Building an Undergraduate Curriculum Through University-Industry Partnership

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Vision of the Baskin School of Engineering

A distinctive engineering school tailored to promote technological innovation

Frontiering, Impacting through excellence in Research, Service and Teaching
Brief History of Engineering Programs at UCSC

• 1967 Department of Computer Science Started - David Huffman recruited from MIT as Chair

• 1984 Department of Computer Engineering Started

• 1997 Baskin School of Engineering Founded

• 1999 Department of Electrical Engineering Started

• 2001 Department of Applied Math and Statistics Started

• 2002 Department of Biomolecular Engineering Started

• 2003 Director and Professor of Information Systems and Technology Management Program hired
Baskin School of Engineering
Academic Programs

Degrees Currently Offered
Bioinformatics- BS, MS, PhD
Computer Science- BA, BS, MS, Ph.D.
Computer Engineering- BS, MS, Ph.D.
Electrical Engineering- BS, MS, Ph.D.
Information Systems Management- BS

Degrees Offered in the Near Future
Applied Mathematics and Statistics- MS, Ph.D.
Biomolecular Engineering- MS, Ph.D.
Information Systems Management- MS
Software Engineering- MS
### Baskin School of Engineering - Its Growth

<table>
<thead>
<tr>
<th></th>
<th>1997-98</th>
<th>2002-03</th>
<th>2005-06</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty (ladder)</td>
<td>25</td>
<td>67</td>
<td>103</td>
<td>130</td>
</tr>
<tr>
<td>Graduate Students (FTE)</td>
<td>60</td>
<td>127</td>
<td>462</td>
<td>700</td>
</tr>
<tr>
<td>Undergraduate (FTE)</td>
<td>594</td>
<td>1059</td>
<td>1414</td>
<td>1535</td>
</tr>
<tr>
<td>Graduate Programs</td>
<td>2</td>
<td>4</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Undergraduate Programs</td>
<td>2</td>
<td>5</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Research Expenditures</td>
<td>4M</td>
<td></td>
<td>24M</td>
<td>37M</td>
</tr>
</tbody>
</table>
Target Areas of Excellence

- Information Technology
  - Security
  - Visualization
- Biotechnology
- VLSI Networks
- Remote Sensing
- Bioinformatics
- Storage
- Databases
- Biomolecular Engineering
- Nanosystems
- NEMS
- Statistics & Mathematical Modeling
- Engineering Management
- Info. Systems Management
## Interdisciplinary Partnerships

<table>
<thead>
<tr>
<th>Arts</th>
<th>Humanities</th>
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<tbody>
<tr>
<td>• Digital Arts/New Media</td>
<td>• Computational Linguistics</td>
</tr>
<tr>
<td>• Music Composition</td>
<td>• Engineering Ethics</td>
</tr>
<tr>
<td></td>
<td>• History of Science, Technology and Medicine</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical &amp; Biological Sciences</th>
<th>Social Sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Biotechnology</td>
<td>• Information Systems Management</td>
</tr>
<tr>
<td>• Nanotechnology</td>
<td>• Human-Computer Interface</td>
</tr>
<tr>
<td>• Environmental Technology</td>
<td></td>
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<tr>
<td>• Adaptive Optics</td>
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S-Curve for Partnership

Achievement

Time

Industry

University
Conventional Industry Interaction Venues

• Internship (e.g., NASA, National Labs, INROADS/Northern California (Hitachi Data Systems, Lockheed Martin, IBM, Calif. State Automobile Assoc., ChevronTexaco), NSC, etc.)
• Coop (5-year BS, e.g. U of Cincinnati, U of the Pacific)
• Industry-sponsored laboratory (e.g., TI DSP University Program, IC fabrication Labs donated by Intel (UIUC), Motorola (RIT), IBM (SUNY-Albany), etc.)
• Industry sponsored projects- Senior Capstone Design, etc.
• Industry speakers for undergraduate hosted seminars (IEEE, SWE, ACM, SPHE, NSBE, etc.)
• Industry alumni inputs
• Advisory council members from industry- input to ABET process
Industry-Sponsored Senior Design Projects

- Company proposes problems and funding of the proposed projects (e.g., GE)
- Course director/instructor makes the problems available for students’ selection for design projects
- IP issues can be agreed prior to start of the course
- Company’s motivation is to encourage education in the areas of growing need or sometime niche need
- Specific real world problems can motivate and benefit students and also instructors
COOP Program - Univ. of the Pacific Case

- All engineering students are required to take the COOP program
- Staff in the School of Engineering (3-4 full time, not cheap) makes recruits companies (more than 100 companies) nationwide and place all eligible students
- Staff also makes visits to the sites and works with supervisors/mentors in industry
- Very well coordinated program, but also costly in view of staff resource and funding
- Strong support from alumni
Industry Input to Undergraduate Curricula

• Brings relevance
• But careful balance required; opinions from small and large companies can be significantly different
• However, uniform emphasis on
  – Communication skills
  – Teamwork
  – Cost awareness
  – Interdisciplinary training
Faculty-Industry Interactions

• On going mutual visits a must
• Exchanging visiting appointments at both sides
• Sabbatical leave of faculty at industry (e.g., faculty member as Manager of industry lab/development project—some of UCB faculty have done so in the past)
• Lecture by industry visitors and suggestions for potential course revision
• CEOs of companies encourage top technical staff members to take leave at universities as “reward”—although in reality not as easy (IBM Watson Lab has done so)
Summary

• Increasing need for close collaboration between industry and engineering programs, in particular EE wherein progress of various fields is rapid
• COOP, Internship, Industry-sponsored student projects, exchange of faculty and industry technical staff are important
• Industry feedback to Undergraduate Curricula is important and alumni, advisory board members, industry visitors can play important roles
• Remember the dynamic S-curve and the $ sign that illustrate the importance and mutual benefits