Preparing for STEM majors

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Background and Professional Experience

• Dean, College of Engineering and Computer Science & Professor of Electrical and Computer Engineering at CSU Northridge, 2006 – present
  (http://www.ecs.csun.edu/ecsdean/ramesh.html)

• Professor & Chair, Electrical Engineering at CSU Sacramento, 1994-2006

• Past President, CSUS Sigma Xi Chapter

• Service on Boards
  • IEEE Educational Activities Board
  • Chair of the Awards and Recognition Committee
  • IEEE-HKN Board of Governors (Western USA Governor)

• Other Board Service
  • SARTA (www.sarta.org), MTISAC (www.mtisac.com), Capital Public Radio (www.capradio.org)
• 437,000 students in 23 campuses
  • Men – 42%
  • Women - 58%
• 54,000 in graduate programs
• 90,000 degrees (07-08)
• CSUN is 2nd largest Campus (36,208)
CSUN’s undergraduate engineering programs are the fastest growing in the nation in the 3 years from ‘05-’08 (96% growth) - ASEE March 2010.

<table>
<thead>
<tr>
<th>School</th>
<th>Growth in Bachelor’s Degrees*</th>
<th>B.S. Degrees: 2008</th>
<th>B.S. Degrees: 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. California State U., Northridge</td>
<td>96%</td>
<td>190</td>
<td>97</td>
</tr>
<tr>
<td>2. South Dakota State University</td>
<td>82%</td>
<td>162</td>
<td>89</td>
</tr>
<tr>
<td>3. California State U., Long Beach</td>
<td>70%</td>
<td>350</td>
<td>206</td>
</tr>
<tr>
<td>4. University of Texas, Arlington</td>
<td>59%</td>
<td>295</td>
<td>186</td>
</tr>
<tr>
<td>5. Univ. of California, Riverside</td>
<td>57%</td>
<td>182</td>
<td>116</td>
</tr>
<tr>
<td>6. City College of the CUNY</td>
<td>54%</td>
<td>249</td>
<td>162</td>
</tr>
<tr>
<td>7. SUNY — Binghamton</td>
<td>49%</td>
<td>218</td>
<td>146</td>
</tr>
<tr>
<td>8. University of Connecticut</td>
<td>44%</td>
<td>272</td>
<td>189</td>
</tr>
<tr>
<td>9. Syracuse University</td>
<td>43%</td>
<td>173</td>
<td>121</td>
</tr>
<tr>
<td>10. George Mason University</td>
<td>42%</td>
<td>317</td>
<td>224</td>
</tr>
</tbody>
</table>

*excluding all computer science
Schools must have awarded at least 75 B.S. degrees in 2005. 215 schools met this criterion.
Regions/nations are now competing globally in a race for talent, capital, and high-value investments across the globe…

… and the global economic landscape is changing…
Challenges

- Global
  - Social Context of Engineering Practice
  - Evolving curricula
  - Workforce needs
“The American education system… just is not stimulating enough young people to want to go into science, math, and engineering.” (page 270)

“…we have done a very poor job of conveying to kids the value of science and technology as a career choice…”

“…we should be embarking on an all-hands-on-deck, no-holds-barred, no-budget-too-large, crash program for science and engineering education immediately.” (page 275)
Engineering – A National Imperative

• “America has always been about innovation, as well as scientific inquiry, and has an incredible diversity of talent out there waiting to be tapped. For every Steve Jobs we need 10,000 others.” – President Barack Obama, February 2012

• With a strong endorsement from President Obama, ASEE and the President’s Council on Jobs and Competitiveness have launched a partnership to measure, evaluate, and celebrate excellence in retention, graduation, and diversity in engineering education. The effort is intended to further the council’s goal of seeing at least a 10 percent increase in engineering graduates over the next decade. A Seal of Excellence will reward engineering colleges that produce more graduates and provide an incentive to others.
The Rapid Pace of Change

- **Years to 25%**
- **U.S. Adoption**

- **Broadband**
  - Source: Computer Systems Policy Project (CSPP.org) Bruce Mehlman 3/04

- **Cell Phones**
  - Source: McKinsey

- **Computers**

- **Television**

- **Electricity**

- **Cars**

- 55 years
- 46 years
- 35 years
- 26 years
- 15
- 13
- 6
Computing Technology (R)Evolution

1935

1946

2010

10/01/12 Preparing for STEM Majors - Ramesh
Social Impact
Successful attributes of the Engineer of 2020

- Possess strong analytical skills
- Exhibit practical ingenuity; posses creativity
- Good communication skills with multiple stakeholders
- Business and management skills; leadership abilities
- High ethical standards and a strong sense of professionalism
- Dynamic/agile/resilient/flexible lifelong learners
- Ability to frame problems, putting them in a socio-technical and operational context
Globalization hits home—Outsourced?

NO. YOU MAY NOT OUTSOURCE YOUR HOMEWORK TO INDIA.
In 2009, 51 percent of U.S. patents were awarded to non-U.S. companies.

China has replaced the U.S. as the world's number one high-technology exporter and is now second in the world in publication of biomedical research articles.

Between 1996 and 1999, 157 new drugs were approved in the United States. In a corresponding period 10 years later, the number dropped to 74.

Almost one-third of U.S. manufacturing companies responding to a recent survey say they are suffering from some level of skills shortage.
So how can we motivate students to pursue STEM majors—specifically in Engineering and Computer Science?
The Perception:  
From Collegeboard.com: *Law*

<table>
<thead>
<tr>
<th>It helps to be…</th>
<th>Are you ready to…</th>
</tr>
</thead>
<tbody>
<tr>
<td>fascinated by the relationship between law and society</td>
<td>engage in intense discussion of thorny legal problems?</td>
</tr>
</tbody>
</table>
From Collegeboard.com:
Broadcast Journalism

<table>
<thead>
<tr>
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<th>Are you ready to…</th>
</tr>
</thead>
<tbody>
<tr>
<td>sharp of mind and quick of tongue</td>
<td>learn how to find and interview sources?</td>
</tr>
</tbody>
</table>
From Collegeboard.com: Civil Engineering

<table>
<thead>
<tr>
<th>It helps to be…</th>
<th>Are you ready to…</th>
</tr>
</thead>
<tbody>
<tr>
<td>A problem-solver who’s creative, curious, logical, and a fan of math.</td>
<td>Spend hours and hours working on problem sets and design projects?</td>
</tr>
</tbody>
</table>
From Collegeboard.com:

**Mechanical Engineering**

<table>
<thead>
<tr>
<th>It helps to be…</th>
<th>Are you ready to…</th>
</tr>
</thead>
<tbody>
<tr>
<td>A fan of science and math, a creative problem solver, and someone who likes to take things apart to find out how they work.</td>
<td>Rely on your math skills? Master <strong>difficult</strong> scientific concepts? Take on a heavy course load? Spend five years as an undergrad…</td>
</tr>
</tbody>
</table>
**From Collegeboard.com:**

**Electrical Engineering**

<table>
<thead>
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<th>It helps to be…</th>
<th>Are you ready to…</th>
</tr>
</thead>
<tbody>
<tr>
<td>A fan of science and math who’s curious about the way things work</td>
<td>Spend hours building detailed, complicated systems</td>
</tr>
<tr>
<td></td>
<td>Try, try, and try again when at first a project doesn’t succeed</td>
</tr>
</tbody>
</table>
We take Engineers for granted

Until there is a problem

- Gulf Oil Spill
- Levees -Katrina
- Power Failures
- Clean Energy & Climate Change
- Clogged Freeways & Regional Growth
Changing the Conversation

Messages for improving public understanding of engineering

- No profession unleashes the spirit of innovation like engineering. From research to real-world applications, engineers constantly discover how to improve our lives by creating bold new solutions that connect science to life in unexpected forward thinking ways. Few professions turn so many ideas into so many realities. Few have such a direct and positive impact on people’s everyday lives. We are counting on engineers and their imaginations to help us meet the needs of the 21st century.

How will engineers and engineering careers change in the future?

• We need to understand where we have been to know where we are going.
• Disconnect between the reality that greets students upon graduation and the models used to train them
• Modern Engineering Education Paradigm – Atmosphere of specializations – Focused on improvements in the world of machines and processes
• Complexity of contemporary design challenges – Vulnerable to small changes, subject to non-local effects as well as the laws of conservation and thermodynamics
• Engineers design, solve, arrange, model, and build for the real beneficiaries – which is the world and everything in it.
• We should strive to teach students how to think, but not what to think
Drivers

Engineering

Society

Technology

• What is intelligence?
• What is information?
• (How) can we build complex systems simply?
Hands-on Project Based Learning
TryEngineering.org

- Launched on 5 June 2006
- Full scale version for the US and Canada is on line
  - Including a very active “ask an engineer” section
  - Newsletters in English and Spanish

- Our portal has become the premier resource for pre-university education on the web

- Visitors come from the US, India, China, Canada, Austria, UK and scores of other countries
Major Sections

- Life of an Engineer
- Become an Engineer
- Find a University
- Lesson Plans
- Ask an Expert
  - Ask an engineer
  - Ask an undergraduate student
- Play Games
Meet Engineering Students

TryEngineering offers profiles of engineering students so you can find out what it might be like to study engineering. The links below offer insights into the experiences of several individuals. Find out more about what the life of an engineering student is like!

- Brett Grumert (Civil Engineering, United States)
- Samuel Russell Screnson (Computer Engineering, United States)
- Rina Hestert (Electrical Engineering, South Africa)
- Sarah Bergman (Electrical Engineering, United States)
- Aravinda Parangrama (Electrical Engineering, United States)
- Renee Dorsey (Electrical Engineering, United States)
- Gus Anderson (Electrical Engineering, United States)
- Jessica Ewing (Mechanical Engineering, United States)

Profiles of students are considered snapshots of a point in the individual's coursework.

(Profiles of engineering students in the United States are provided by the Sloan Career Cornerstones Center.)

Preparing for STEM Majors - Ramesh
ACCESS Program (Accelerated Coursework in Computer Science and Engineering for Student Success)

Talented High School Program (CSUN)

Sponsored by the College of Engineering and Computer Science, at CSUN

Designed for talented high school juniors and seniors who are interested in the field of Engineering and/or Computer Science

MSE 101/L—Intro to Engineering course online & lab portion at local high school campus

Students will earn two college credits
CSUN is a leader in pursuing green technologies

- 1 MW fuel cell plant
- 100 kW triple-junction CPV
- PV panels provide shade for parking and generate 672 kW
Red RAVEN
(Robotic Autonomous Vehicle Engineered in Northridge)

“Prophets of Science” - Science Channel, Aired on March 7, 2012 – starring George Lucas, Prof. Lin, Red Raven and others 😊
A winning habit
IGVC 2012 Champions

10/01/12 Preparing for STEM Majors -
Ramesh
Indoor and Outdoor Mobility for an Intelligent Autonomous Wheelchair

C.T. Lin, C. Euler, P.J. Wang, A. Mekhtarian, and G. Leonard
College of Engineering and Computer Science
California State University, Northridge, USA
Sensors and System Components

- Sensor Input
- Power
- Motion Output
- LabVIEW
Hybrid Run with User
Looking to the future

- Focus on engineering as a basic characteristic of human activity
- Emphasize relationship of engineering to society
- Promote a better image of engineering
- Engineering is creative, satisfying, ever-changing
- Focus on solving global challenges
- Focus on innovation
For Additional Information..

CECS Web URL:
http://www.csun.edu/ecs/

College e-Newsletter:
http://www.ecs.csun.edu/ecs/enews

Or contact CECS Dean:
S. K. Ramesh – (s.ramesh@csun.edu )