

# BS Electrical Engineering Program Assessment Plan

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Spring 2018

## **What is your program mission statement?**

The mission of the Electrical Engineering program at Montana Tech is to provide a quality education that stresses the fundamentals of engineering, mathematics, and science in order to prepare graduates to enter and continue the practice of electrical engineering at the professional level.

**What are your program objectives?** *Program educational objectives are broad statements that describe what graduates are expected to attain within a few years of graduation. Program educational objectives are based on the needs of the program's constituencies. List your program objectives. Describe the process and timeline used to periodically review the objectives.*

The objectives of the Electrical Engineering program are to produce graduates who achieve some of the following:

1. Successfully practice the Electrical Engineering profession as demonstrated by
  - a. continued professional employment,
  - b. job promotion,
  - c. expanding career responsibility.
2. Obtain professional registration.
3. Successfully complete an advanced EE degree.
4. Continued professional development such as society membership and participation.

Program objectives are reviewed each year at a dedicated meeting. All constituents (faculty, students, alumni, and industry) are represented at the meeting. Two critical questions are addressed: 1) are the objectives relevant; and 2) are they being fulfilled? Results of the meeting are used to implement program changes and/or changes to the objectives.

**What are your program outcomes?** *Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program.*

- *List the performance indicators for each outcome.*
- *List the metrics for each performance indicator*

Electrical Engineering outcomes are numbered A thru M below. Performance indicators are sub-numbered (e.g., A.1). Metrics follow the performance indicators.

- A. An ability to apply knowledge of mathematics, science, and engineering
  1. Apply non-EE general engineering knowledge
    - i. Metric 1: course outcome grades - average grade in EGEN 201.
    - ii. Metric 2: course outcome grades - average grade in EGEN 202.

2. Knowledge of engineering sciences fundamental to EE
  - i. Metric 1: FE exam - ratio score on "Engineering Sciences" questions
- B. An ability to design and conduct experiments, as well as to analyze and interpret data
  1. Design and conduct experiments, as well as to analyze and interpret data
    - i. Metric 1: course outcome grades - scores on specific material from EELE 261.
    - ii. Metric 2: course outcome grades - scores on specific material from EELE 355.
- 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
  1. Design a system, component, or process to meet desired needs
    - i. Metric 1: course outcome grades - scores on specific material from EELE 317.
    - ii. Metric 2: course outcome grades - scores on specific material from EELE 488/489
  2. Incorporate realistic constraints into the design
    - i. Metric 1: course outcome grades - scores on specific material from EELE 488/489.
- D. An ability to function on multi-disciplinary teams
  1. Have and apply non-EE engineering knowledge
    - i. Metric 1: course outcome grades - average grade in EGEN 201.
    - ii. Metric 2: course outcome grades - average grade in EGEN 202.
  2. Demonstrated an ability to function in a team
    - i. Metric 1: course outcome grades - scores on specific material from EELE 355.
- E. An ability to identify, formulate, and solve engineering problems
  1. Identify, formulate, and solve engineering problems
    - i. Metric 1: course outcome grades - scores on specific material from EELE 321 and 445.
- F. An ability to understand professional and ethical responsibility
  1. Understand professional and ethical responsibility
    - i. Metric 1: FE exam – ratio score on "Ethnics and Professional Practice" questions.
    - ii. Metric 2: course outcome grades - scores on specific material from EELE 394.
    - iii. Metric 3: course outcome grades - scores on specific material from EELE 488/489.
- G. An ability to communicate effectively
  1. Writing communication
    - i. Metric 1: course outcome grades - average grade WRIT 321.
    - ii. Metric 2: course outcome grades - scores on specific material from EELE 488/489.
  2. Oral communication
    - i. Metric 1: course outcome grades - scores on specific material from EELE 210.
    - ii. Metric 2: course outcome grades - scores on specific material from EELE 488/489.

- H. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
  - 1. Understand engineering economics
    - i. Metric 1: FE exam – ratio score on “Engineering Economics” questions.
    - ii. Metric 2: course outcome grades - average grade EGEN 325.
  - 2. Understand global, environmental, and societal issues
    - i. Metric 1: graduate exit interviews – specific question on exit survey.
    - ii. Metric 2: ETS exam – average scores on “Social Studies” and “Humanities” questions.
- I. A recognition of the need for, and an ability to engage in life-long learning
  - 1. A recognition of the need for, and an ability to engage in life-long learning
    - i. Metric 1: FE Exam – overall exam pass rate.
    - ii. Metric 2: course outcome grades – course outcome grades - scores on specific material from EELE 394.
    - iii. Metric 3: course outcome grades – course outcome grades - scores on specific material from EELE 488/489.
    - iv. Metric 4: graduate exit interviews - specific question on exit survey.
- J. A knowledge of contemporary issues
  - 1. A knowledge of contemporary issues
    - i. Metric 1: course outcome grades - scores on specific material from EELE 210.
    - ii. Metric 2: course outcome grades - scores on specific material from EELE 394.
    - iii. Metric 3: graduate exit interviews - specific question on exit survey.
- K. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
  - 1. An ability to write and use computer programs
    - i. Metric 1: FE Exam – ratio score on “Computer Systems” questions.
    - ii. Metric 2: FE Exam – ratio score on “Software Development” questions.
    - iii. Metric 3: course outcome grades – scores on specific material from EELE 203.
    - iv. Metric 4: course outcome grades – scores on specific material from EELE 308.
    - v. Metric 5: course outcome grades – scores on specific material from EELE 317.
- L. The knowledge of advanced mathematics including differential and integral calculus, differential equations, linear algebra, complex variables, probability and statistics, and discrete mathematics
  - 1. have and apply knowledge of advanced algebra
    - i. Metric 1: FE exam - ratio score on “Mathematics” questions.
    - ii. Metric 2: course outcome grades - scores on specific material from EELE 203.
  - 2. have and apply knowledge of calculus
    - i. Metric 1: FE exam - ratio score on “Mathematics” questions.
    - ii. Metric 2: course outcome grades - average grade in M 273.
  - 3. have and apply knowledge of differential eqns.
    - i. Metric 1: FE exam - ratio score on “Mathematics” questions.
    - ii. Metric 2: course outcome grades - average grade in M 274.
    - iii. Metric 3: course outcome grades - scores on specific material from EELE 308.
  - 4. have and apply knowledge of linear algebra
    - i. Metric 1: FE exam - ratio score on “Mathematics” questions.

- ii. Metric 2: course outcome grades - average grade in M 333.
- 5. have and apply knowledge of complex variables
  - i. Metric 1: FE exam - ratio score on "Circuits" questions.
  - ii. Metric 2: FE exam - ratio score on "Power" questions.
  - iii. Metric 3: course outcome grades - scores on specific material from EELE 203.
- 6. have and apply knowledge of probability and statistics
  - i. Metric 1: FE exam - ratio score on "Engineering Probability and Statistics" questions.
  - ii. Metric 2: course outcome grades - average grade in STAT 332.
  - iii. Metric 3: course outcome grades - scores on specific material from EELE 445.
- 7. have and apply knowledge of boolean mathematics
  - i. Metric 1: FE exam - ratio score on "Digital Systems" questions.
  - ii. Metric 2: FE exam - ratio score on "Computer Systems" questions.
  - iii. Metric 3: course outcome grades - scores on specific material from EELE 261.
- 8. have and apply knowledge of discrete-time mathematics
  - i. Metric 1: FE exam - ratio score on "Signal Processing" questions.
  - ii. Metric 2: course outcome grades - scores on specific material from EELE 308.
- M. The knowledge of 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
  - 1. have and apply knowledge of microprocessors
    - i. Metric 1: FE exam - ratio score on "Computer Systems" questions.
    - ii. Metric 2: course outcome grades - average grade in CSCI 255.
  - 2. have and apply knowledge of circuit analysis
    - i. Metric 1: FE exam - ratio score on "Circuits" questions.
    - ii. Metric 2: course outcome grades - scores on specific material from EELE 203.
  - 3. have and apply knowledge of electronics
    - i. Metric 1: FE exam - ratio score on "Electronics" questions.
    - ii. Metric 2: course outcome grades - scores on specific material from EELE 317.
  - 4. have and apply knowledge of digital systems
    - i. Metric 1: FE exam - ratio score on "Digital Systems" questions.
    - ii. Metric 2: course outcome grades - scores on specific material from EELE 261.
  - 5. have and apply knowledge of electric machines and power
    - i. Metric 1: FE exam - ratio score on "Power" questions.
    - ii. Metric 2: course outcome grades - scores on specific material from EELE 355.
    - iii. Metric 3: course outcome grades - average grade in EELE 454.
  - 6. have and apply knowledge of electromagnetics
    - i. Metric 1: FE exam - ratio score on "Electromagnetics" questions.
    - ii. Metric 2: course outcome grades - average grade in PHSX 423.
  - 7. have and apply knowledge of signal and systems
    - i. Metric 1: FE exam - ratio score on "Signal Processing" questions.
    - ii. Metric 2: course outcome grades - scores on specific material from EELE 308.
  - 8. have and apply knowledge of control systems
    - i. Metric 1: FE exam - ratio score on "Control Systems" questions.

- ii. Metric 2: course outcome grades - scores on specific material from EELE 321.
- 9. have and apply knowledge of communication systems
  - i. Metric 1: FE exam - ratio score on "Communication" questions.
  - ii. Metric 2: course outcome grades - scores on specific material from EELE 445.

**Describe your program outcome assessment process including timeline.**

The program Assessment Coordinator (AC) collects and organizes metrics every semester. An assessment cycle is conducted every other year. For a given assessment cycle, the AC assesses each Performance Indicator (PI) using the metric data collected since the last cycle. The assessment is summarized in rubrics for presentation to the faculty at an evaluation meeting.

**Describe the program outcome evaluation process.**

At the evaluation meeting, the faculty review the PI assessment for each outcome. A "grade" of unsatisfactory, satisfactory, or excellent is assigned collectively by the faculty to each PI. A set of "recommended actions" for the program are assigned for each outcome using the evaluation results and the professional judgement of the faculty. Status and results of the actions taken are tracked by the AC and presented to the faculty at the next assessment/evaluation cycle