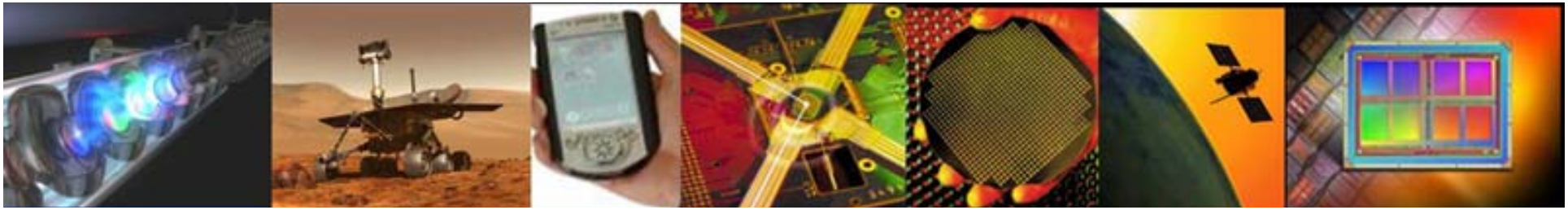


18-200 Fall 2006

The Emerging Trends in Electrical and Computer Engineering

Hosting instructor: Prof. Jimmy Zhu; Time: Thursdays 3:30-4:20pm; Location: DH 2210

	Date	Lecturer	Lecture Contents
L01	08/31	Prof. B. Krogh/S. Blanton	ECE curriculum/student advising
L02	09/07	Prof. B. Falsafi	Intro to Computer Hardware
L03	09/14	Prof. T. Mukherjee	Intro to Circuits
L04	09/21	Prof. J. Hoburg/J. Zhu	Intro to Applied Physics
L05	09/28	Prof. D. O'Hallaron	Intro to Computer Software
L06	10/05	Prof. T. Chen	Intro to Signal and Systems
L07	10/12	Prof. R. Rutenbar	Analog Circuit
L08	10/19	Prof. M. Sitti	Miniature Robots
L09	10/26	Prof. R. Rajkumar	DARPA Grand Challenge
L10	11/02	Prof. M. Savvides	Biometrics
L11	11/09	Prof. D. Siewiorek	Context Aware Mobile Computing
L12	11/16	TBD	
L13	11/30	Prof. M. Kryder	Hard Disk Drives
L14	12/07	Dean P. Khosla	Engineering at Carnegie Mellon

Electrical & Computer ENGINEERING

The ECE Curriculum

Prof. Bruce H. Krogh
Associate Dept. Head
HH 1109

krogh@ece.cmu.edu

Recent Alumni Survey (94-04 grads)

11. Which of the following general categories best describes your current work assignment? (Check all that apply.)	
Design	79
Sales/Marketing	16
Education	6
Manufacturing	4
Management	28
Finance	24
Research and Development	103
Graduate School	41
Unemployed	3
Other	44
TOTAL	348

"Other"

- Analyst
- business owner
- Consulting
- Design & Field Support
- Development Team, DBA
- EDA Software
- Engineering
- Engineering, but not design
- Events
- Government Contracts
- Information Technology
- Law
- management consulting
- Networking
- Operations & IT consulting
- patent engineer
- Policy and Strategic Planning
- quality
- Radio Operator
- Server application development
- Service/Medical
- Software
- Software
- Software Development
- Support
- System Engineer
- Test
- Venture Capital
- Verification
- Verification Engineer
- Weapons inspector

ECE Core Courses

Freshman year

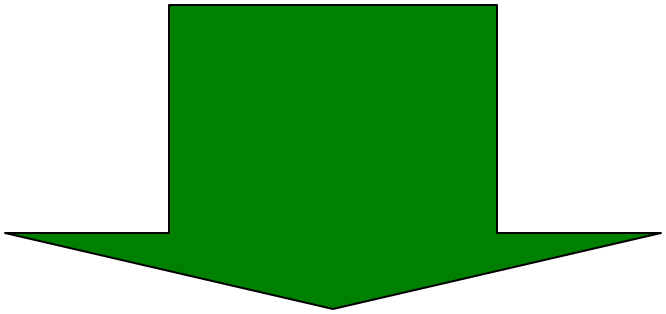
18-100 Introduction to Electrical and Computer Engineering

18-220 Fundamentals of Electrical Engineering

18-240 Fundamentals of Computer Engineering

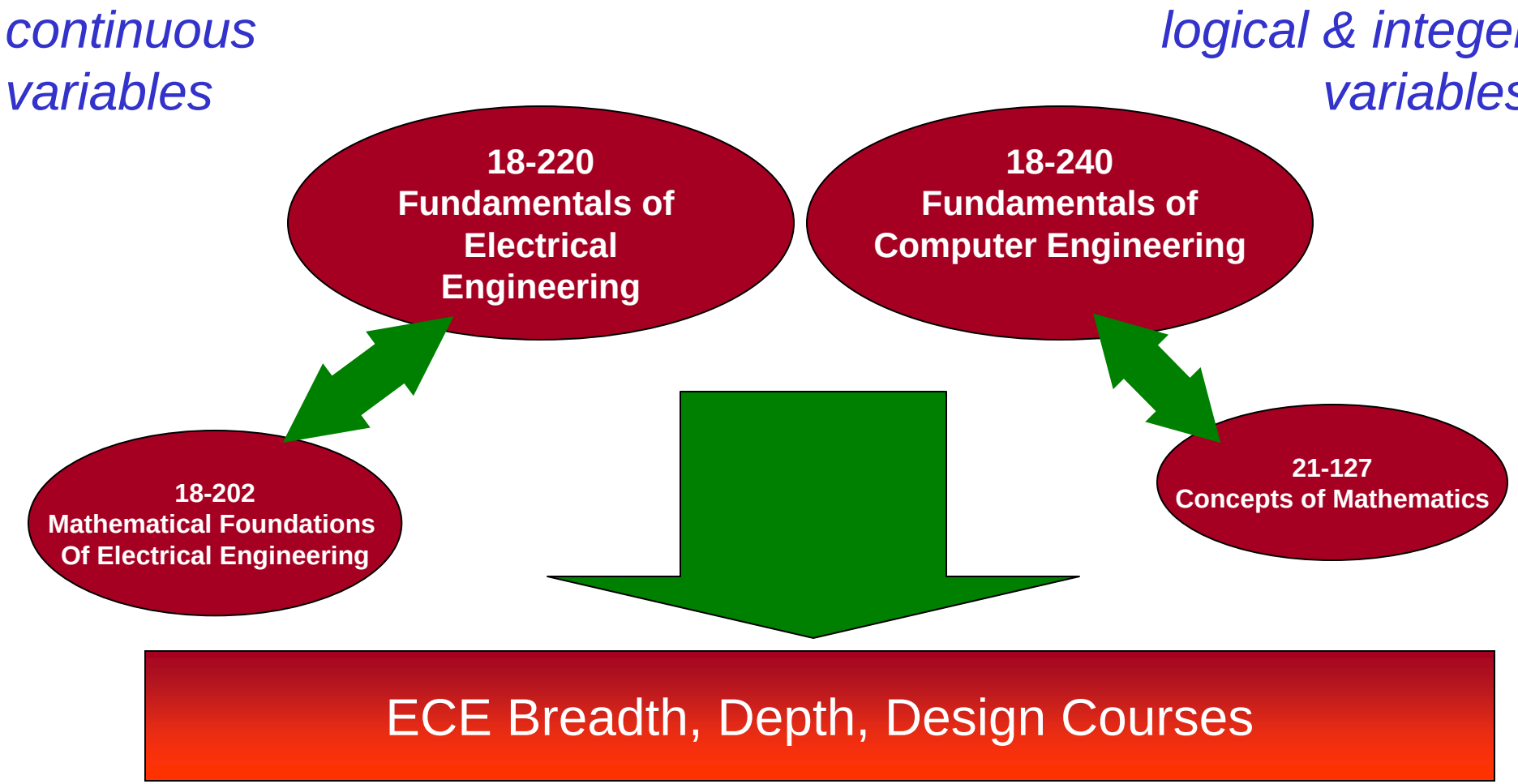
- physical devices
- analog circuits
- signal analysis
- electrical systems

- logical devices
- digital circuits
- logic design
- computers



ECE Breadth, Depth, Design Courses

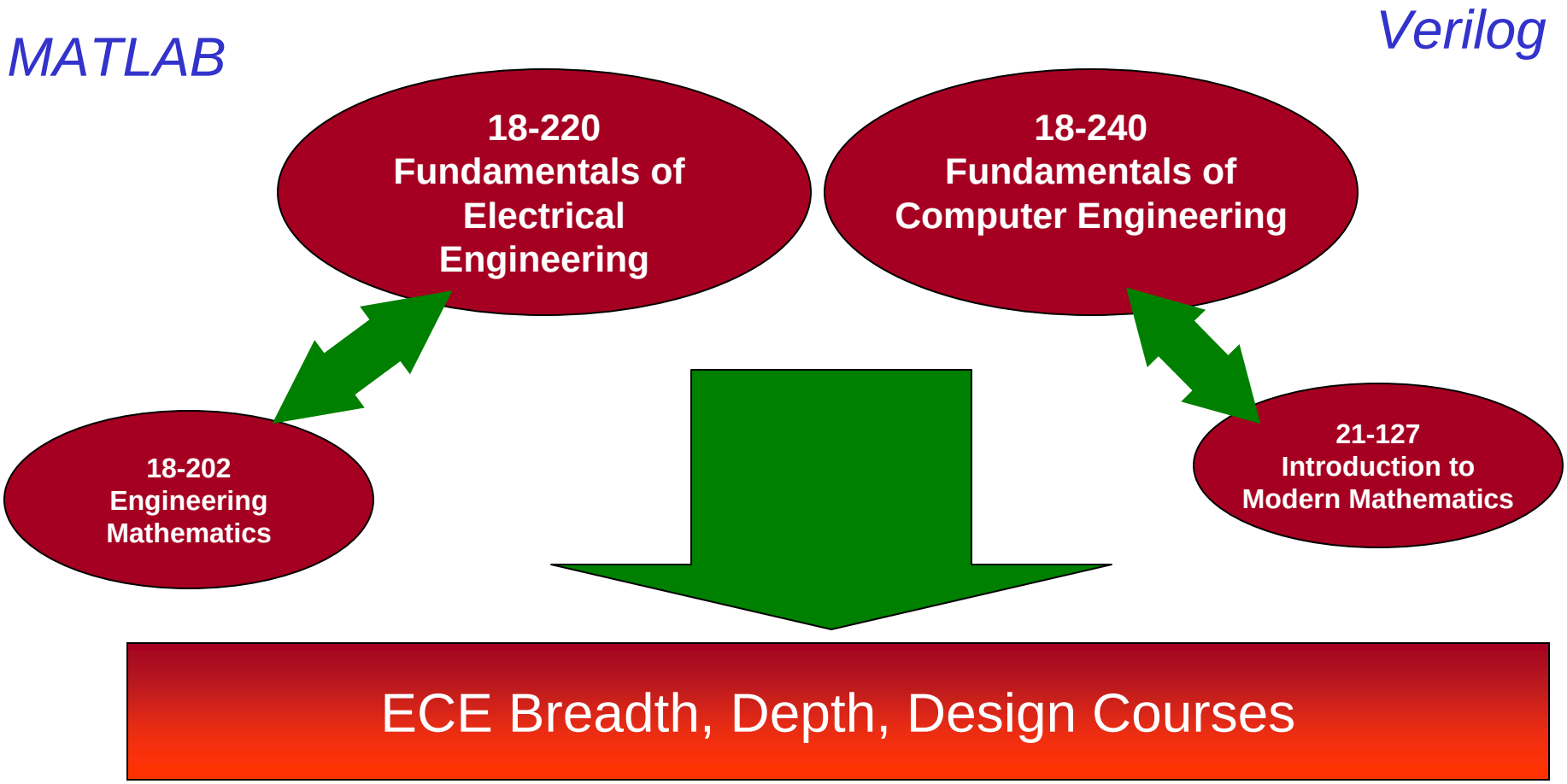
Math Co-Requisites



ECE Math – A Sampling of Topics

- Continuous math (18-202)
  - complex variables
    - used to describe electrical signals and systems
  - matrices
    - used to model and analyze circuits and systems
  - differential equations
    - used do describe dynamic systems
- Discrete math (21-127)
  - logic
    - used to model and design digital circuits
  - induction
    - used to analyze computer algorithms and programs

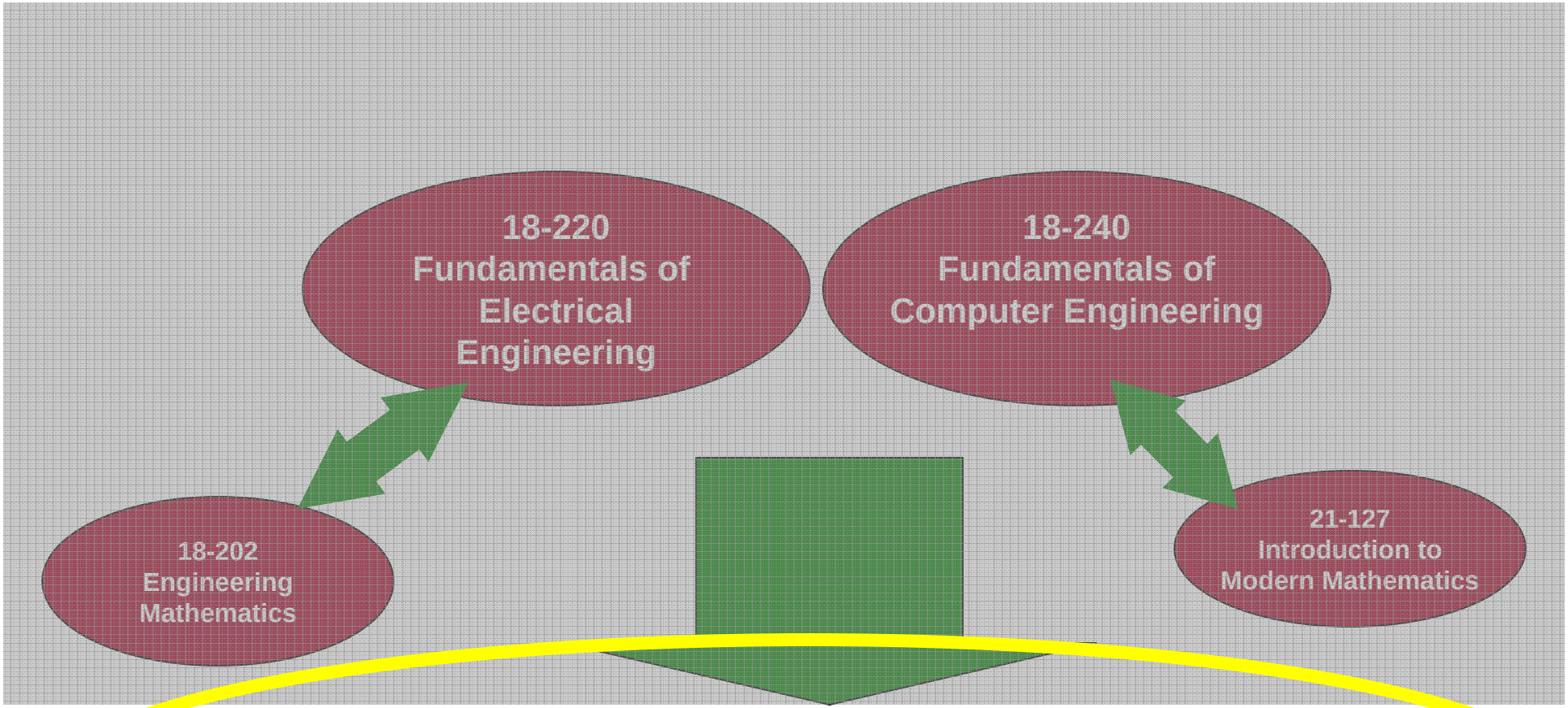
ECE Software Tools



ECE Tools

- MATLAB
  - high-level numerical programming environment
  - industry standard for analysis, simulation and design of systems for signal processing and control
  - http://www.mathworks.com/
- Verilog
  - hardware description language (HDL)
  - widely used HDL for designing and documenting electronic systems
  - http://www.verilog.com/

The Rest of the Curriculum



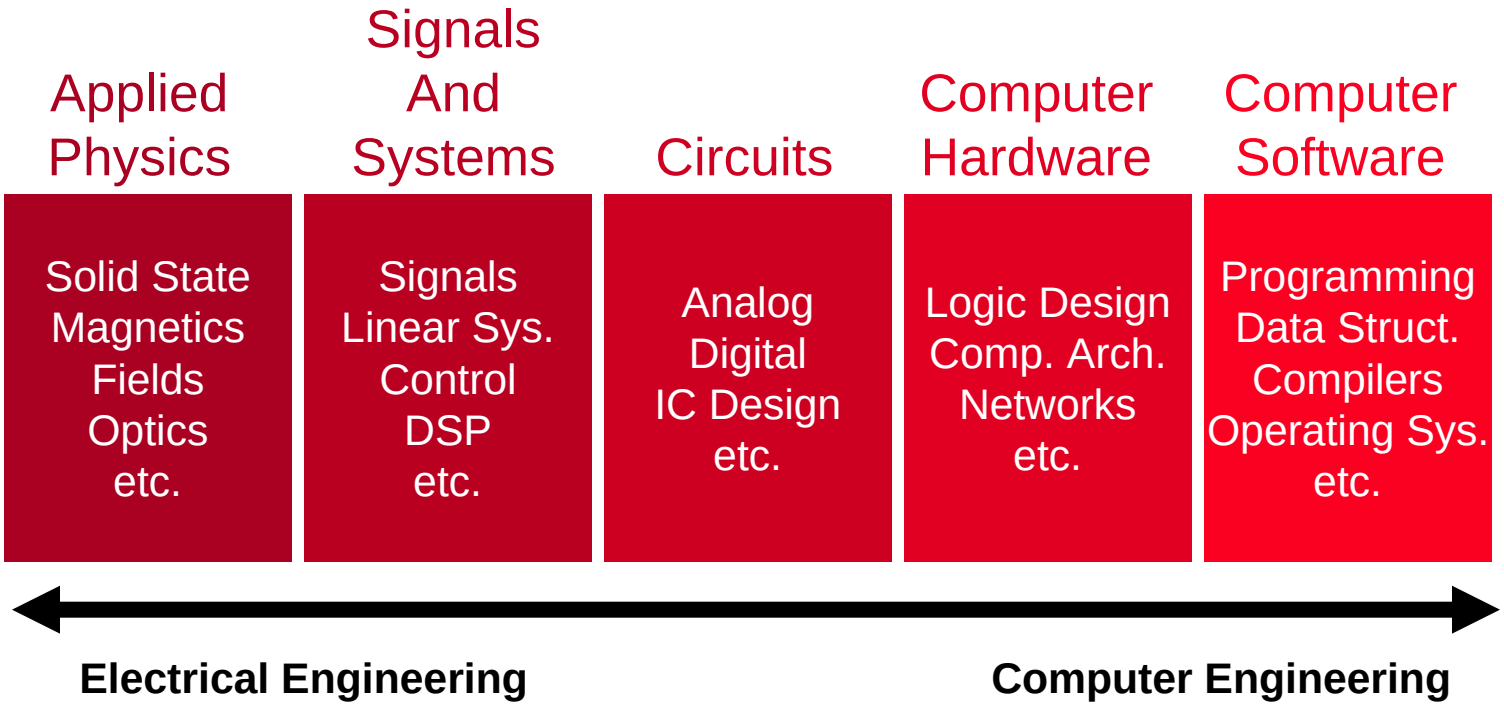
ECE Breadth, Depth, Design Courses

Breadth, Depth, Coverage

Requirements

- Breadth
  - 3 courses from three different areas
- Depth
  - 1 course with a Breadth course as a pre-requisite
- Coverage
  - 2 additional ECE courses

ECE Course Areas



Requirements

- Breadth: 3 courses from three different areas
- Depth: 1 course with a Breadth course as a pre-requisite
- Coverage: 2 additional ECE courses

Electrical & Computer ENGINEERING

Applied Physics

18300	Fundamentals of Electromagnetics
18310	Fundamentals of Semiconductor Devices
18401	Electromechanics
18402	Applied Electrodynamics
18410	Physical Sensors, Transducers and Instrumentation
18412	Field Effect Devices and Technology
18413	Intro to Computer-Aided Instrumentation and Characterization
18416	Data Storage Systems Technology
18417	Introduction to Optical Communication Systems
18517	Data Storage Systems Design
18614	Microelectromechanical Systems
18712	Opto-Electronics for Networks
18713	Optical Networks
18715	Applied Magnetism and Magnetic Materials
18716	Advanced Applied Magnetism
18815	Integrated Circuit Fabrication Processes
18817	Applied Physics: Fundamentals of Semiconductors and Nanostructures

Applied Physics

18300 Fundamentals of Electromagnetics
18310 Fundamentals of Semiconductor Devices
18401 Electromechanics

electronic materials, devices, sensors, data storage systems, manufacturing processes, electromagnetic wave transmission and reception

18712 Opto-Electronics for Networks
18713 Optical Networks
18715 Applied Magnetism and Magnetic Materials
18716 Advanced Applied Magnetism
18815 Integrated Circuit Fabrication Processes
18817 Applied Physics: Fundamentals of Semiconductors and Nanostructures

Signals & Systems

18396	Signals and Systems
18450	Digital Wireless Communications
18470	Fundamentals of Control
18474	Embedded Control Systems
18491	Fundamentals of Signal Processing
18493	Electroacoustics
18496	Bioimaging
18551	Digital Communications and Signal Processing Systems Design
18575	Control System Design
18578	Mechatronic Design
18751	Applied Stochastic Processes
18752	Estimation, Detection and Identification
18753	Information Theory and Coding
18756	Circuit Switching and Packet Switching
18757	Principles of Broadband Communications
18758	Wireless Communication
18771	Linear Systems
18772	Multivariable Control
18777	Large-Scale Dynamic Systems
18791	Digital Signal Processing I
18792	Advanced Digital Signal Processing
18793	Optical Imaging and Radar Processing
18794	Pattern Recognition Theory
18796	Multimedia Comm, Coding Systems, & Networking
18798	Image and Video Processing

Signals & Systems

18396 Signals and Systems
18450 Digital Wireless Communications
18470 Fundamentals of Control
18474 Embedded Control Systems
18491 Fundamentals of Signal Processing

modeling and algorithms for digital signal processing (audio, images, etc.), communication systems, and control systems, robotics

18758 Wireless Communication
18771 Linear Systems
18772 Multivariable Control
18777 Large-Scale Dynamic Systems
18791 Digital Signal Processing I
18792 Advanced Digital Signal Processing
18793 Optical Imaging and Radar Processing
18794 Pattern Recognition Theory
18796 Multimedia Comm, Coding Systems, & Networking
18798 Image and Video Processing

Circuits

18321 Analysis and Design of Analog Circuits
18322 Analysis and Design of Digital Circuits
18415 Between Design & Marketplace of Deep Submicron IC's
18525 Integrated Circuit Design Project
18623 Analog Integrated Circuit Design
18721 High-Frequency Analog Integrated Circuit Design & Device Modeling
18722 Advanced Digital VLSI Circuit Design
18723 RFIC Design and Implementation
18724 Microelectromechanical System Design
18725 Digital Integrated Circuit Design
18762 Circuit Simulation: Theory and Practice
18764 In Between Design & Manufacturing of SM ICs

Circuits

18321 Analysis and Design of Analog Circuits

18322 Analysis and Design of Digital Circuits

**integrated circuits, digital circuit design,
analog circuit design,
electronic design automation**

18724 Microelectromechanical System Design

18725 Digital Integrated Circuit Design

18762 Circuit Simulation: Theory and Practice

18764 In Between Design & Manufacturing of SM ICs

Computer Hardware

18340	Digital Computation
18345	Introduction to Telecommunications Networks
18360	Introduction to Computer Aided Digital Design
18441	Verification of Computer Hardware Systems
18447	Introduction to Computer Architecture
18540	Rapid Prototyping of Computer Systems
18544	Network Design and Evaluation
18545	Advanced Digital Design Project
18741	Advanced Computer Architecture
18742	Multiprocessor Architecture
18743	Energy Aware Computing
18744	Hardware Systems Engineering
18746	Advanced Storage Systems
18747	Advanced Techniques in Microprocessors
18748	Dependable System Design
18759	Wireless Networks
18760	VLSI CAD: Logic to Layout
18765	Digital System Testing and Testable Design
18766	The Art and Science of System-Level Design
18767	VLSI CAD: Software to Logic
18841	Advanced Operating Systems and Distributed Systems
18843	Mobile Computing Systems and Applications
15213	Introduction to Computer Systems

Computer Hardware

18340 Digital Computation
18345 Introduction to Telecommunications Networks
18360 Introduction to Computer Aided Digital Design
18441 Verification of Computer Hardware Systems
18447 Introduction to Computer Architecture

computer architecture, logic synthesis and testing, data storage systems, computer networks, embedded systems

18759 Wireless Networks
18760 VLSI CAD: Logic to Layout
18765 Digital System Testing and Testable Design
18766 The Art and Science of System-Level Design
18767 VLSI CAD: Software to Logic
18841 Advanced Operating Systems and Distributed Systems
18843 Mobile Computing Systems and Applications
15213 Introduction to Computer Systems

Computer Software

18342	Fundamentals of Embedded Systems*
18349	Embedded Real-Time Systems*
18549	Distributed Embedded Systems*
18730	Introduction to Computer Security
18749	Dependable Embedded Systems*
18845	Internet Services
15-211	Fundamental Data Structures and Algorithms
15-212	Principles of Programming
15-312	Programming Language Design and Processing
15-381	Artificial Intelligence: Representation and Problem Solving
15-385	Artificial Intelligence: Computer Vision
15-410	Operating System Design & Implementation
15-411	Compiler Design
15-415	Database Applications
15-441	Computer Networks
15-451	Algorithm Design & Analysis
15-453	Formal Languages and Automata
15-462	Computer Graphics I
15-681	Machine Learning

* The embedded systems courses are also listed under "Computer Hardware"

Computer Software

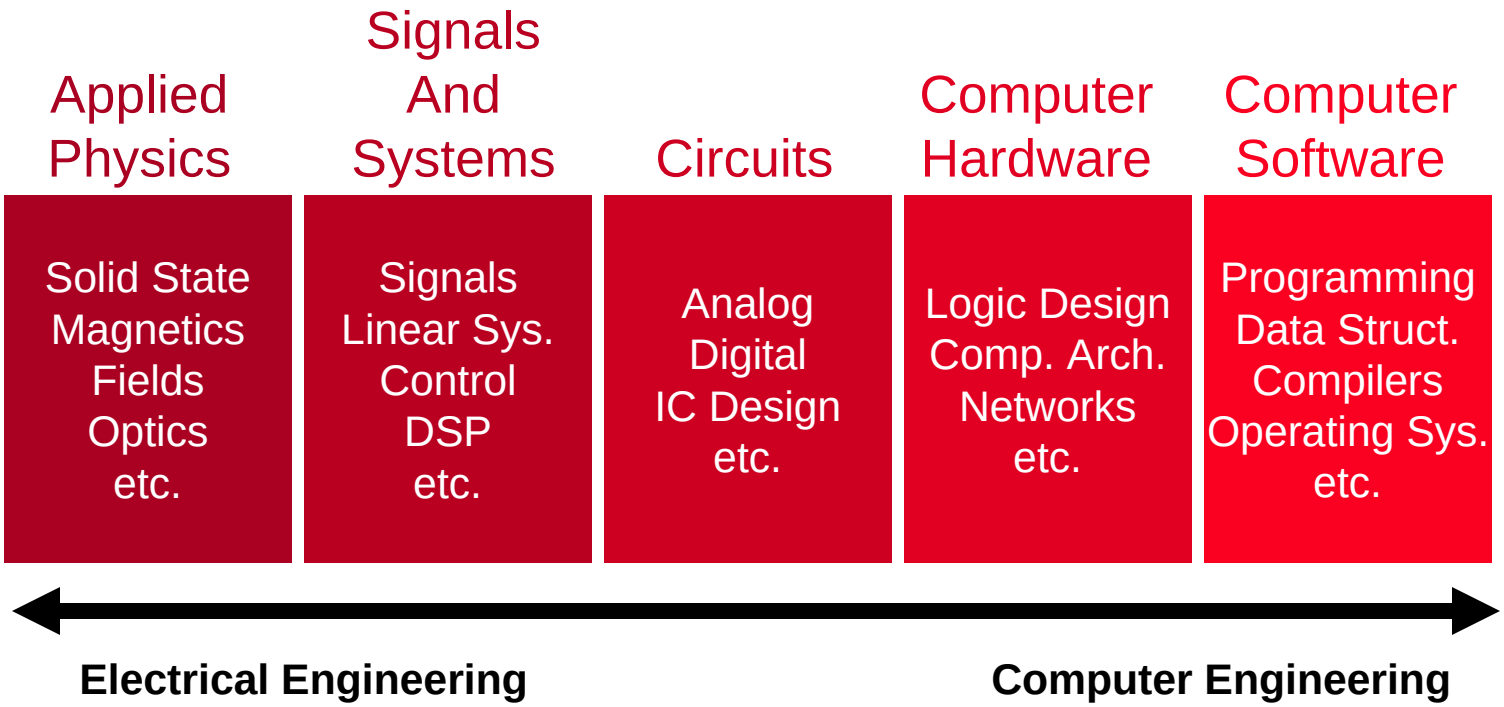
18342 Fundamentals of Embedded Systems*
18349 Embedded Real-Time Systems*
18549 Distributed Embedded Systems*

system software (operating systems, device drivers), networks, algorithms, graphics, security, artificial intelligence

15-415 Database Applications
15-441 Computer Networks
15-451 Algorithm Design & Analysis
15-453 Formal Languages and Automata
15-462 Computer Graphics I
15-681 Machine Learning

* The embedded systems courses are also listed under "Computer Hardware"

ECE Course Areas



Requirements

- Breadth: 3 courses from three different areas
- Depth: 1 course with a Breadth course as a pre-requisite
- Coverage: 2 additional ECE courses

1 Required Capstone Design Course

18-513 Wireless System Design

18-517 Data Storage Systems Design

18-525 Integrated Circuit Design Project

18-527 Digital Systems on a Chip Design

18-540 Rapid Prototyping of Computer Systems

18-544 Network Design and Evaluation

18-545 Advanced Digital Design Project

18-549 Embedded Systems Design

18-551 Digital Communications and Signal Processing Systems

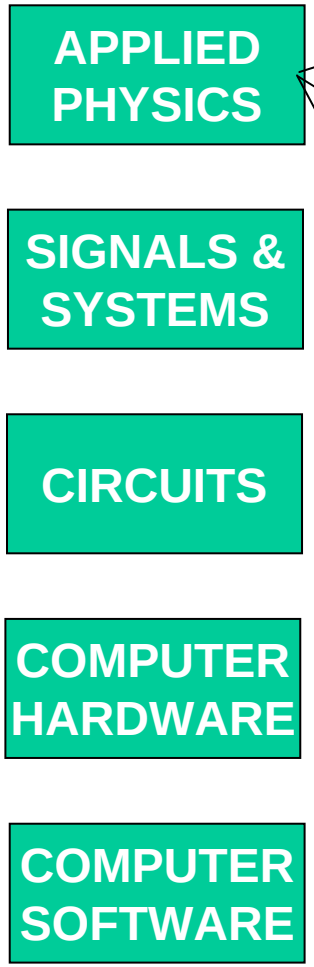
18-578 Mechatronic Design

Background for Capstone Design Courses

APPLIED PHYSICS	18-513	Wireless System Design
	18-517	Data Storage Systems Design
SIGNALS & SYSTEMS	18-525	Integrated Circuit Design Project
	18-527	Digital Systems on a Chip Design
CIRCUITS	18-540	Rapid Prototyping of Computer Systems
	18-544	Network Design and Evaluation
COMPUTER HARDWARE	18-545	Advanced Digital Design Project
	18-549	Embedded Systems Design
COMPUTER SOFTWARE	18-551	Digital Communications and Signal Processing Systems
	18-578	Mechatronic Design

Electrical & Computer ENGINEERING

Background for Capstone Design Courses



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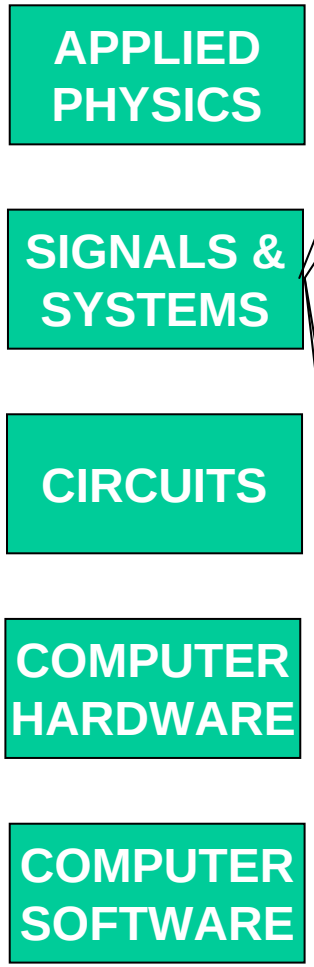

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Electrical & Computer ENGINEERING

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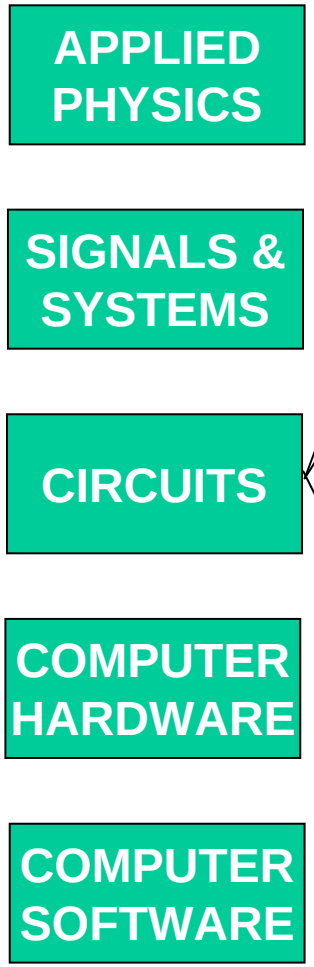

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Electrical & Computer ENGINEERING

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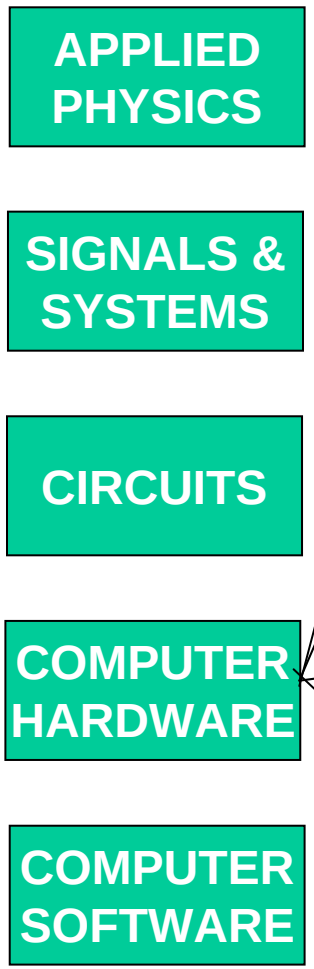

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Electrical & Computer ENGINEERING

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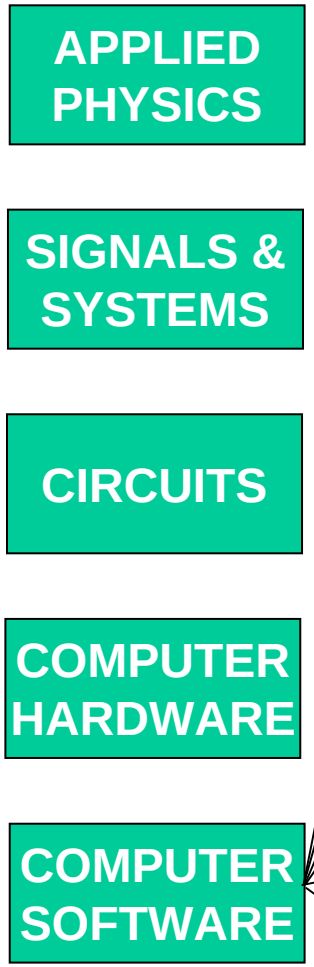

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18-551 Digital Communications and Signal Processing Systems

18-578 Mechatronic Design

Lot's of flexibility!!!

Freshman Year		**Sophomore Year**	
Fall	**Spring**	**Fall**	**Spring**
Introduction to Electrical & Computer Engineering *(12)*	Introductory Engineering Elective *(12)*	Emerging Trends in ECE *(1)*	ECE Core Course *(12)*
Introductory/ Intermediate Programming *(10)*	Physics for Engineering Students I *(12)*	ECE Core Course *(12)*	Concepts of Mathematics/ Mathematical Foundations of EE *(9/12)*
Calculus *(10)*	Calculus *(10)*	Mathematical Foundations of EE /Concepts of Mathematics *(12/9)*	Probability and Statistics *(9)*
Writing/Expression Course *(9)*	General Education Course *(9)*	Physics for Engineering Students II *(12)*	General Education Course *(9)*
Computer Skills Workshop *(3)*		General Education Course *(9)*	Free Elective *(9)*
Total Units: 44	***43***	***46/43***	***48/51***

Electrical & Computer ENGINEERING

Flexibility continued!!!

Junior Year		Senior Year	
Fall	**Spring**	**Fall**	**Spring**
ECE Breadth Course 1 *(12)*	ECE Breadth Course 3 *(12)*	ECE Coverage Course 1 *(12)*	ECE Capstone Design/Coverage Course 2 (12)
ECE Breadth Course 2 *(12)*	ECE Depth Course *(12)*	Engineering Elective *(12)*	Engineering Elective *(12)*
Math/Science Elective 1 *(9)*	Math/Science Elective 2 *(9)*	General Education *(9)*	General Education Course *(9)*
General Education Course *(9)*	General Education Course *(9)*	Free Elective *(9)*	Free Elective *(9)*
Free Elective *(3/6/9)*	Free Elective *(3/6/9)*	Free Elective *(3/6/9)*	Free Elective *(3/6/9)*
45/48/51	***45/48/51***	***45/48/51***	***45/48/51***

Counting your beans ...

Carnegie Mellon University
Degree Audit

Run Date:
10/23/03

Major: 2001:CIT:BS:ECE

Advisor: JMPETERS
Department: ECE
School: CIT

ANDREW_ID:
CLASSLEVEL:
CUM_QPA:
UNITPASSED:
UNIT_INPRG:
UPCOMING:
Student ID:
Full Name:
Major:

Not Matched:

For BS Electrical & Computer Engineering 2001 Catalog Year
CIT Core Requirements

1. Computing Skills Workshop	: 99-101	Fall	'02	P	3.0
2. Programming	: 15-100	Fall	'02	A	10.0
3. Freshmen Math I	: 21-115	Fall	'02	AP	5.0
	21-116	Fall	'02	AP	5.0
4. Freshmen Math II	: 21-117	Fall	'02	A	5.0
	21-118	Fall	'02	A	5.0
5. Math Corequisite	: 18-202	Fall	'03	*	12.0
	21-127	Spring	'03	A	9.0
6. Math\Sci Electives	: 21-259	Spring	'03	A	9.0
	21-260	Fall	'03	*	9.0
7. Prob & Statistics	:1 unfilled course				
8. Physics I	: 33-106	Spring	'03	A	12.0
9. Physics II	: 33-107	Sum1	'03	TR	12.0
10. Writing/Expression	: 82-085	Spring	'03	A	9.0
11. Humanistic Studies	: 79-104	Fall	'02	B	9.0
12. Cognition and Institutions	: 73-100	Sum1	'03	TR	9.0
13. Depth Seq in H&SS/FA	:27.00 unfilled Units				
14. Non Tech Electives	: 73-250	Fall	'03	*	9.0
	85-219	Sum1	'03	TR	9.0
15. Intro_to_ECE	: 18-100	Fall	'02	A	12.0
16. Intro Engineering Elect	: 24-101	Spring	'03	A	12.0
17. ECE Core	: 18-220	Fall	'03	*	12.0
	1 unfilled course				
18. ECE Breadth	: 15-211	Fall	'03	*	12.0
	2 unfilled courses				
19. ECE Coverage	:24.00 unfilled Units				
20. Capstone Design Elective	:12.00 unfilled Units				
21. Engineering Elective	: 15-200	Spring	'03	A	9.0
	3.00 unfilled Units				
22. Free Electives	: 15-113	Fall	'03	*	5.0
	21-125	Fall	'02	A	3.0
	21-257	Fall	'03	*	9.0
	37.00 unfilled Units				

ECE Depth Requirement

1. ECE Depth	: 15-211	Fall	'03	*	12.0
	1 unfilled course				

Academic Audit –

- *accessible from the ECE web site*
- *go to "Current Students /Undergraduate"*

Electrical & Computer ENGINEERING

A Few More things ...

Minors, Majors, Double Degrees

- Double degrees: MORE CREDITS

ECE Industry CO-OP

- Open to juniors with QPA of 3.0 and above
- 8 month period January to August
- Additional summer period (optional)

Summer Internships

- Regular on-campus recruiting events

International Opportunities

- Study abroad

  www.studentaffairs.cmu.edu/oie/sab/index.cfm

- Technical internships: IAESTE

  www.andrew.cmu.edu/user/iaeste/

The IMB Program

- Open to students with QPA of 3.0 and above
- Requirements of “Course Option” M.S. degree
  - Simply a way for CMU ECE Juniors to be admitted to the MS program without submitting a full application
  - The BS and MS (course option) requirements apply
  - Courses taken any time can be applied to the MS degree (i.e., don't have to have completed the BS degree for courses to count toward the MS)
  - No courses can be counted double
  - Need to carefully consider when to switch to "graduate standing" (it may affect financial aid)
  - For excellent students, the regular MS program may be better than the IMB (you might get paid as a Research Assistant, rather than paying tuition in the IMB program)

Projects

- It's a good way to have some professor(s) know you personally (you are going to want recommendations some day!)
- Start looking for opportunities
  - go to web sites
  - talk to other students
  - visit the professors
  - look outside of ECE
- Don't just talk to professors teaching your courses!!!

Getting More Information:

www.ece.cmu.edu