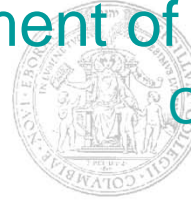


The Fu Foundation School of Engineering and Applied Science

Department of Electrical Engineering



COLUMBIA UNIVERSITY

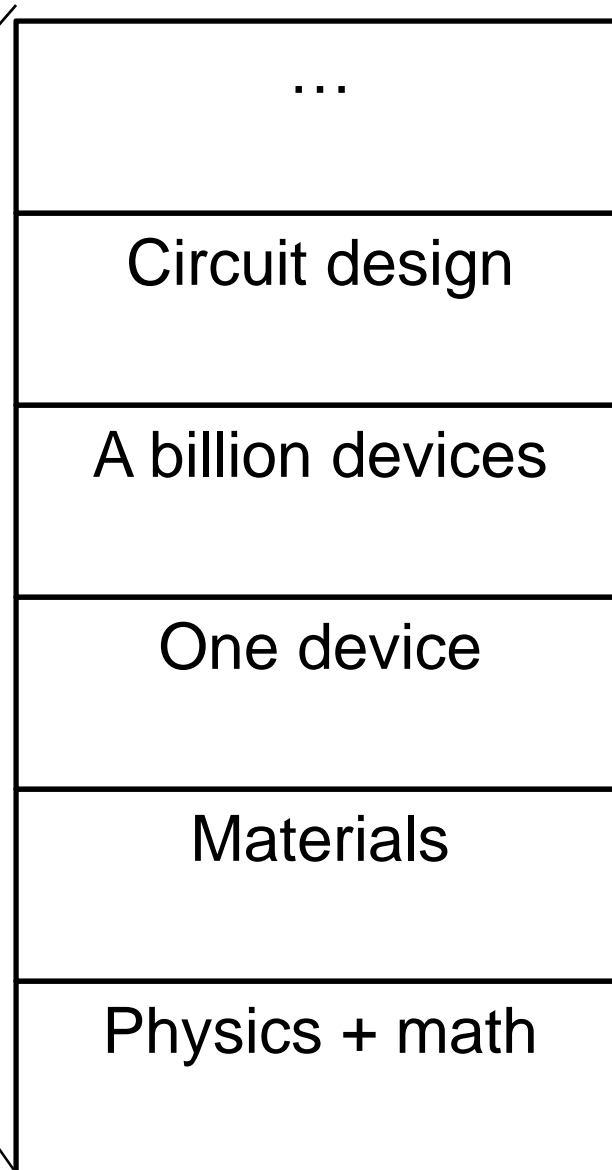
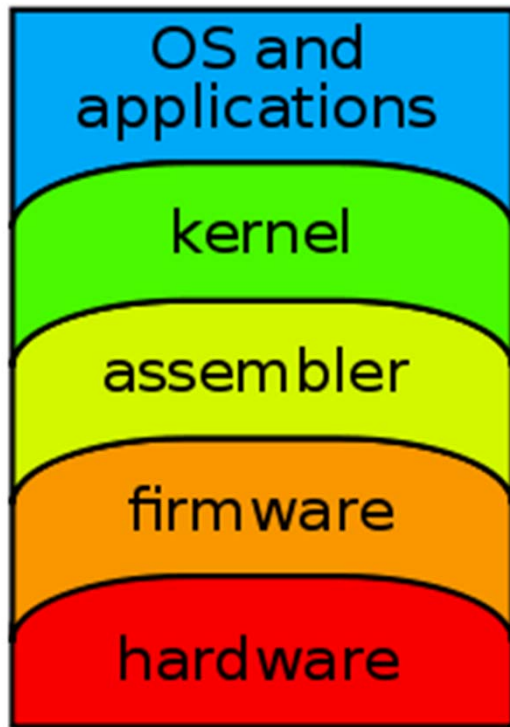
IN THE CITY OF NEW YORK

Microelectronic Devices, Electromagnetics, Plasma Physics, & Photonics

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Approaches to program

- All of these topics are closely related, so the best program will likely mix and match topics to suit your interests
- There are introductory courses offered in the fall in all of the topical areas if you are still deciding
- Note that some of the relevant courses are offered in other departments in SEAS

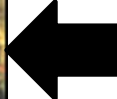
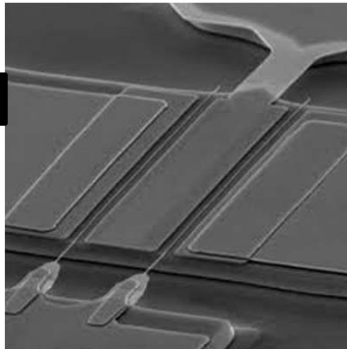
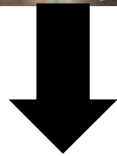


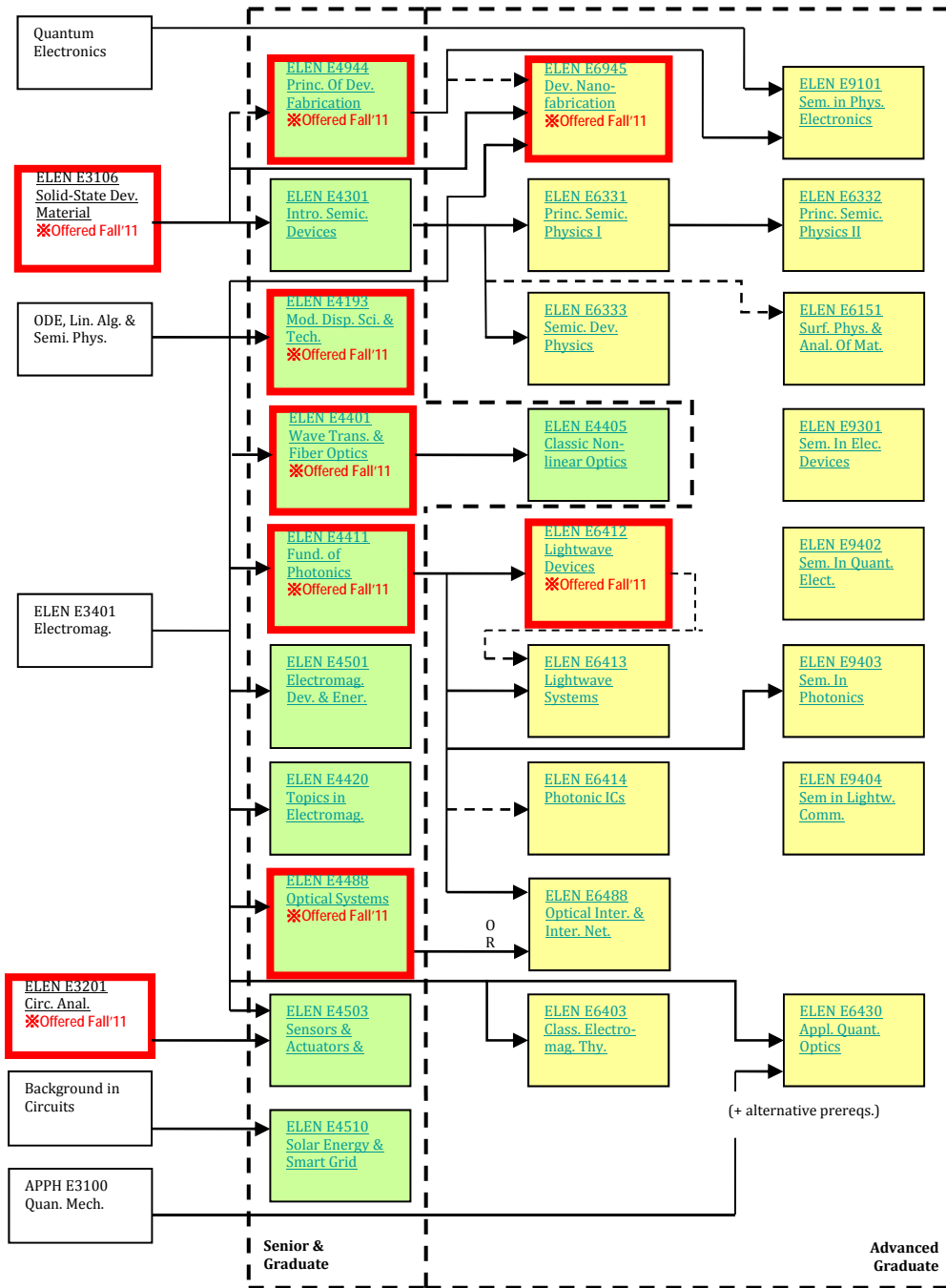
How do we get from



+







Microelectronic devices

- Covers:
 - Fabricating devices starting from raw materials
 - Modeling, and understanding their operation (especially the physics of operation)
 - Design of superior devices
 - Use at the single device level (circuit design is at the multi-device level)
- Useful for careers in silicon microelectronics, MEMS, device modeling, solar energy, and device/material fabrication.
- **Device physics is foundational for circuit design**

Microelectronics-Fall

ELEN 4944 Principles of microfabrication

ELEN 6302 MOS transistor

MECE E4212x Microelectromechanical systems

MSAE E6251y Thin Films and Layers

MECE E6700y Carbon Nanotube Science and Technology

ELEN 6945 Device nanofabrication

Courses in solid state physics/material science:

APPH 4100x Quantum physics of matter

APPH E6081x Solid State Physics, I

CHAP E4120x Statistical Mechanics

APPH E4010x Introduction To Nuclear Science

MSAE E4101x Structural Analysis of Materials

MSAE E4206x Electronic and Magnetic Properties of Solids

MSAE E4207y Lattice Vibrations and Crystal Defects

Microelectronics-Spring

ELEN 4301 Introduction to semiconductor devices

ELEN 6331 Principles of semiconductor physics

APPH E6082y Solid State Physics, II

+ more...

Optics

- Making devices that generate, measure, or manipulate light, and using them to do useful things (e.g. building high speed networks)
- Useful for many careers in science and engineering. Topics include networking, surface science, optoelectronics device fabrication, displays, data storage, and laser technology.
- Inseparable from electromagnetics and devices—any program in optics will likely share elements with the others and vice versa.

Optics

Fall:

ELEN 4193 Display science and technology

ELEN 4411 Fundamentals of photonics

ELEN 4488 Optical systems

(APPH 4110 Modern optics)

ELEN 6412 Lightwave devices

ELEN 4401 Wave Trans/ & Fiber Optics

Spring:

ELEN 6413 Lightwave systems

ELEN 6414 Photonic integrated circuits

Electromagnetics

- The propagation of electromagnetic waves in vacuum and in media (like optics, but for a wider range of wavelengths).
- Covers topics such as how to make antennas, move and store energy, guide radio waves, etc.
- Useful for RF circuit designers as well as in many scientific, communication, and design careers.

Electromagnetics

Fall:

ELEN 4401 Wave transmission and fiber optics

ELEN 4501 Electromagnetic devices and energy conversion

APPH E4300x Applied Electrodynamics

Spring:

ELEN E4703 Wireless Communications

Plasma physics

- How to understand, make, and control plasmas (overlaps with electromagnetism and many other traditional EE areas)
- Extensively used in some areas of lighting, fusion, material conversion, material analysis, plasma fusion, astrophysics, etc.

Plasma-Fall

Fall:

APPH E4301y Introduction To Plasma
Physics (pre-req for other courses in the
area)

APPH E6101x Plasma Physics, I

APPH E6102y Plasma Physics, II

Specialized classes

APPH E4130y Physics of solar energy

MSAE E4090x Nanotechnology

Classes in medical and nuclear physics
(APAM)

Final advice

- The devices and electromag. track offers a variety of choices for concentration or to enrich a program in another area (e.g. circuits)
- Assess your mastery of the prerequisites for each track you're interested in and make sure to take a course that's at the right level for you
- Be sure to keep courses in other related departments in mind when mapping out your schedule
- Your career goals will help guide which areas you want to focus in
- Attend the research overview day next week and look for projects! Up to 6 units of project can be applied toward your degree.