

The ECE Curriculum

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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

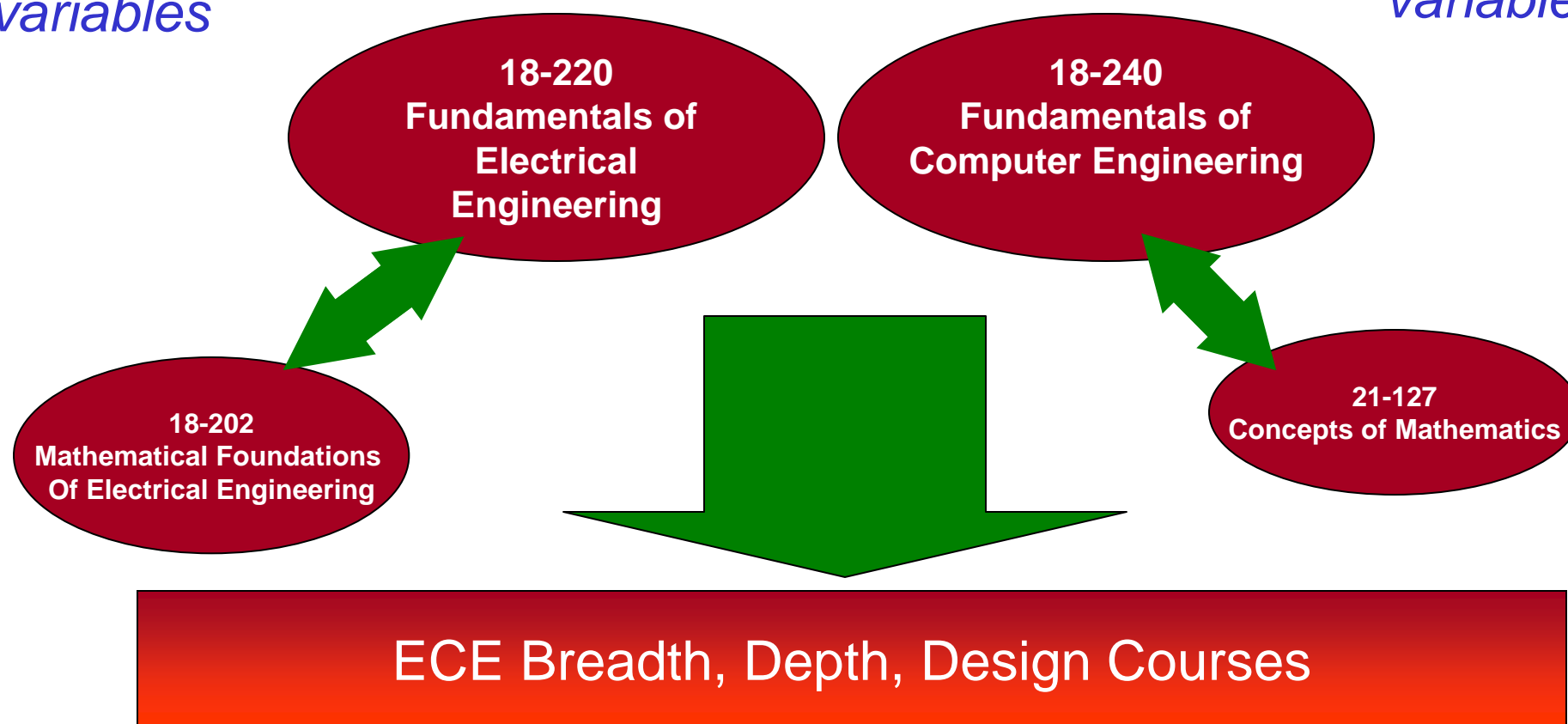
- logical devices
- digital circuits
- logic design
- computers

ECE Breadth, Depth, Design Courses

Math Co-Requisites

*continuous
variables*

*discreet
variables*



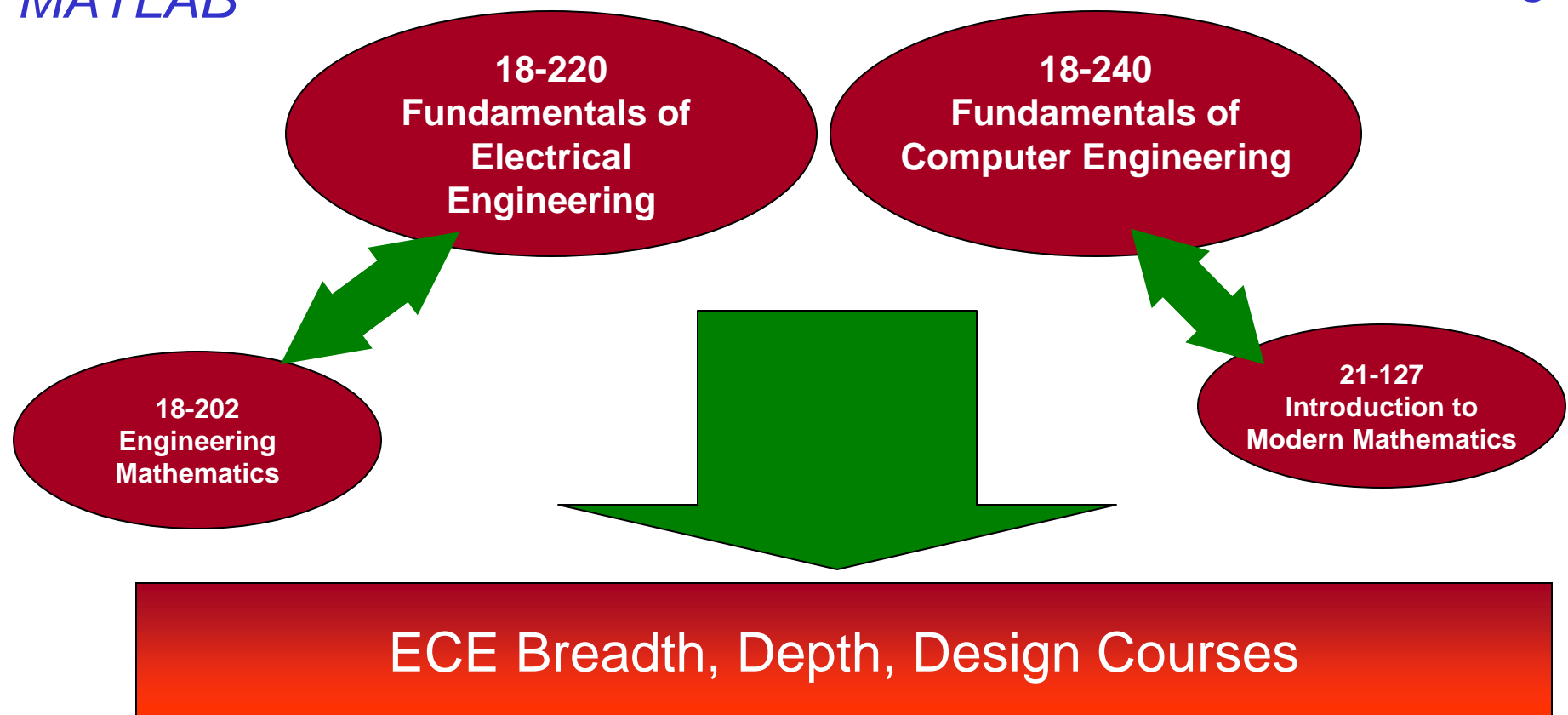
ECE Math – A Sampling of Topics

- 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 to 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

MATLAB

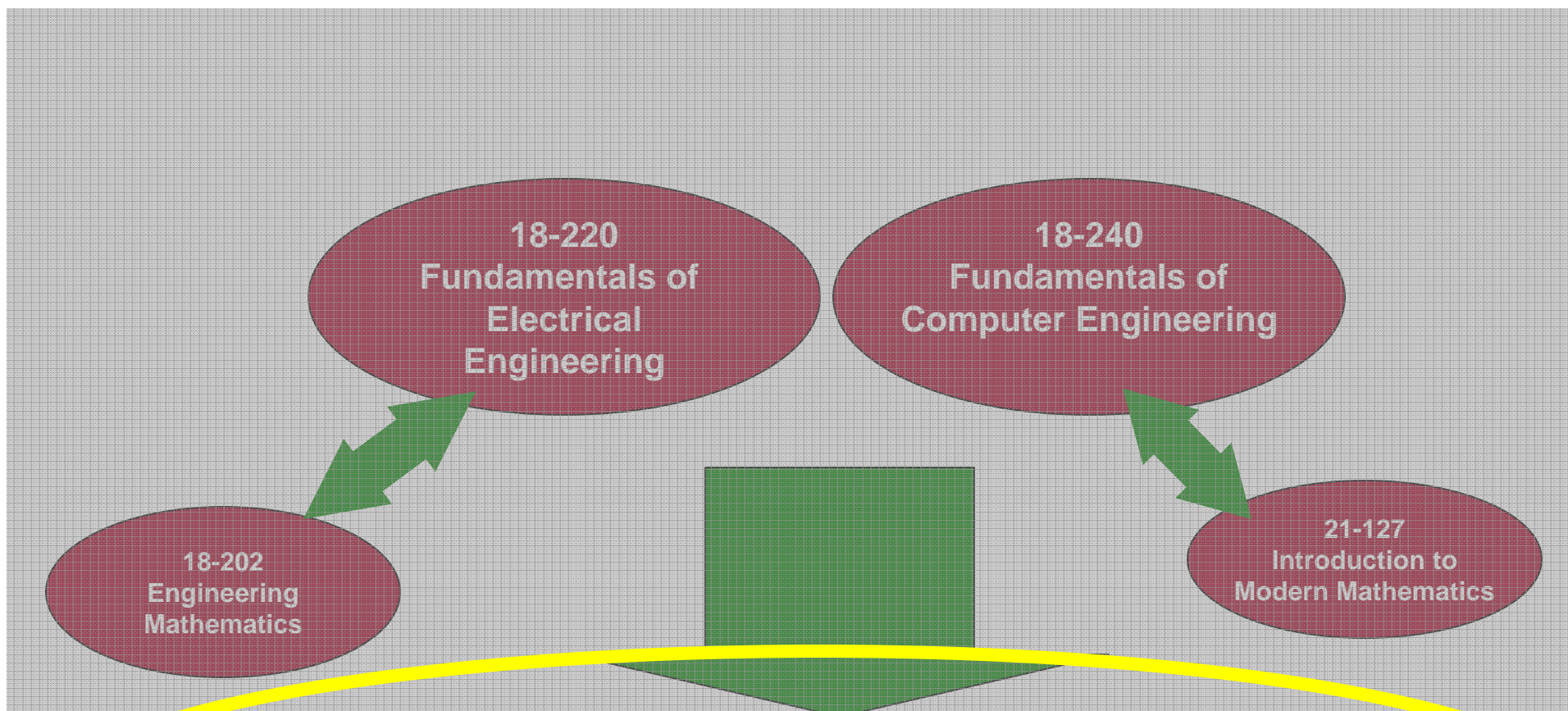
Verilog



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



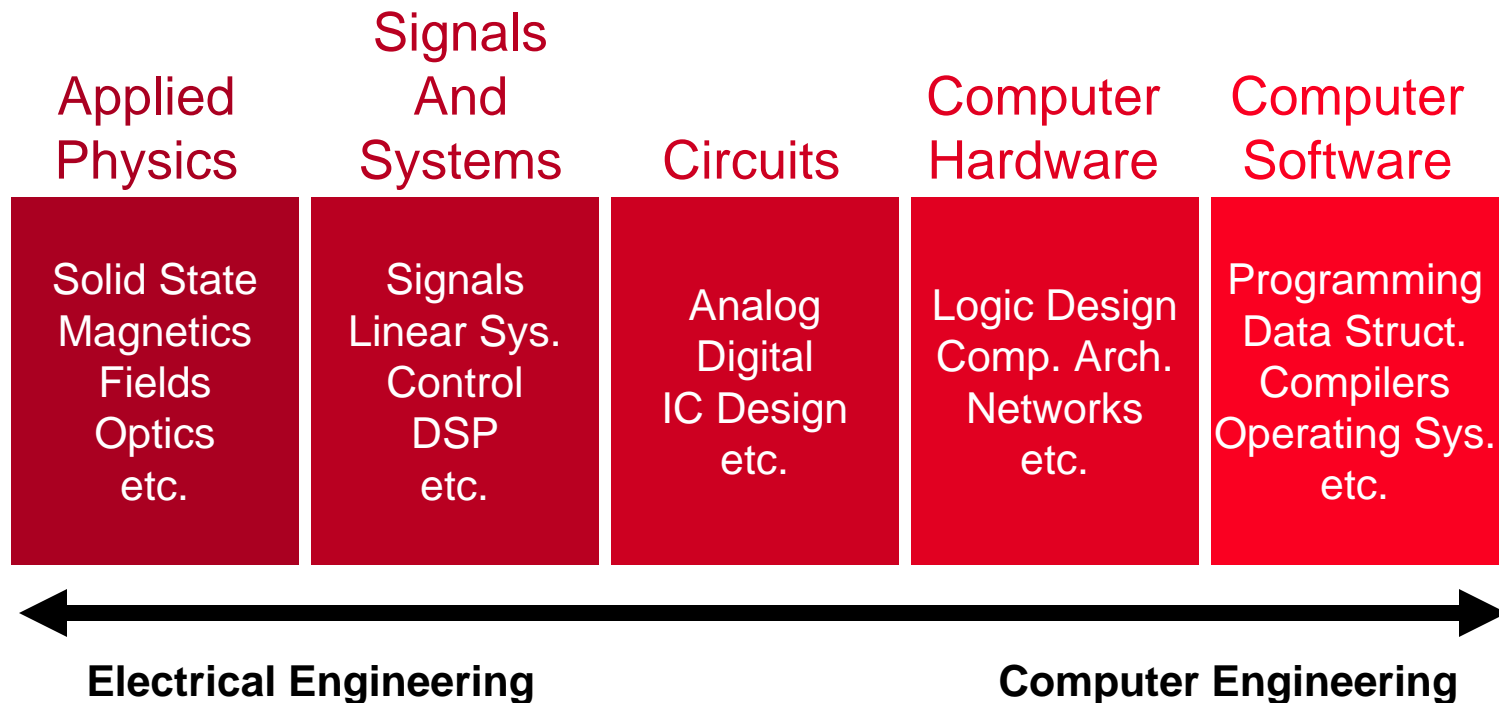
ECE Breadth, Depth, Design Courses

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



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

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

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

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/	
18745	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 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"

1 Required Capstone Design Course

- 18-517 **Data Storage Systems Design**
- 18-523 **Analog Integrated Circuit Design**
- 18-525 **Integrated Circuit Design Project**
- 18-544 **Network Design and Evaluation**
- 18-545 **Advanced Digital Design Project**
- 18-549 **Distributed Embedded Systems**
- 18-551 **Digital Communications and Signal Processing Systems**
- 18-578 **Mechatronic Design**
- 39-500 **CIT Honors Research Project**

Putting It All Together: A Typical Schedule

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

Putting It All Together - 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

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)
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Flexibility continued!!!

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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		For BS Electrical & Computer Engineering 2001 Catalog Year CIT Core Requirements
Advisor: JMPETERS Department: ECE School: CIT		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 unfiled course
ANDREW_ID: CLASSLEVEL: CUM_QPA: UNITPASSED: UNIT_INPRG: UPCOMING: Student ID: Full Name: Major:		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 unfiled 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
Not Matched:		17. ECE Core : 18-220 Fall '03 * 12.0 1 unfiled course 18. ECE Breadth : 15-211 Fall '03 * 12.0 2 unfiled courses 19. ECE Coverage :24.00 unfiled Units 20. Capstone Design Elective :12.00 unfiled Units 21. Engineering Elective : 15-200 Spring '03 A 9.0 3.00 unfiled 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 unfiled Units
		ECE Depth Requirement 1. ECE Depth : 15-211 Fall '03 * 12.0 1 unfiled course

Academic Audit –

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

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