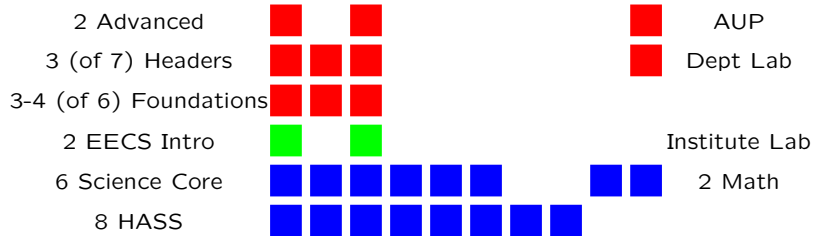


The New EECS Curriculum



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Time Line

Our previous SB program served well for more than 25 years.

- **1975:** EE → EECS
- **1979:** 4 subject (60-unit) common core established
 - 6.001: Structure and Interpretation of Computer Programs
 - 6.002: Circuits and Electronics
 - 6.003: Signals and Systems
 - 6.004: Computation Structures
- **1994:** M.Eng. program established
- **2004:** Curriculum Initiative Committee established
 - examine knowledge/modes of thought needed today and in future
 - recommend changes to curriculum
- **2006:** Pilots for new subjects
- **2007:** New curriculum available as option
- **2008:** New curriculum required

Recommended Curricular Goals

Our educational programs must change to continue to meet the needs of our **changing discipline**.

- Make a broader range of EECS topics accessible to undergraduates
 - communication, software engineering, devices, bioengineering
 - energy, nanoscale engineering, optics, quantum mechanics
- Provide an integrated hands-on introduction
 - provide motivation, help students choose their focus
- Ensure depth in students' focus areas (streams) by end of SB
- Improve students' preparation for starting MEng
 - increase depth before fifth year (streams)
 - provide more time in fifth year for MEng research
- Develop an evolvable curricular structure

Recommended Educational Goals

Our educational programs must change to continue to meet needs of **changing student clientele** and their changing career opportunities.

- Increase student involvement in determining their education
 - increased motivation
 - better informed choices
- More open-ended and hands-on experiences, emphasizing connections between design and modeling and analysis
 - increased understanding
- Provide opportunity for real mastery
 - increased satisfaction

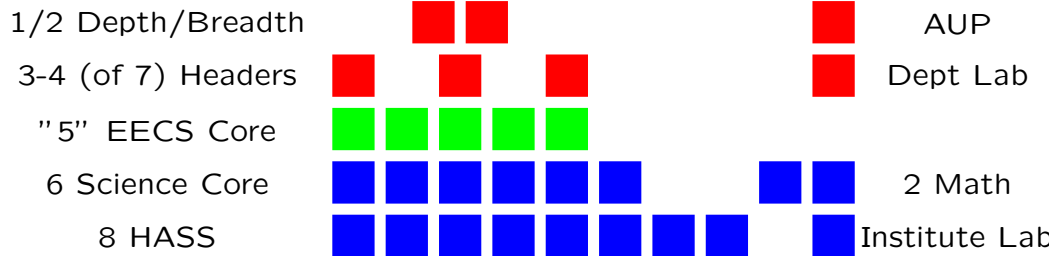
Recommended Curricular Structure

Fewer, more integrated sophomore-level requirements, earlier (sophomore and junior level) choices, and greater depth (streams).

- 2 introductory subjects: big ideas in EECS in authentic context
- 2 math (as before)
- 3-4 foundation (sophomore) subjects (out of 6 instead of 4)
 - 6.002: Circuits and Electronics
 - 6.003: Signals and Systems
 - 6.004: Computation Structures
 - 6.005: Principles of Software Development
 - 6.006: Introduction to Algorithms
 - 6.007: Applied Electromagnetics: From Motors to Lasers
 - ... inference/information/statistics? others?
- 3 header (junior) subjects (out of 7)
- 1 department lab
- 2 advanced undergraduate subjects (defining streams)
- 1 senior project with (communication intensive) companion subject

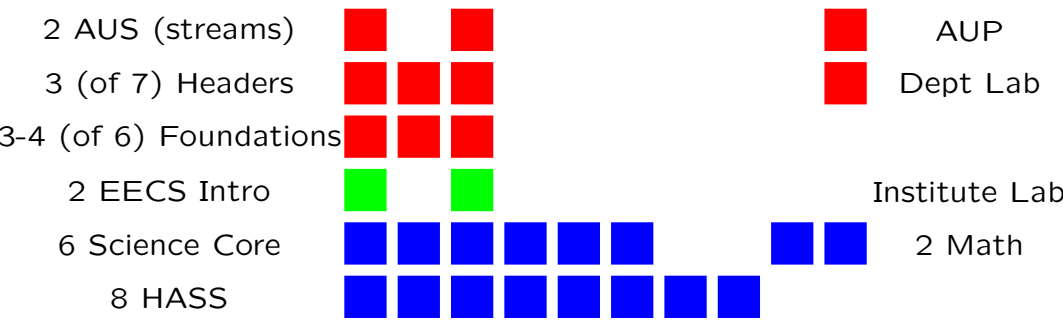
Curricular Structure

Previous SB Requirements



Curricular Structure

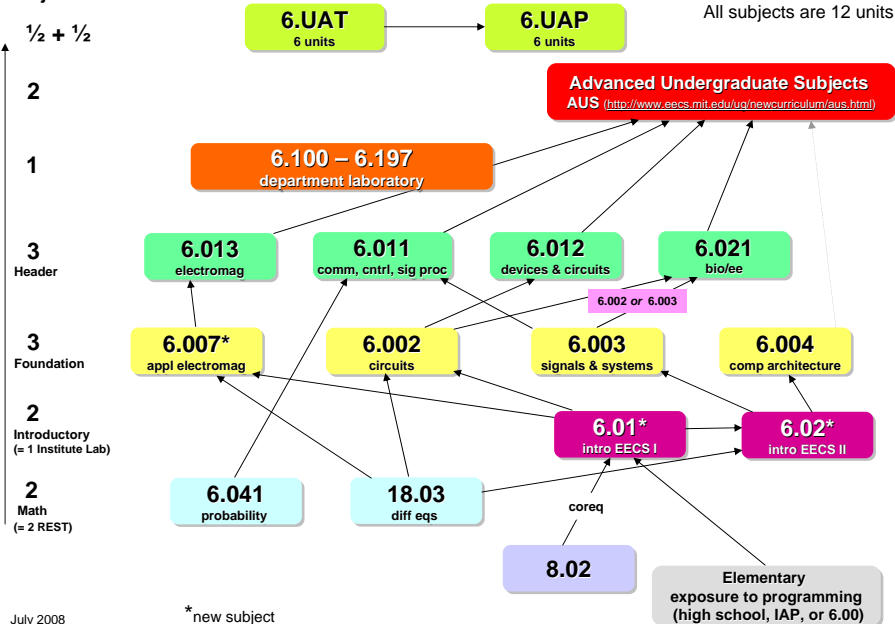
New SB Requirements



Details: 6-1

New 6-1: SB in Electrical Science & Engineering

Subjects



Details: 6-2

New 6-2: SB in Electrical Engineering & Computer Science

Subjects

$\frac{1}{2} + \frac{1}{2}$

6.UAT
6 units

6.UAP
6 units

All subjects are 12 units

2

Advanced Undergraduate Subjects
AUS <http://www.eecs.mit.edu/ug/undergraduate.html>

1

6.100 – 6.197
department laboratory

3

Header
(1 EE, 1 CS,
and 1 EE or CS)

EE 6.013
em

EE 6.011
comm, cntrl, sig proc

EE 6.012
dvcs & circts

EE 6.021
bio/ee

6.033 CS
comp sys

6.034 CS
AI
prereqs to be decided

6.046 CS
adv algorithms

4

Foundation
(2 EE, 2 CS)

EE 6.007*
appl electromag

EE 6.002
circuits

EE 6.003
signals & systems

EE 6.004 CS
comp architecture

6.005* CS
software

6.006* CS
algorithms

2

Introductory
(= 1 Institute Lab)

6.01*
intro EECS I

6.02*
intro EECS II

2

Math
(= 2 REST)

6.041
probability

18.03
diff eqs

coreq

18.06
linear algebra

6.042
discrete math

coreq

8.02

Elementary
exposure to programming
(high school, IAP, or 6.00)

* new subject

New Introductory Subjects: 6.01 & 6.02

The new introductory subjects are intended to provide a different type of common experience for EECS students.

- Provide broader view of fundamental EECS ideas and applications
 - help students make informed choices about their education
- Make explicit connections between EE and CS subject matter
- Demonstrate value of formal tools (models, programs, math, physics) in authentic applications
- Give students practice with selected skills
- Increase students' intellectual independence

(More on these in the next two talks.)

Foundation Subjects (sophomore level)

Diversification at the foundation level provides choice for our students as well as a structure to allow for curricular evolution.

- 6.002: Circuits and Electronics
- 6.003: Signals and Systems
- 6.004: Computation Structures
- 6.005: Principles of Software Development
- 6.006: Introduction to Algorithms
- 6.007: Applied Electromagnetics: From Motors to Lasers
- ... inference/information/statistics? others?

(More on 6.007 in a subsequent talk.)

Header Subjects (junior level)

Only minor changes are required to integrate our current junior level subjects into the new curricular structure.

- 6.011: Introduction to Communication, Control, and Signal Processing
- 6.012: Microelectronic Devices and Circuits
- 6.013: Electromagnetics and Applications
- 6.021: Quantitative Physiology: Cells and Tissues
- 6.033: Computer System Engineering
- 6.034: Artificial Intelligence
- 6.046: Design and Analysis of Algorithms

Streams and Advanced Undergraduate Subjects

Streams and advanced undergraduate (senior) subjects provide mechanisms for ensuring depth in the SB program.

- Streams are selected to be well-defined/recognizable specializations
 - important as credentials for our graduates
- Defined by advanced undergraduate (senior) subjects
- Build on headers, foundations, and laboratory subjects for depth
 - stream = path through curriculum, not a single subject
- Provide a catalog of EECS opportunities for new students
 - advising tool

Initial List of Advanced Undergraduate Subjects

We are now turning attention to development of advanced undergraduate subjects.

- 6.022: Quantitative Physiology: Organ Transport Systems
- 6.023: Fields, Forces and Flows in Biological Systems
- 6.035: Computer Language Engineering
- 6.045: Automata, Computability and Complexity
- 6.047: Computational Biology: Genomes, Networks, Evolution
- 6.061: Introduction to Electric Power Systems
- 6.301: Solid-State Circuits
- 6.302: Feedback Systems
- 6.602: Fundamentals of Photonics
- 6.701: Introduction to Nanoelectronics
- 6.801: Machine Vision
- 6.803: The Human Intelligence Enterprise
- 6.804: Computational Cognitive Science
- 6.805: Ethics and the Law on the Electronic Frontier
- 6.813: User Interface Design and Implementation
- 6.815: Digital and Computational Photography
- 6.837: Computer Graphics
- 16.36: Communication Systems Engineering

Streams

Possible streams are listed here (not yet complete) —
the number and granularity of streams are under discussion.

Communications
Signal Processing
Machine Vision
Machine Learning
Human-Computer Interaction
Information Systems
Computer Systems
Software Engineering
Cryptography
Power Electronics
Photonics
Semiconductor Mat. and Dev.
Nanoelectronics
Bioelectronics
Medical Imaging

Control and Optimization
Robotics
Graphics
Natural Language Processing
Artificial Intelligence
Computer Architecture
Parallel and Dist. Computing
Algorithms
Analog Circuits
Power and Energy Systems
Quantum Electronics
Organic Electronics
Micro/Nano Devices & MEMS
Medical Informatics
Speech and Hearing

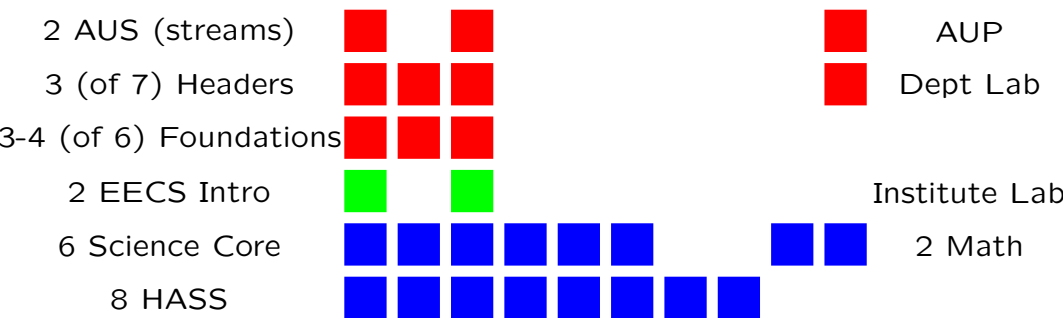
MEng Requirements

The new SB curriculum relaxes requirements of the MEng.

- builds on Advanced Undergraduate Subjects (senior)
 - reduce Graduate H Subject requirement from 4 to 3.5
- Streams → Concentration
 - concentration = coherent group of 3 subjects from Advanced Undergraduate Subjects (2) and Graduate H Subjects (3)
- more time for MEng thesis work

Curricular Structure

New SB Requirements



More information:

<http://www.eecs.mit.edu/ug/newcurriculum/index.html>

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