics I, II
General Chemistry I
Engineering Computations (or Computer Science)

B) Humanities and Social Sciences (6 CU)

Freshman Seminar and five courses in humanities and social sciences as permitted by the General Education Requirements. The Freshman Seminar must be in the Social Science/Humanities area.

C) Engineering Sciences (8 CU)

Introduction to Engineering (0 CU) – (7-8 week)
Fundamentals of Engineering Design
Electric Circuits
Statics
Dynamics
Thermodynamics

Digital Circuits and Microprocessors
Controls
Engineering Economics

D) Electrical Engineering Specialization Courses (9 CU)

Electronics
Systems & Signals
Communication Systems
Digital Signal Processing
Embedded Systems
Engineering Electromagnetics
Digital Systems Engineering
Microcomputer Systems
Computer Architecture & Organization

E) Technical Electives (2 CU)

Three design electives must be selected: one each semester during the last two semesters in school.

Senior Design Electives (2 CU)

The two electives must be selected from the following list:

Electronics II
RF/Microwave Engineering
Control Systems II
VLSI Design
Bioinstrumentation
Robotics
Project Management
Special Topics in Electrical Engineering
Independent Study

F) Capstone Course (1 CU)

Senior Project (Year-long activity)

G) Engineering Experimental Experience (3 CU)

Six (1/2 unit) courses:

Electric Circuits Lab
Controls Lab
Electrical Engineering Lab I, II, III, IV

CITATIONS:

A. ABET Requirements

ABET Criteria 4 stipulates: "Students must be prepared for engineering practice through the curriculum culminating in a major design experience …" All engineering programs must include a professional component consisting of

(a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline
(b) one and one-half years of engineering topics consisting of engineering sciences and engineering design appropriate to the student's field of study
(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

In Criterion 6 it specifies: "Programs must provide opportunities for students to learn the use of modern engineering tools. Computing …"

In Criterion 8: Electrical Engineering criteria

> The program must demonstrate that graduates have: knowledge of probability and statistics, including applications appropriate to the program name and objectives; and knowledge of mathematics through differential and integral calculus, basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components, as appropriate to program objectives.
> Programs containing the modifier "electrical" in the title must also demonstrate that graduates have a knowledge of advanced mathematics, typically including differential equations, linear algebra, complex variables, and discrete mathematics.

B. Fundamentals of Engineering Examination Topics for Electrical Engineering.

The areas listed below are the given in the Fundamentals of Engineering examination given by the State as part of registration as a professional engineer for all engineering majors. Students must earn a minimum grade of 70% on this national examination in order to pass it.

Mathematics
Applied Mathematics
Electric Circuits
Engineering Economy
Thermodynamics
Fluid Mechanics
Dynamics
Statics
Chemistry
Mechanics of Materials
Material Science
Heat Transfer
Computer Software and Hardware
Controls
Measurements
Materials Science