Microelectronic Devices, Electromagnetics, Plasma Physics, & Photonics

Prof. James Teherani
j.teherani@columbia.edu
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 Intel Core M Processor 1.3B transistors
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 4301 Introduction to Semiconductor Devices
ELEN 4944 Principles of Microfabrication
ELEN 6907 Emerging Nanoelectronic Devices
MECE 4212 Microelectromechanical Systems

Courses in solid state physics/material science:
APPH 4100 Quantum Physics of Matter
APPH 6081 Solid State Physics, I
CHAP 4120 Statistical Mechanics
MSAE 4206 Electronic and Magnetic Properties of Solids
Microelectronics-Spring

ELEN 4301 Introduction to Semiconductor Devices  
(new class now offered in Fall)
ELEN 6331 Principles of Semiconductor Physics
APPH 6082 Solid State Physics, II
MECE 4212 Microelectromechanical Systems
MECE 4213 Bio-microelectromechanical Systems  
(BioMEMS): Design, Fabrication and Analysis
+ more…
Optics and Electromagnetics

- Making devices that generate, measure, or manipulate light and radio waves
- 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.
- Also relevant for optical and RF circuit design
Optics

Fall:
ELEN 4193 Display Science and Technology
ELEN 4411 Fundamentals of Photonics
APPH 4110 Modern Optics
ELEN 6413 Lightwave Systems
ELEN 4488 Optical Systems

Spring:
ELEN 6412 Lightwave Devices
ELEN 6488 Optical Interconnects + Interconnection Networks
Electromagnetics

Fall:
ELEN 4411 Fundamentals of Photonics
APPH 4300 Applied Electrodynamics
BMEN 4430 Principles of Magnetic Resonance imaging

Spring:
ELEN 4703 Wireless Communications
Plasma physics (APAM)

- 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.

Fall
- APPH 6101 Plasma Physics, I

Spring
- APPH 4301 Introduction To Plasma Physics (pre-req for other courses in the area)
- APPH 6102 Plasma Physics, II
Other relevant classes

APPH 4130 Physics of Solar Energy
MECE 4210 Energy Infrastructure Planning

Classes in medical and nuclear physics
Final advice

• The devices/optics/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

• If you are interested in research, look for projects! Up to 6 units of project can be applied toward your degree.

• Think about what you will do over the summer and after you graduate
ELEN 4301
Intro to Semiconductor Devices
ELEN 4301
Intro to Semiconductor Devices

• New, revamped curriculum
• MS/PhD students: great foundational course
• PhD students: great to prepare for quals
• Provides strong fundamentals, useful across diverse areas
  – Photonics
  – Analog + Digital Circuits
  – Microfabrication
  – VLSI design
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