Proposal for the BSEE Curriculum for the 2002-2004 Catalog

Prof. Brian L. Evans

On Behalf of the BSEE Curriculum Committee
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Student Participants
Ariane Beck, Robert Knock, Elijah Liu, and Brian Ward

http://www.ece.utexas.edu/~bevans/eereform/
Dressed for Success Tomorrow

• **Mastery of “hard” skills**
  – Fundamentals of mathematics, physics, *biology*
  – Theory and practice of electromagnetics, devices, circuits, systems, software, *networking*
  – *Design principles, abstraction, and complexity*

• **Mastery of “soft” skills**
  – Oral and written engineering communication
  – Business practice of *marketing, budgeting, product development, and ethics*
**1998-2000 BSEE Degree**

**Electromag. and Devices (3 courses)**
- PHY 303L
- EE 325
- EE 339

**Circuits (6 courses)**
- EE 302
- EE 411
- EE 321
- EE 338
- EE 338K
- Adv. Lab.

**Systems (3 courses)**
- EE 313
- EE 362K
- EE 319K

**Digital Hardware (2 courses)**
- EE 316
- EE 312

**Software (1 course)**
- EE 155

**Engineering Comm. (3 courses)**
- EE 333T

**BSEE Curriculum**

- Shading: lab course
- Black lines: co-requisites
- Adv. Lab: EE 321K, 345M, or 345S
## 1998-2000 BSEE Curriculum

<table>
<thead>
<tr>
<th>Topic</th>
<th>Percentage</th>
<th>Credit Hours</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>analog circuits/systems</td>
<td>40%</td>
<td>24.5</td>
<td>2/3 EE302 + 2/3 EE313 + EE411 + 1/2 EE321 + EE321K + EE338 + EE338K + EE351K + EE362K</td>
</tr>
<tr>
<td>specialization</td>
<td>18%</td>
<td>11.0</td>
<td>1/2 EE464H/K + 3 tech. area electives</td>
</tr>
<tr>
<td>analog devices/electromagnetics</td>
<td>10%</td>
<td>6.0</td>
<td>EE325 + EE339</td>
</tr>
<tr>
<td>engineering communication</td>
<td>9%</td>
<td>5.6</td>
<td>EE155 + EE333T + 4/10 EE464H/K</td>
</tr>
<tr>
<td>digital logic/microprocessors</td>
<td>8%</td>
<td>5.0</td>
<td>1/6 EE302 + EE316 + 1/2 EE319K</td>
</tr>
<tr>
<td>programming</td>
<td>8%</td>
<td>4.5</td>
<td>EE312 + 1/2 EE319K</td>
</tr>
<tr>
<td>discrete-time processing/data acquisition</td>
<td>4%</td>
<td>2.5</td>
<td>1/3 EE313 + 1/2 EE321</td>
</tr>
<tr>
<td>business practice</td>
<td>2%</td>
<td>0.9</td>
<td>1/6 EE302 (ethics) + 1/10 EE464H/K (ethics)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
<td><strong>60.0</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Required EE courses:** 51 hours  
**Technical area electives:** 9 hours  
**Hard skills:** 53.3 hours  
**Soft skills:** 6.7 hours
Possible 2002-2004 BSEE Degree

- Electromag. and Devices (3 courses)
  - PHY 303L
  - EE 325
  - EE 339

- Circuits (3 courses)
  - EE 411
  - EE 438
  - EE 362K

- Systems (3 courses)
  - EE 313
  - EE 351K
  - EE 366

- Digital Hardware (2 courses)
  - EE 306
  - EE 312
  - EE 322

- Software (2 courses)
  - EE 319K
  - EE 333T

- Engineering Comm. (3 courses)
  - EE 155
  - EE 302
  - EE 313

- Adv. Lab

Shading: lab course
Black lines: co-requisites
Dashed lines: “or” prereq

BSEE Curriculum
Advanced Laboratory Course

• **Prepare a student for Senior Design**
  – EE321 Electrical Engineering Lab I
  – EE440 Microelectronics Fabrication Tech.
  – EE345L Microprocessor Interfacing Lab
  – EE345S Real-Time Digital Sig. Proc. Lab OR
  – EE374L Applications of Biomedical Eng.

• **Leverage student’s technical area**
  – Counted as technical area elective for BSEE
Possible 2002-2004 Curriculum

<table>
<thead>
<tr>
<th>Topic</th>
<th>Percentage</th>
<th>Credit Hours</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>specialization</td>
<td>30%</td>
<td>20.0</td>
<td>Advanced Lab + 1/2 EE464H/K + 5 technical area electives</td>
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<tr>
<td>analog circuits/systems</td>
<td>24%</td>
<td>16.5</td>
<td>1/2 EE302 + 2/3 EE313 + EE411 + 3/4 EE438 + EE351K + EE362K</td>
</tr>
<tr>
<td>digital logic/microprocessors</td>
<td>10%</td>
<td>6.5</td>
<td>1/6 EE302 + EE306 + EE319K</td>
</tr>
<tr>
<td>programming</td>
<td>9%</td>
<td>6.0</td>
<td>EE312 + EE322</td>
</tr>
<tr>
<td>analog devices/electromagnetics</td>
<td>9%</td>
<td>6.0</td>
<td>EE325 + EE339</td>
</tr>
<tr>
<td>engineering communication</td>
<td>8%</td>
<td>5.6</td>
<td>EE155 + EE333T + 4/10 EE464H/K</td>
</tr>
<tr>
<td>business practice</td>
<td>6%</td>
<td>3.9</td>
<td>1/6 EE302 (ethics) + 1/10 EE464H/K (ethics) + EE366 (economics)</td>
</tr>
<tr>
<td>discrete-time processing/data acquisition</td>
<td>4%</td>
<td>2.5</td>
<td>1/6 EE302 + 1/3 EE313 + 1/4 EE438</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>67.0</td>
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</table>

Required EE courses: 49 hours
Technical area electives: 18 hours

Hard skills: 57.5 hours
Soft skills: 9.5 hours

BSEE Curriculum
## 2002-2004 BSEE Curriculum

<table>
<thead>
<tr>
<th>Topic</th>
<th>1998-2000 Credit Hours</th>
<th>2002-2004 Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>specialization</td>
<td>11.0</td>
<td>20.0</td>
</tr>
<tr>
<td>analog circuits/systems</td>
<td>24.5</td>
<td>16.5</td>
</tr>
<tr>
<td>digital logic/microprocessors</td>
<td>5.6</td>
<td>6.5</td>
</tr>
<tr>
<td>programming</td>
<td>4.5</td>
<td>6.0</td>
</tr>
<tr>
<td>analog devices/electromagnetics</td>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>engineering communication</td>
<td>5.6</td>
<td>5.6</td>
</tr>
<tr>
<td>business practice</td>
<td>0.9</td>
<td>3.9</td>
</tr>
<tr>
<td>discrete-time processing/data acquisition</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Total</td>
<td>60.0</td>
<td>67.0</td>
</tr>
</tbody>
</table>

Changes are shown in yellow
More Choices, Faster Access

- **Students choose two technical areas**
  - BSEE students could only choose one before
  - BS Comp. Eng. students had no choice before
  - Two technical electives support technical area

- **More choices of technical areas**
  - 15 technical areas instead of 9
  - Each technical area has 4-8 courses
  - First semester juniors can access technical area
Tech Areas: EE Emphasis, Part 1

- **Unchanged technical areas**
  - Electromagnetic Engineering
  - Management and Production
  - Power Systems and Energy Conversion

- **New Electronics technical area**
  - Eight courses
  - Includes EE 321, EE 321K, and EE 338K
  - Allows smooth transition from previous catalogs
## Tech Areas: EE Emphasis, Part 2

### 2000-2002
- Biomedical Eng. / Premedical
- Electronic Devices, Materials, and Int. Electronics
- Telecomm./Signal Processing

### 2002-2004
- Biomedical Eng. / Premedical
- Robotics/Controls
- Electronic Materials/Devices
- Comm./Networking Signal and Image Processing

*BSEE Curriculum*
Tech Areas: Comp. Eng. Emphasis

2000-2002

Computer Engineering

Software Engineering

2002-2004

Computer Design

Embedded Systems

VLSI Design

Software Development

System Software

BSEE Curriculum
Possible Impact of Reform

- **Transfer students in 1999-2000**
  - 18.9% of new ECE students in 1999-2000
  - 11 fresh., 39 soph., 24 juniors, 12 seniors
- **Transfer students could finish in 2 years if they have completed 2 years elsewhere**
- **Total number of hours (128 hours now)**
  - BSEE degree at 123 hours
  - BS Comp. Eng. degree at 123 hours
Appendix

Motivations to Pursue BSEE

• **Early 1980s:** home computers, MTV, voiceband data modems, bulletin boards
• **Late 1980s:** PCs, analog cell phones, audio CD players, bulletin boards
• **Early 1990s:** laptops, digital cell phones, video CDs, Internet browsing
• **Late 1990s:** palm pilots, Internet cell phones, DVDs, MP3 players, ADSL
Appendix

Trends in Consumer Electronics

- Increasing amount of communications, signal processing, networking capabilities
- Increasingly digital: software larger role
- Analog, RF, optical subsystems needed to interface systems to physical world
- Devices & semiconductor manufacturing
  - Shrinking area, volume & power consumption
  - Exponential increase in processor speeds
## BSEE Technical Area Choices

<table>
<thead>
<tr>
<th>Technical Area</th>
<th>Students</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Engineering</td>
<td>230</td>
<td>37%</td>
</tr>
<tr>
<td>Telecommunications and Signal Proc.</td>
<td>99</td>
<td>16%</td>
</tr>
<tr>
<td>Management and Production</td>
<td>66</td>
<td>11%</td>
</tr>
<tr>
<td>Integrated Electronics</td>
<td>62</td>
<td>10%</td>
</tr>
<tr>
<td>Electronic Materials and Devices</td>
<td>28</td>
<td>5%</td>
</tr>
<tr>
<td>Electromagnetic Engineering</td>
<td>25</td>
<td>4%</td>
</tr>
<tr>
<td>Premed/Biomedical</td>
<td>25</td>
<td>4%</td>
</tr>
<tr>
<td>Software Engineering</td>
<td>23</td>
<td>4%</td>
</tr>
<tr>
<td>Communication and Control</td>
<td>21</td>
<td>3%</td>
</tr>
<tr>
<td>Biomedical Engineering</td>
<td>21</td>
<td>3%</td>
</tr>
<tr>
<td>Information Systems Engineering</td>
<td>12</td>
<td>2%</td>
</tr>
<tr>
<td>Power Systems and Energy</td>
<td>9</td>
<td>1%</td>
</tr>
</tbody>
</table>

Appendix

Digital Hardware Courses

• **EE306 Introduction to Computing**
  – Bottom-up treatment of computer architecture from gates to assembly language programming
  – Overlap with EE302, EE316, and EE319K which frees these courses to teach other topics

• **EE319K Intro. to Microcontrollers**
  – Move 50-75% of EE345L to EE319K
  – Move 50-75% of EE345M into EE345L
  – EE345M becomes a real-time OS course
Appendix

Digital Hardware Courses

• **EE316 Digital Logic Design**
  – Pre-requisite: EE 306 or CS310
  – Current topics: digital logic
  – Suggested topics: digital logic, FPGAs, VHDL
  – Required for BS Comp. Eng. degree

• **EE316 as BSEE technical elective**
  – Required for Computer Design, Embedded Systems, and VLSI Design technical areas (applies to one-half of current BSEEs)
## Appendix

### Circuits and Systems Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Remove</th>
<th>Add</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE302</td>
<td>Dynamic circuit analysis</td>
<td>Signal/system representation</td>
</tr>
<tr>
<td></td>
<td>Digital system design</td>
<td>Finite state machines</td>
</tr>
<tr>
<td>EE411</td>
<td>Two-port networks</td>
<td>Operational amplifiers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bode plots</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Three-phase circuits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laplace transforms</td>
</tr>
<tr>
<td>EE313</td>
<td>Signal/system representation</td>
<td>Review sig/sys representation</td>
</tr>
<tr>
<td></td>
<td>Quantization</td>
<td>AM/FM modulation</td>
</tr>
<tr>
<td>EE338</td>
<td></td>
<td>Two-port networks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lab component (EE438)</td>
</tr>
<tr>
<td>EE351K</td>
<td></td>
<td>Markov chains</td>
</tr>
</tbody>
</table>

Add one-hour lab component to EE338 to form EE438
No proposed changes to EE362K
Appendix

Lab for EE 438 Electronic Circuits

- **Generation & acquisition of test signals**
  - Sinusoids and noise

- **Measure current, voltage, impedance**
  - 2/3-terminal devices; analyze mystery circuit

- **Complex transfer function measurement**
  - Transfer function, magnitude/phase response to sinusoid/noise input, Bode plot/breakpoints

- **Spectrum measurements and analysis**