Fall 2004 Board of Advocates meeting – Engineering session (10:00 am-12:00 noon)

Undergraduate programs – BSECE, BSME, BSE
  Overview of current curricula
  Curriculum changes – completed and planned
  Current program “objectives” (2005 catalog)
Next accreditation review (Fall 2006 campus visit)
  ABET perspective and criteria

Graduate programs and research projects
  MS in ECE, ME and BME; Master of Engineering
Design projects, organizations, and other student subjects
Other department activities and initiatives
Drawing on Board of Advocates resources
Other comments from Advocates
The mission of the Department of Engineering is to educate students, within a caring Christian environment, in the discipline of engineering, by combining a strong technical foundation with an emphasis on professional, moral, ethical, and leadership development.
## B.S. Curricula Overview

<table>
<thead>
<tr>
<th>Components / Programs</th>
<th>BS ECE / BS ME / BS EGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>33 33 33</td>
</tr>
<tr>
<td>Mathematics and Science</td>
<td>32 32 32</td>
</tr>
<tr>
<td>Engineering and Comp. Sci.</td>
<td>71 71 55-56</td>
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<tr>
<td>Concentration</td>
<td>16-15</td>
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<tr>
<td>TOTAL</td>
<td>136 136 136</td>
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</table>
## General Education Component

<table>
<thead>
<tr>
<th>Course</th>
<th>BS ECE</th>
<th>BS ME</th>
<th>BS E</th>
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<tbody>
<tr>
<td>English (Fresh., Tech.)</td>
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<td>6</td>
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<tr>
<td>Great Texts (Anc., Med.)</td>
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<td>Religion (Script., Trad.)</td>
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<tr>
<td>Pol. Sci. or Literature</td>
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<tr>
<td>Foreign Language</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Economics (Engineering)</td>
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<td>3</td>
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<tr>
<td>Ethics Elective</td>
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<tr>
<td>Physical Education</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Chapel</td>
<td>(2)</td>
<td>(2)</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>33</td>
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## Mathematics and Science Component

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<thead>
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<th>Course</th>
<th>BS ECE</th>
<th>BS ME</th>
<th>BS E</th>
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</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>21</td>
<td>21</td>
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<td>Physics</td>
<td>8</td>
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<tr>
<td>Chemistry</td>
<td>3</td>
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<tr>
<td>Math./Sci. Elective</td>
<td>-</td>
<td>-</td>
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<tr>
<td>TOTAL</td>
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## Engineering Major Component

<table>
<thead>
<tr>
<th></th>
<th>BS ECE</th>
<th>BS ME</th>
<th>BS E</th>
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<tbody>
<tr>
<td><strong>Engineering</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Required</td>
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<td>22</td>
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<tr>
<td>Other Required</td>
<td>30</td>
<td>36</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td>12</td>
<td>9</td>
<td>27-26</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>71</td>
<td>71</td>
<td>71</td>
</tr>
</tbody>
</table>

|                      |        |       |       |
| **Computer Science** |        |       |       |
| Common Required      | 4      | 4     | 4     |
| Other Required       | 3      |       |       |
| **Concentration**    |        |       |       |
| May be outside ECS   |        |       | 15-16 |
| **Total**            | 71     | 71    | 71    |
Required EGR Courses Common to All Majors

- Introduction to Engineering
- Introduction to Engineering Analysis
- Thermodynamics
- Electrical Circuits
- Signals and Systems
- Engineering Design I
- Engineering Design II
Other Required EGR – BS ECE

All Majors
Introduction to Engineering*  Introduction to Engineering Analysis*
Thermodynamics  Electrical Circuits*
Signals and Systems  Engineering Design I*
               Engineering Design II*

ECE Major
Applied Electromagnetics  Electrical Materials
Electronic Design*  Control Systems
Digital Logic Design*  Microprocessor Systems
Computer Organization  Computer Systems Design*
Digital Signal Processing*  (plus 12 hours of EGR electives)

* Denotes accompanying laboratory
Other Required EGR – BS ME

**All Majors**
- Introduction to Engineering*
- Thermodynamics
- Signals and Systems
- Introduction to Engineering Analysis*
- Electrical Circuits*
- Engineering Design I*
- Engineering Design II*

**ME Major**
- Statics
- Strength of Materials
- Mat. & Manuf. Processes*
- Fluid Mechanics
- Advanced Thermodynamics
- Control Systems
- Dynamics
- Machine Design
- Mechanical Vibrations
- Heat Transfer
- M. E. Laboratory**
- Computer-Aided Design

(plus 9 hours of EGR electives)
Other Required EGR – BS E

**All Majors**
- Introduction to Engineering*
- Thermodynamics
- Signals and Systems
- Electrical Circuits*
- Engineering Design I*
- Engineering Design II*

**EGR Major**
- Statics
- (plus at least 26 hours of EGR electives, including one stem)
  - Electronics
  - Signal Processing
  - Computer Systems
  - Mechanical Design
  - Fluids-Thermal Energy
  - Biomechanics
ABET: Accreditation Board for Engineering and Technology (federation of 31 technical and professional societies, representing over 1.8 million professionals)

Accrediting Commissions

<table>
<thead>
<tr>
<th>Commission</th>
<th>Accreditation Commission</th>
<th>Inst.</th>
<th>Prog.</th>
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</thead>
<tbody>
<tr>
<td>EAC</td>
<td>Engineering Accreditation Commission</td>
<td>343</td>
<td>1700</td>
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<tr>
<td>CAC</td>
<td>Computing Accreditation Commission</td>
<td>181</td>
<td>197</td>
</tr>
<tr>
<td>ASAC</td>
<td>Applied Science Accreditation Commission</td>
<td>48</td>
<td>66</td>
</tr>
<tr>
<td>TAC</td>
<td>Technology Accreditation Commission</td>
<td>226</td>
<td>679</td>
</tr>
</tbody>
</table>
ABET Objectives of Accreditation

(1) Assure that graduates of an accredited program are adequately prepared to enter and continue the practice of engineering

(2) Stimulate the improvement of engineering education

(3) Encourage new and innovative approaches to engineering education and its assessment

(4) Identify accredited programs to the public
ABET Accredits Programs

- All programs lead to degrees
- All paths of study must be accreditable
- A program is described by:
  - Objectives
  - Outcomes
  - Curriculum
- Transcript is primary evidence of degree
Philosophy

- Institutions and programs define mission and objectives to meet the needs of their constituents - enable program differentiation
- Programs demonstrate how criteria and educational objectives are being met
- Emphasis on outcomes — preparation for professional practice
Emphasis

- Student, faculty, facilities, institutional support, and financial resources linked to program objectives
- Knowledge required for entry into the engineering profession
- Practice of continuous improvement
  - Input of constituencies
  - Process focus
- Outcomes and assessment linked to objectives
Accreditation Criteria

1. Students
2. Program Educational Objectives
3. Program Outcomes and Assessment
4. Professional Component
5. Faculty
6. Facilities
7. Institutional Support & Financial Resources
8. Program Criteria
Criterion 2 - Program Educational Objectives

- Program Educational Objectives:
  - statements that describe the expected accomplishments of graduates during the first several years following graduation from the program

- Unique to the program and institution

- Consistent in all publications
Criterion 2 - Program Educational Objectives

- Each program must have
  - Detailed published educational objectives
  - Process based on needs of constituencies in which objectives are determined and periodically evaluated
  - A curriculum and processes that prepare students for achievement of the objectives
  - A system of on-going evaluation that demonstrates achievement and uses results to improve the effectiveness of the program
Evaluation of Program Objectives

- The following tools are useful in evaluation of program objectives:
  - Alumni surveys
  - Industrial/Professional Advisory Boards
  - Employer’s surveys and placement data
  - Graduate programs at other universities

- Programs may choose to use these or other appropriate assessment methods
Criterion 3 - Program Outcomes and Assessment

- Program outcomes:
  - Statements that describe what students are expected to know or be able to do by the time of graduation from the program.
  - The achievement of outcomes indicates that the student is equipped to achieve the program educational objectives.
  - ABET designated outcomes (a-k) included in some way.
Criterion 3 — Program Outcomes and Assessment (continued)

- Programs must demonstrate their graduates have outcomes “a to k”
- Programs must have an assessment process with documented results
- Evidence that the results of the assessment process are applied to the further development and improvement of the program
ABET Program Outcomes

- Engineering programs must demonstrate that their graduates have:
  
a. An ability to apply knowledge of mathematics, science, and engineering appropriate to the discipline
  
b. An ability to design and conduct experiments, analyze and interpret data
  
c. An ability to design a system, component, or process to meet desired needs
  
d. An ability to function on multi-disciplinary teams
  
e. An ability to identify, formulate and solve engineering problems
ABET Program Outcomes (continued)

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 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
<table>
<thead>
<tr>
<th>Terms</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>Statements that describe the expected accomplishments of graduates during the first few years after graduation.</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Statements that describe what students are expected to know and able to do by the time of graduation.</td>
</tr>
<tr>
<td>Performance</td>
<td>Specific, measurable statements identifying the performance(s) required to meet the outcome: confirmable through evidence.</td>
</tr>
<tr>
<td>Criteria</td>
<td></td>
</tr>
<tr>
<td>Assessment</td>
<td>Processes that identify, collect, use and prepare data that can be used to evaluate achievement.</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Process of reviewing the results of data collection and analysis and making a determination of the value of findings and action to be taken.</td>
</tr>
</tbody>
</table>
The mission of the Department of Engineering is to educate students, within a caring Christian environment, in the discipline of engineering, by combining a strong technical foundation with an emphasis on professional, moral, ethical, and leadership development.
BS ECE Program Objectives

The objectives of the program are:

1. to provide graduates with the academic preparation necessary to be productive and successful engineers.

2. to prepare graduates with the knowledge and skills necessary for interacting effectively with society.

3. to prepare graduates, within an educational environment shaped by Christian ideals, for the thoughtful integration of work and life and to view the engineering profession as a lifelong commitment to serving others.
BS ME Program Objectives

Upon successful completion of the B.S. in M.E. program, the graduate will be able to:

1. apply knowledge of mathematics, basic science and engineering science to bring creatively a project from problem statement to final design.

2. be professionally competent and engaged in life-long learning, serving society in a professional career or by continuing their education in a graduate program.

3. work in interdisciplinary teams and clearly communicate ideas through a variety of media.

4. be a responsible professional with a strong sense of vocation, ethics, and integrity developed in an educational environment shaped by Christian ideals, enabling graduates to become leaders in their churches, communities, professional societies, and society as a whole.
The objectives of the program leading to the B.S.E. degree are:

1. to prepare graduates with the fundamental skills and knowledge required for entry into the engineering profession.

2. to provide students with the flexibility for career paths which differ from those traditionally associated with engineering profession, but which benefit from the technical knowledge, disciplined thinking, and creative problem-solving skills acquired via an engineering education.

3. to prepare graduates with the knowledge and skills necessary for success in a professional environment, including clarity in communication, ability to work on a team, an understanding of professional and ethical responsibilities, and recognition of the need for lifelong learning.

(continued)
The objectives of the program leading to the B.S.E. degree are:

4. to prepare graduates who wish to pursue post-baccalaureate study in fields such as engineering science, medicine, law, or business administration with the requisite foundations in mathematics, basic science, engineering fundamentals, and the humanities.

5. to prepare graduates for the thoughtful integration of work and life by fostering, within an educational environment shaped by Christian ideals, an awareness of the interrelationships between engineering, technology, the natural environment, and the people and social institutions comprising our local and global communities.