Microelectronic Devices, Electromagnetics, Plasma Physics, & Photonics

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Approaches to program

• These topics are rather closely related, so the best program will likely mix and match topics to suit your interests
• There are introductory courses offered in the fall if you are still deciding
• Note that some of the relevant courses are offered in other departments in SEAS
OS and applications

- kernel
- assembler
- firmware
- hardware

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- Circuit design
- A billion devices
- One device
- Materials
- Physics + math
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
MECE E4212x Microelectromechanical systems
MECE E6700y Carbon nanotube science and technology
ELEN 6945 Device nanofabrication
ELEN 6907 Emerging nanoelectronic devices

Courses in solid state physics/material science:
APPH 4100x Quantum physics of matter
PHYS 4023x Thermal and statistical physics
APPH E6081x Solid state physics, I
MSAE E4101x Structural analysis of materials
MSAE E4206x Electronic and magnetic properties of solids
Microelectronics-Spring

ELEN 4301 Introduction to semiconductor devices
ELEN 6331 Principles of semiconductor physics
APPH E6082y Solid State Physics, II
+ more...
Photonics

- 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.
- Closely related to electromagnetics and devices—any program in optics will likely share elements with the others and vice versa.
Photonics

Fall:
ELEN 4193 Display science and technology
ELEN 4411 Fundamentals of photonics
ELEN 4488 Optical systems
ELEN 6413 Lightwave systems
ELEN 6414 Photonic integrated circuits
APAM 4410 Modern optics
APAM 6110 Laser interactions with matter

Spring:
ELEN 6412 Lightwave devices
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:
APPH E4300x Applied electrodynamics
PHYS G6092 Electromagnetic theory

Spring:
ELEN E4703 Wireless communications
PHYS G6094 Classical fields and waves
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
• Look for projects! Up to 6 units of project can be applied toward your degree.