A PROPOSAL FOR A NEW EE CURRICULUM

Yannis Tsividis
Department of Electrical Engineering
Columbia University

Curriculum committee:

Keren Bergman

Alex Elefteriadis

Dan Rubenstein

Amiya Sen

Yannis Tsividis

- Permanent Visitor: Charles Zukowski

Outline

- Reasons for change
- Considerations in new curriculum design
- Proposed changes
- Typical templates
- Work still to be done
- Time table for implementation

Reasons for Change

- Present curriculum has too large a core, makes it impossible to start early in certain subject areas, and allows students to graduate without depth.

Considerations in the Design of the New Curriculum

1. The core, as a whole, should:

- Provide fundamental tools.
- Expose students to the breadth of EE.
- Serve as a springboard.

2. Need for depth in one area

- Familiarization with process of digging into a discipline in depth.
- Opportunity for students to pursue their own passion.
- Job opportunities.

3. Need for breadth

- Innovation requires more and more an interdisciplinary approach.
- Exposure to other fields helps one's creativity in his/her own field.
- Exposure to other fields reduces the chance of obsolescence.

4. Advantages of starting EE early

- Motivates students.
- Allows for just-in-time exposure to math and physics, and motivates their study.
- Gives students more time to explore before choosing a depth area.

Advantages of starting EE early, cont'd

- Allows time to take classes in chosen depth area.
- Allows for spreading non-technical requirements more evenly.

Early start in *all* depth areas

All students should be able to take courses
in *any* of the depth areas
in their *first* year in EE:

- Columbia students as sophomores;
- Transfer students as juniors.

Summary of objectives

- Provide strong core
- Introduce depth
- Ensure breadth
- Early start in all depth areas

Proposed Changes

- Eliminate the following course requirements (and add 2 tech electives):
  - Signals and Systems II
  - Thermodynamics
  - Linear Algebra

- Ask for the following changes, in coordination with the rest of the School (the Math dept. is receptive):
  - Incorporate complex numbers and basics of linear algebra and ODEs into Calculus II
  - Replace ODE course by “Linear Algebra and Differential Equations” course, and possibly have it taken before Calculus III.

- Make the following changes to Signals and Systems I (3202):
  - Remove its circuits prerequisite
  - Redesign it to include an introduction to discrete-time concepts
  - Move it to the fall.

- Add to the core a choice between:
  - Introduction to Communication Systems
  - Introduction to Network Engineering.

- Institute a *depth* requirement:
  - At least two technical electives in one area, in addition to those in the core;
  - At least one of those electives must have as a prerequisite another course in the same area, or a related course in the core.

- Institute a *breadth* requirement:
  - At least two technical electives outside the depth area, in addition to those in the core;
  - One or both of these electives can be from other departments.

A proposal also under consideration:

- Replace the Chemistry requirement by:

"Chemistry/Biology. Choose one course from:

  – CHEM C1403 or higher
  – BIOL W2001 or higher"

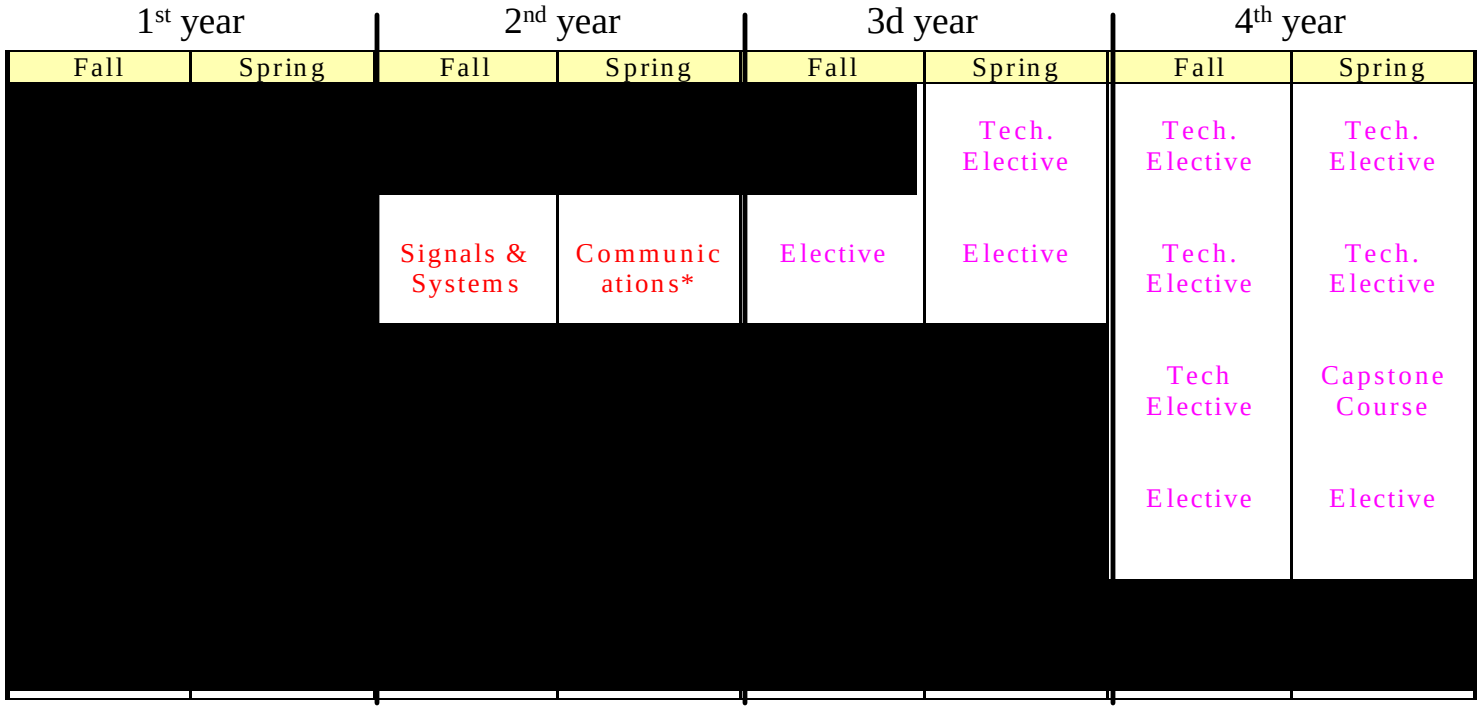
Typical templates

Sample template:
Early-starting students

1st year		2nd year		3d year		4th year	
Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Calculus I	Calculus II	Calculus III	Differen. Equations	Physics III	Tech. Elective	Tech. Elective	Tech. Elective
Physics I	Physics II	Signals & Systems	Communic ations*	Elective	Elective	Tech. Elective	Tech. Elective
Pro-gramming	Chemistry /Biology	Probability	Digital Systems	Sem. Dev. & Lab**	EM & Lab**	Tech Elective	Capstone Course
Gateway Lab	Intro to EE	Circuits	Electro-nics	Data Structures	Physics Lab	Elective	Elective
Non Tech.	Non Tech.	Non Tech.	Non Tech.	Non Tech.	Non Tech.	Non Tech.	Non Tech.

Note: Labs also exist in conjunction with Circuits, Signals and Systems, Digital Systems, and Electronics.

Sample template:
Early-starting students



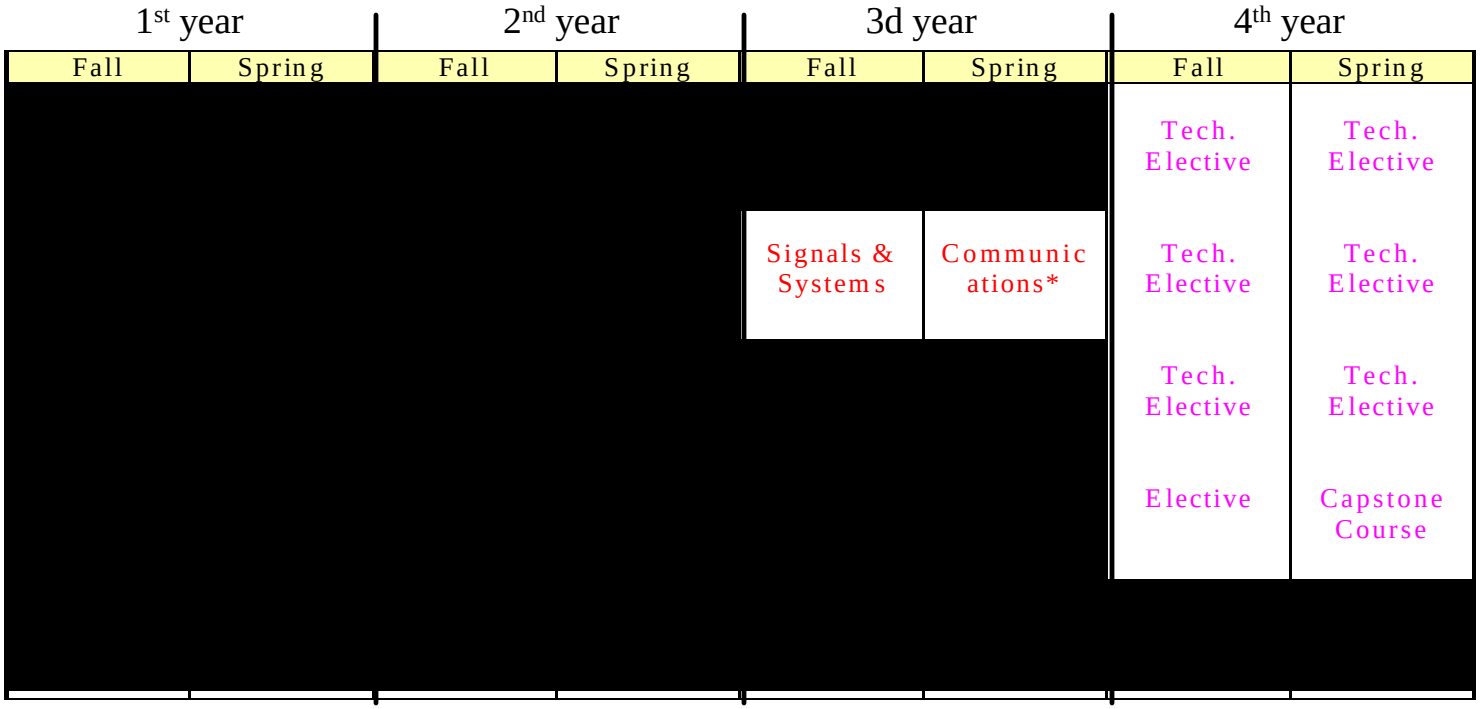
Example: Illustrating flexibility for students oriented toward signals, systems or communications. Similar flexibility exists for other focus areas.

Sample template:
Late-starting & transfer students

1st year		2nd year		3d year		4th year	
Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Calculus I	Calculus II	Calculus III	Differen. Equations	Data Structures	Digital Systems	Tech. Elective	Tech. Elective
Physics I	Physics II	Physics III	Probability	Signals & Systems	Communic ations*	Tech. Elective	Tech. Elective
Pro-gramming	Chemistry /Biology		Intro to EE	Circuits	Electro-nics	Tech. Elective	Tech. Elective
Gateway Lab		Non Tech.		Sem. Dev. & Lab**	EM & Lab**	Elective	Capstone Course
Non Tech.	Non Tech.	Non Tech.	Physics Lab	Non Tech.	Non Tech.	Non Tech.	Non Tech.

Note: Labs also exist in conjunction with Circuits, Signals and Systems, Digital Systems, and Electronics.

Sample template:
Late-starting & transfer students



Example: Illustrating flexibility for students oriented toward signals, systems or communications. Similar flexibility exists for other focus areas.

Work still to be done

- Get more comments from students, faculty, industry, etc.
- Coordinate with School's "First Two Years" committee.
- Talk to the Math department.
- Create new courses/revise courses affected.

Work still to be done, cont'd

- Formulate depth requirements for each area.
- Post sample templates.
- Get approvals.
- Improve advising to prospective transfer students.
- Announce.

Proposed time table

- Finish discussions with “First Two Years” committee and the Math department: 2/28/03
- Finish course revision and submission to COI: 3/31/03
- Formulate depth requirements & post sample templates: 4/15/03
- Announce: 5/1/03