



Engineering College Council

College of Engineering

David Gries
Associate Dean of Engineering

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The Undergrad Curriculum

College of Engineering

Undergrad curriculum

Overview

We have pressing issues.

Do a serious study of the curriculum next year?

- A brief history of the curriculum
- Brief intro to the issues
- Panel: Joe Burns, T&AM & Vice Provost
Lance Collins, M&AE
Charlie Van Loan, CS
Frank Moon, M&AE
- Discussion

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Engineering College, 1948-49

Switching from 4-year to 5-year program

Purpose: Broadly professional, designed to train **men** for **leadership** in public service, business, industry. ...

The College emphasizes instruction in the basic principles and applications of science and offers specialized options only to a limited extent.

In electrical engineering, for instance, the full effect of the vacuum tube is as yet unknown, but this invention has already required not only a modification of existing electrical machines but also an entirely new theoretical approach.

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Mechanical Engineering, 48-49

5-year program, first two years

English 3, 3 Public speaking 2 Economics 3
History 3, 3 Psych 3

Math (analytic geometry & calc) 3, 3, 3

Physics (mechanics; wave motion, sound, heat; elec/mag; elect./optics) 3, 3, 3

Chemistry (inorganic; organic; physical) 3, 3, 2, 2

Drawing; descriptive geometry; drafting 3, 3

Casting processes; pattern shop; machine tools 7

Corporate/Industrial Org 3

Mechanics 3

16.5 credits / semester

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Mechanical Engineering, 48-49 5-year program, last three years

Applied math 3
EE 3, 3, 3, 3

Law 3 Industrial accounting 4
Elective 3, 3, 3

Mechs & strength of materials 3, 3, 3

Eng materials 3, 3

Eng materials lab 3, 3

Materials processing 3

Mechanical eng lab 3, 3, 3

Heat power eng 3, 3

Machine design 3, 3

Kinematics 3

Dynamics of machinery 3

Fluid mechanics 3

Industrial Eng 3

Internal comb. eng 3

Steam power plants 3

Project 3, 3 Courses connected to project 3, 3

Almost no flexibility

17.67 credits / semester

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Mechanical Engineering, 48-49 4-year program

Do not show the curriculum. Much like 5-year curriculum:

No project

Almost no flexibility (2, 1)

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College of Engineering 65-66
 5-year program becomes 4-years + M.Eng.

Tuition + fees: \$1800 for the year
 65% of undergrads: scholarships or grants-in-aid

10 modern, spacious buildings, finest equipment

Computer Science started
 MS and PhD only

Extensive computing facilities
 Control Data 1604 and 180A
 IBM 1401 and 1410



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1948: 4 yr to 5-yr
 1965: 5-yr to 4-yr + MEng

Mechanical
 Engineering

	1948	1965	2004
Math	3,3,3,3	4,4,4,3	4,4,4,4,3
Phys	3,3,3,3	3,3,4,4	4,4,4
Chem	3,3,2,2	3,4,(4)	4
CS			4
drafting ...	3,3		
English	3,3	3,3	3,3
T. Comm	2		(3)
Lib stud	4*3	6*3	6*3
	60		66

must include some statistics
 calc needed for admission

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48: 4 yr to 5-yr
65: 5-yr to 4-yr + MEng

Mechanical Engineering

<p>1948 EE 3, 3, 3, 3 Electives 2, 1</p> <p>Mechanical Eng courses 20 * 3</p> <p>146 credits (4 yr)</p>	<p>2004 EE 3 Outside electives 3,3,3 Inside electives 3,3,3 ENGRI: 3</p> <p>Mechanical Eng courses 6*4, 5*3, 2, 1*3 design</p> <p>126 credits (4 yr)</p>
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48: 4 yr to 5-yr
65: 5-yr to 4-yr + MEng

Mechanical Engineering

1948 Flexibility
4-yr electives: 2,1
5-yr electives 3,3,3 project 3,3,3,3

2004 Flexibility
Intro to engineering (ENGRI) 3
Advisor-approved electives 3,3,3
Electives outside major 3,3,3
Concentration within Major: 3,3,(3 design)

aerospace biomechanics therm sys eng
eng mater vehicle eng mech sys & design

Some depts have less flexibility

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The situation today

the factors

Inter-dept and inter-college majors

Globalization

Diversity

Experiential learning

Complexity

Computing revolution

Biology revolution

Interdisciplinary work

Management - Business

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The situation today

Inter-dept & Inter-college majors

•Engineering Policy Committee:

Requirements for Interdept/college Majors

1. Measurable and sustainable student demand for the major
2. No existing major can be modified to meet the goals of the new major
3. The curriculum would be difficult to achieve with electives within an existing major
4. Opportunities for graduates —industry, graduate school, and professional programs
5. Faculty support and leadership
6. Identification of new resources needed
7. Evaluation plan

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The situation today

ISST Major

Information Science, Systems, & Technology (ISST) Joint CS/ORIE Major

- > Studies design and management of complex information systems
- > Two specialization options (7 advanced courses in each)
 - Management Science Option
 - Information Science Option

**Approved by Board of Trustees.
Approved by NY State.**

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The situation today

Inter-dept & Inter-college majors

Environmental Engineering: Joint CEE/BEE Major

- > Single curriculum to eliminate confusion
- > National leadership in training environmental engineers
- > Will seek ABET accreditation after the first class graduates

**Engineering College: approved by Board of Trustees.
Awaiting approval by NY State.**

CALS: Awaiting approval by SUNY.



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The situation today

Study abroad

With more and more globalization, more and more engineering students want (and should have) the chance to study abroad.

Competitors are ahead of us:

Georgia Tech

Michigan

Stanford and MIT



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The situation today

Study abroad PROPOSED

Curriculum in most majors make a year abroad almost impossible

M&AE, ORIE in Paris, using Co-op summer program (proposed)

Hawaii semester (EAS)

•L'Ecole Centrale Paris (proposed)

- > Semester or Junior year abroad
- > Jr. & Sr. years abroad, Meng

•China: undergrad summer (proposed)

•IIT Kanpur: one-year abroad



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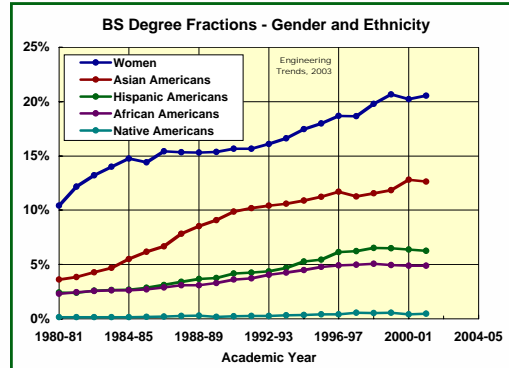
The situation today

Diversity

Where are the women and URMS?

They are the future.

What in our curriculum and teaching keeps them away?



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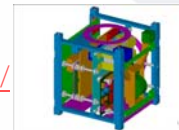
The situation today

Experiential learning

Project teams

QuickTime™ and a TIFF (uncompressed) decompressor are needed to see this picture.

www.engineering.cornell.edu/projectteams/



AIDE ?

Astro 21

AUV 15

EWF ?

CubeSAT 32

Snake Arm ?

Phoenix 10?

HEV 35

Odysseus 10

Program cont. 10?

Solar Decathlon 70



Formula SAE 35

Moonbuggy 13

Roboflag 14

Mini Baja ?

Robocup 26

Steel bridge ?

Concrete canoe 10?

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The situation today

Complexity

Computing Biology Management Business
Interdisciplinary work

ISST
inter-
dept

Flexibility
Breadth versus Depth
General engineering degree?

ENV ENG
inter-
college

New Department: Biomedical Engineering

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Makeover for engineering education

Wulf (NAE pres) and Fischer (NAE Council chair)

Agenda for change

Science is analytic: it strives to understand nature, or what is.

Engineering is synthetic: it strives to create. Engineers "design under constraint" —constraints being nature, cost, safety, environmental impact, reliability, manufacturability, maintainability, society, politics.

Students need same skills as before but more, and in broader areas: technology has changed dramatically, global issues, sensitivity to diversity, communication skills, ...

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Makeover for Engineering Education

Wulf and Fischer

Areas in need of reform

- Curriculum: fundamentals change —still continuous math and physics but also discrete math, information technology, biology, and even cultural /business practices.
- First professional degree is the B.S. —but not in business, law, medicine.
- Diversity. Where are the minorities and women in engineering?
- Technological literacy for the general population.

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Summary

- **The undergrad curriculum needs work.**

Seriously study in 2004-2005?

- **Our awareness of what it takes to teach well needs improving.**

We may make this a priority in 2004-2005.

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