

**CHARLES L. BROWN
DEPARTMENT
Of
ELECTRICAL AND COMPUTER ENGINEERING**

**UNDERGRADUATE HANDBOOK
For The
EE CURRICULUM**

April 2014



Charles L. Brown

Mr. Brown was a 1943 graduate of the UVA School of Engineering and Applied Science, Department of Electrical Engineering. He was a veteran of the Navy who served in the Pacific Theatre and worked for AT&T for over 40 years. As CEO and Chairman of AT&T, he guided the company through one of the largest corporate reorganizations in United States history in order to settle the government's antitrust case in 1982.

Mr. Brown served on the UVA Board of Visitors from 1986-1990 and served as vice chairman of the executive committee of the 1993-2000 UVA Capital Campaign.

The department was renamed the **CHARLES L. BROWN DEPARTMENT of ELECTRICAL and COMPUTER ENGINEERING** on October 1, 2004.

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University of Virginia
Charles L. Brown
Department of
Electrical and Computer Engineering
Undergraduate Handbook
for the
EE Curriculum

Foreword

The purpose of this handbook is to introduce you to the Department of Electrical and Computer Engineering and to assist you in planning your course of studies. For the rules and regulations of the University and the School of Engineering and Applied Science, including graduation and other academic requirements, you should consult the University of Virginia Undergraduate Record. Or the main SEAS website. Information regarding undergraduate advising can be found on the SEAS homepage at <http://www.seas.virginia.edu/advising/undergradhandbook.php>. Information on the Electrical and Computer Engineering homepage can be found at <http://www.ece.virginia.edu>. The School of Engineering and Applied Science homepage can be found at <http://www.seas.virginia.edu>.

Mission Statement

The mission of the Department of Electrical and Computer Engineering is to educate students to become leaders in the fields of electrical and computer engineering and the community as a whole, and to perform advanced scholarly research that creates new knowledge, innovative technology, and employment opportunities, to enhance the economic competitiveness of the Commonwealth of Virginia and to improve the quality of life for all humanity.

New Curriculum for the Class of 2017 and Beyond

Beginning with the class of 2017, the department will implement a new curriculum with increased emphasis on hands-on learning and integration of Electrical Engineering topics. The highlights of the improvements are listed below. Details of the changes in requirements can be found later in this handbook and on the ECE department website.

- Student engagement and learning will be enhanced by offering the core required courses in a studio format where students learn about new ideas and concepts and then work in small groups to see them in action for themselves
- The courses formerly known as Circuits (ECE 2630), Electronics (ECE 2660), and Signals and Systems (ECE 3750) will become ECE Fundamentals I, II, and III, respectively, to facilitate connections between basic areas of EE and CpE to help students to gain a broader and deeper perspective on their major field.
- ECE Fundamentals I, II, and III will become four –credit courses taught in the studio style with emphasis on conceptual learning through direct hands-on experience.
- The Embedded Systems (ECE 3430) course will also expand its hands-on content and move to four credits.
- Electromagnetic Fields (ECE3209) will be taught as a four-credit course in the studio mode incorporating demonstrations and experiments to make a more direct connection from theoretical concepts to practical applications.
- EE majors will no longer be required to take Physics II (Phys 2415) and its associated lab (Phys 2419). This material will be learned in our Electromagnetic Fields course in more depth and with engineering applications.

Electrical Engineering Program Educational Objectives and Outcomes

Electrical Engineering Educational Objectives

Graduates of the Electrical Engineering program at the University of Virginia utilize their academic preparation to become successful practitioners and innovators in electrical engineering and other fields. They analyze, design and implement creative solutions to problems with electrical and electronic devices and systems. They contribute effectively as team members, communicate clearly and interact responsibly with colleagues, clients, employers and society.

Electrical Engineering Program Educational Outcomes

The graduated electrical engineering student will have:

- (a) an ability to apply knowledge of mathematics, science and engineering
- (b) an ability to design and conduct experiments, as well as, to analyze and interpret data
- (c) an ability to design a system, component or process to meet desired needs within realistic constraints, such as, economic , environmental, social, political, ethical, health and safety, manufacturability and sustainability
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills and modern engineering tools necessary for engineering practice

A Welcome from the Chair

Welcome to the Department of Electrical and Computer Engineering. Your admission to the School of Engineering and Applied Science places you among the very best students in our nation. In addition, we feel strongly, on the basis of your background and accomplishments, that you have what it takes to earn a degree here at Virginia. Your acceptance into the Department of Electrical and Computer Engineering places you in an even more select group. We offer you a challenging course of studies, a situation worthy of your talents. Your success in this endeavor will require much work and determination, and is in your hands. However, we are here to help you in any way we can.

The Department of Electrical and Computer Engineering is very strong in every one of the areas of frequent concern in engineering education:

1. **Excellent student-to-faculty ratio.** At Virginia you will find a ratio of approximately 16:1, allowing faculty members to devote much individual attention to students.
2. **Highly qualified faculty.** At Virginia you will be treated to the opportunity of taking courses from highly qualified faculty, many of whom are internationally known for their achievements.
3. **State-of-the-art laboratory equipment.** Recent state allocations have continued to allow us to equip our laboratories with some of the finest in electronic equipment.
4. **Integration of computers and state-of-the-art software into the curriculum.** You will find that computers and electronic design automation are used extensively in your courses. Also of great importance, we provide a high degree of access to these facilities throughout the Engineering School.

You will find that a bachelor's degree in electrical engineering provides you with a variety of excellent career options. Not only is the job market for electrical and computer engineers in government and industry very favorable, but abundant opportunities exist for continuing your education at the graduate level. Moreover, the rigorous nature of the electrical engineering curricula provides an excellent preparation for advanced study and entry into a professional career in such fields as business, law, and medicine.

For the above reasons we feel strongly that you have made a wise choice in selecting the profession of Electrical and Computer Engineering, and the University of Virginia.

I hope you will take full advantage of the educational opportunities available in the Department. Good luck in your endeavors over the next several years and I hope that you enjoy your undergraduate years at UVA.

John C. Lach,
Professor and Chair



The Electrical and Computer Engineering Professions

Most dictionaries define engineering as that profession which applies mathematics and science to provide economical utilization of the materials and forces of nature in structures, machines, systems and products for the benefit of humanity. Thus, an engineer is quite different from a scientist, who is concerned principally with uncovering general truths and the operation of general laws having to do with nature. While the domains of study are quite close, the two disciplines have very different goals.

Electrical and computer engineering requires of its practitioners an unusually thorough knowledge of advanced mathematics and basic sciences. This is necessary because of the extremely broad spectrum of areas comprising the discipline. For example, electrical and computer engineers are concerned with the following:

- communication systems ranging from local to satellite networks
- computer graphics for engineering workstation and displays
- computer networking
- computer vision and robotics
- control systems for aircraft, automobiles, satellites, and a multitude of other products
- design automation
- design and construction of computers and peripherals
- digital picture processing of images from a variety of sources for the purpose of improving the ability to extract information
- electric power systems electronic systems and products, such as television and stereophonic equipment
- electro-optical systems, including computers and signal processing devices
- instrumentation
- integrated circuits and systems on chips
- microwave circuits and systems
- semiconductor devices and materials
- signal processing methodologies and systems .

The curriculum devised by the faculty of the Department will develop your abilities to practice the professions of electrical and computer engineering in an effective manner. As discussed elsewhere in this Handbook, you and your advisor can tailor a program of study that will emphasize particular areas of interest to you.

Student Advising

As an **electrical** or **computer* engineering** student, you have been assigned a faculty advisor to assist you in several important aspects of preparing for your profession. Your faculty advisor will assist you in preparing and updating your program of study. You must consult your advisor and obtain his/her approval whenever you register or pre-register for classes. Your advisor will also provide counsel on matters such as appropriate student organizations which can further your understanding and enhance your participation in the profession of electrical and computer engineering and develop your understanding of the social, ethical and economic considerations implicit in the practice of engineering. Be sure to visit your advisor at least once, and preferably twice a semester to keep him/her abreast of your progress and any problems you may encounter.

If you are an **Electrical Engineering (EE)** student and wish to change advisors, first obtain the consent of the person you wish to advise you, and then notify Mr. Dan Fetko in the Department office, C-210 Thornton Hall. Any problems or questions which you cannot resolve successfully with your advisor should be brought to the attention of Prof. Lloyd Harriott Associate Chair for Undergraduate EE Program, in room THN E213.

If you or your advisor wish to consult your student file, see Mr. Dan Fetko. Mr. Fetko also maintains a bulletin board around the corner from the Department entrance, on which he posts schedules, advisor lists and other information of student interest.

To facilitate convenient communication with your advisor, the Department uses the University's electronic mail system. This allows either you or your advisor to request an appointment when necessary or, in many cases, to resolve questions without the need for a meeting. It is important that you check your computer account for mail on a regular basis. E-mail is an easy way for you to communicate with faculty and staff, as well as other students, here and at other Universities. **Email is not intended as a substitute for personal visits with your adviser and instructors.**

*A separate degree program in **Computer Engineering (CpE)** is offered by the Departments of Electrical and Computer Engineering and Computer Science at UVA. See the web page (www.cpe.virginia.edu) for more information, or contact Prof. Joanne Dugan at 434-982-2078 or 434-924-3198.

Electrical Engineering Curriculum by Semester: Class of 2014, 2015, 2016

FIRST SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
APMA 1110	Single Variable Calculus II	4		
CHEM 1610	Introductory Chemistry for Engrs.	3		
CHEM 1611	Introductory Chemistry for Engrs. Lab	1		
ENGR 1620	Introduction to Engineering	4		
STS 1010	Engineering, Technology & Society	3		

15 Units

SECOND SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
APMA 2120	Multivariable Calculus	4		
CS 1110	Introduction to Programming	3		
PHYS 1425	General Physics I	3		
PHYS 1429	General Physics I Workshop	1		
SCI 1	Science Elective (1)	3		
HSS 1	HSS Elective (2)	3		

17 Units

THIRD SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
APMA 2130	Ordinary Differential Equations	4		
CS 2110	Software Dev. Methods	3		
ECE 2630	Introductory Circuit Analysis	3		
PHYS 2415	General Physics II	3		
PHYS 2419	Physics Lab I	1		
HSS 2	HSS Elective (2)	3		

17 Units

FOURTH SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
MATH	Math Elective (2000 LEVEL/ABOVE)	3		
ECE 2660	Electronics I	4		
ECE 2330	Digital Logic Design (3)	3		
UE 1	Unrestricted Elective (6)	3		
STS 2--	STS Elective	3		

16 Units

FIFTH SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
ECE 3209	Electromagnetic Fields	3		
ECE 3750	Signals & Systems	3		
ECE 3430	Intro to Embedded Computing	3		
TECH 1	Technical Elective (4)	3		
UE 2	Unrestricted Elective (6)	3		

15 Units

SIXTH SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
APMA 3100	Probability	3		
ECE 1	ECE Elective 1 (5)	3		
ECE 2	ECE Elective 2 (5)	3		
UE 3	Unrestricted Elective (6)	3		
HSS 3	HSS Elective (2)	3		

15 Units

SEVENTH SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
STS 4500	STS and Engineering Practice	3		
ECE 3	ECE Elect. 3 (5) (Major Design Experience)	3		
ECE Lab 1	ECE Lab Elective 1 (5)	1.5		
ECE 4	ECE Elective 4 (5)	3		
ECE 5	ECE Elective 5 (5)	3		
UE 4	Unrestricted Elective (6)	3		

16.5 Units

EIGHTH SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
STS 4600	The Engineer, Ethics & Professional Resp.	3		
ECE 6	ECE Elective 6 (5)	3		
ECE Lab 2	ECE Lab Elective 2 (5)	1.5		
ECE 7	ECE Elective 7 (5)	3		
TECH 2	Technical Elective (4)	3		
UE 5	Unrestricted Elective (6)	3		

16.5 Units

TOTAL = 128 UNITS

Electrical Engineering Curriculum by Requirements: Class of 2014, 2015, 2016

Humanities and Social Science (HSS)	Semester	Unit Hours	Grade
HSS1			
HSS2			
HSS3			

Unrestricted Elective	Semester	Unit Hours	Grade
UE1			
UE2			
UE3			
UE4			
UE5			

Required Science and Science Electives	Semester	Unit Hours	Grade
CHEM 1610 – Intro. Chem. For Engrs.		3.0	
CHEM 1611 – Intro. Chem. For Engrs. Lab		1.0	
PHYS 1425 – General Physics I		3.0	
PHYS 1429 – General Physics I Workshop		1.0	
PHYS 2415 – General Physics II		3.0	
PHYS 2419 – Physics Lab 1		1.0	
Science Elective		3.0	

Applied Mathematics and Mathematics Elective	Semester	Unit Hours	Grade
APMA 1110 – Single Variable Calculus II		4.0	
APMA 2120 – Multivariable Calculus		4.0	
APMA 2130 – Ordinary Diff. Equations		4.0	
APMA 3100 – Probability		3.0	
Mathematics Elective		3.0	

ENGR	Semester	Unit Hours	Grade
ENGR 1620 – Introduction to Engineering		4.0	

Computer and Software	Semester	Unit Hours	Grade
CS 1110 – Intro. To Programming		3.0	
CS 2110 – Software Dev. Methods		3.0	

Technical Electives	Semester	Unit Hours	Grade
Tech. Elect 1			
Tech. Elect 2			

ECE Electives	Semester	Unit Hours	Grade
ECE 1		3.0	
ECE 2		3.0	
ECE 3		3.0	
ECE 4		3.0	
ECE 5		3.0	
ECE 6		3.0	
ECE 7 (Major Design Experience)		3.0	
ECE Lab 1		1.5	
ECE Lab 2		1.5	

ECE Requirements	Semester	Unit Hours	Grade
ECE 2630 – Introductory Circuit Analysis		3.0	
ECE 2660 – Electronics I		4.0	
ECE 2330 – Digital Logic Design		3.0	
ECE 3209 – Electromagnetic Fields		3.0	
ECE 3750 – Signals & Systems		3.0	
ECE 3430 – Intro to Embedded Computing		3.0	

STS and Thesis	Semester	Unit Hours	Grade
STS 1010 – Engineering, Tech. & Society		3.0	
STS 4500 – STS and Engineering Practice		3.0	
STS 4600 – The Engr., Ethics & Prof. Resp.		3.0	
STS 2xxx– STS Elective		3.0	
Thesis: Coordinated under STS 4500 & STS 4600			

Total = 128 Units

Major Design Experience	Semester	Unit Hours	Grade
		3.0 Units of ECE Elective	

Electrical Engineering Curriculum by Semester: Class of 2017 and Beyond

FIRST SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
APMA 1110	Single Variable Calculus II	4		
CHEM 1610	Introductory Chemistry for Engrs.	3		
CHEM 1611	Introductory Chemistry for Engrs. Lab	1		
ENGR 1620	Introduction to Engineering	4		
STS 1010	Engineering, Technology & Society	3		

15 Units

SECOND SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
APMA 2120	Multivariable Calculus	4		
CS 1110	Introduction to Programming	3		
PHYS 1425	General Physics I	3		
PHYS 1429	General Physics I Workshop	1		
SCI 1	Science Elective (1)	3		
HSS 1	HSS Elective (2)	3		

17 Units

THIRD SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
APMA 2130	Ordinary Differential Equations	4		
CS 2110	Software Dev. Methods	3		
ECE 2630	ECE Fundamentals I	4		
ECE 2330	Digital Logic Design	3		
HSS 2	HSS Elective (2)	3		

17 Units

FOURTH SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
MATH	Math Elective (2000 LEVEL/ABOVE)	3		
ECE 2660	ECE Fundamentals II	4		
TECH 1	Technical Elective	3		
UE 1	Unrestricted Elective (6)	3		
STS 2--	STS Elective	3		

16 Units

FIFTH SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
ECE 3209	Electromagnetic Fields	4		
ECE 3750	ECE Fundamentals III	4		
ECE 3430	Intro to Embedded Computing	4		
HSS 2	HSS Elective	3		

15 Units

SIXTH SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
APMA 3100	Probability	3		
ECE 1	ECE Elective 1 (5)	3		
ECE 2	ECE Elective 2 (5)	3		
UE 3	Unrestricted Elective (6)	3		
HSS 3	HSS Elective (2)	3		

15 Units

SEVENTH SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
STS 4500	STS and Engineering Practice	3		
ECE 3	ECE Elect. 3 (5) (Major Design Experience)	3		
ECE Lab 1	ECE Lab Elective 1 (5)	1.5		
ECE 4	ECE Elective 4 (5)	3		
ECE 5	ECE Elective 5 (5)	3		
UE 4	Unrestricted Elective (6)	3		

16.5 Units

EIGHTH SEMESTER		UNIT HRS.	GRADE	COMMENTS OR NOTES
STS 4600	The Engineer, Ethics & Professional Resp.	3		
ECE 6	ECE Elective 6 (5)	3		
ECE Lab 2	ECE Lab Elective 2 (5)	1.5		
ECE 7	ECE Elective 7 (5)	3		
TECH 2	Technical Elective (4)	3		
UE 5	Unrestricted Elective (6)	3		

16.5 Units

TOTAL = 128 UNITS

Electrical Engineering Curriculum by Requirements: Class of 2017 and Beyond

Humanities and Social Science (HSS)	Semester	Unit Hours	Grade
HSS1			
HSS2			
HSS3			

Unrestricted Elective	Semester	Unit Hours	Grade
UE1			
UE2			
UE3			
UE4			
UE5			

Required Science and Science Electives	Semester	Unit Hours	Grade
CHEM 1610 – Intro. Chem. For Engrs.		3.0	
CHEM 1611 – Intro. Chem. For Engrs. Lab		1.0	
PHYS 1425 – General Physics I		3.0	
PHYS 2419 – Physics Lab 1		1.0	
Science Elective		3.0	

Applied Mathematics and Mathematics Elective	Semester	Unit Hours	Grade
APMA 1110 – Single Variable Calculus II		4.0	
APMA 2120 – Multivariable Calculus		4.0	
APMA 2130 – Ordinary Diff. Equations		4.0	
APMA 3100 – Probability		3.0	
Mathematics Elective		3.0	

ENGR	Semester	Unit Hours	Grade
ENGR 1620 – Introduction to Engineering		4.0	

Computer and Software	Semester	Unit Hours	Grade
CS 1110 – Intro. To Programming		3.0	
CS 2110 – Software Dev. Methods		3.0	

Technical Electives	Semester	Unit Hours	Grade
Tech. Elect 1			
Tech. Elect 2			

ECE Electives	Semester	Unit Hours	Grade
ECE 1		3.0	
ECE 2		3.0	
ECE 3		3.0	
ECE 4		3.0	
ECE 5		3.0	
ECE 6		3.0	
ECE 7 (Major Design Experience)		3.0	
ECE Lab 1		1.5	
ECE Lab 2		1.5	

ECE Requirements	Semester	Unit Hours	Grade
ECE 2630 – ECE Fundamentals I		4.0	
ECE 2660 – ECE Fundamentals II		4.0	
ECE 2330 – Digital Logic Design		3.0	
ECE 3209 – Electromagnetic Fields		4.0	
ECE 3750 – ECE Fundamentals III		4.0	
ECE 3430 – Intro to Embedded Computing		4.0	

STS and Thesis	Semester	Unit Hours	Grade
STS 1500 – Intro Lang., Comm. & Tech.		3.0	
STS 4500 – STS and Engineering Practice		3.0	
STS 4600 – The Engr., Ethics & Prof. Resp.		3.0	
STS 2xxx– STS Elective		3.0	
Thesis: Coordinated under STS 4500 & STS 4600			

Total = 128 Units

Major Design Experience	Semester	Unit Hours	Grade
		3.0 Units of ECE Elective	

Minimal Requirements for the Major Design Experience (MDE)

Currently the major MDE course is ECE 4991. Students can enroll in a section of ECE 4907-0X, the EE Projects course, (which must be taught by the ECE faculty) and satisfy the MDE requirement if the section meets the following criteria:

1. The course must be focused on a semester-long major design project that addresses a real-world engineering problem.
2. Each student must be a member of a team of at least 3 members.
3. A written project proposal should address a) the problem statement, b) the requirements and c) formal specifications.
4. At least one oral presentation should be given by each student during the semester.
5. The project will have a final written report. The report should address considerations and constraints in most of the following types: economic, environmental, sustainability, manufacturability, ethical, health & safety, social and political (as mandated by ABET).
6. The final report (or earlier report) should also provide a detailed design and discussion of tradeoffs, as well as, design validation and verification.

ECE 4332 and ECE 4440 are also approved MDE courses for EE majors. Other courses may be used to satisfy the MDE requirement with prior approval from Prof. Lloyd Harriott (lrh8t@Virginia.EDU) and the Undergraduate Curriculum Committee.

1. **Science Elective I** must be chosen from the following list. The associated lab is not required but is encouraged.

BIOL 2010 - Introduction to Biology: Cell Biology & Genetics

BIOL 2020 - Introduction to Biology: Organismal & Evolutionary Biology

CHEM 1620 - Introductory Chemistry for Engineers

ECE 2066 - Science of Information

ENGR 2500 - Hands on Intro to Nanoscience

MSE 2090 - Introduction to the Science and Engineering of Materials

PHYS 2620 - Introductory Physics IV: Quantum Physics

2. **HSS Electives** are to be selected from the list of approved courses which has been prepared by the school. A printout of this list is available in the Undergraduate Dean's Office, Thornton A-122.

3. ECE 2330 is offered both in the Fall and Spring semesters. One could take it in the 3rd semester.

4. **A Technical Elective** is defined as a course in engineering (may be ECE), mathematics, or science (intended for science majors) at the 3000 level or above. Any course appearing on the approved list of HSS electives may not be used as a technical elective.

5.

- ECE4435, ECE4440 each count as one course and one lab if chosen as electives.
- One of the seven ECE electives must be the Major Design Experience (MDE) course, currently offered as ECE 4991 – Capstone Design.
- MSE 6670: Electronic, Optical and Magnetic Properties of Material, PHYS 5310: Optics and PHYS 5320: Fundamentals of Photonics will be cross-listed as ECE courses. Before such cross-listing takes place, EE students may use these courses as ECE electives.
- If you use a 4000-level ENGR course to fulfill your MDE requirement, and your project involves sufficient Electrical Engineering content, you may petition to use it as an ECE elective.

6. An **Unrestricted Elective** may be any graded course at the University except level-1 mathematics and any other courses that substantially duplicate courses offered for the degree.

Frequently Asked Questions on the EE Curriculum

1. What courses can be used as HSS electives?

The dean's office publishes a list of courses that can and cannot be used to meet this requirement. A printout of this list is available in Thornton A-122.

2. Is there anything else that we need to be aware of in choosing an HSS elective?

Students cannot take language courses in their native language for HSS electives. Native language was designated on their application to UVA.

3. Are unrestricted electives completely unrestricted?

Not really. By definition, an unrestricted elective may be any graded course in the University except mathematics courses below MATH 1310 (or APMA 1090) and any other courses that substantially duplicate courses offered for the degree.

4. I have to take APMA 1090. Can I use it for something?

Yes. You can use it as an unrestricted elective (three credits).

5. What are the choices for the science elective?

There are 7 choices: BIOL 2010, BIOL 2020, CHEM 1620, ECE 2066, ENGR 2500, MSE 2090 and PHYS 2620.

6. What courses are counted as Tech Electives?

A technical elective is defined as a course in engineering (may be ECE), mathematics, or science (intended for science majors) at the 3000 level or above. Any course appearing on the approved list of HSS electives may not be used as a technical elective.

7. Can I take COMM classes as Tech electives?

COMM classes may be used as unrestricted electives, not as technical electives.

7. Can I take ASTR 3420 as a Technical Elective?

No. ASTR 3420 is not intended for science majors.

9. Are we required to sign up for the ECE 4991 MDE course?

You are required to satisfy the MDE requirement which is met by ECE 4991. However, you have the option to sign up for a section of ECE 4907-0X, as long as it satisfies the MDE criteria approved by the faculty. You may also take ECE 4332 or ECE 4440 to satisfy the MDE requirement. The MDE criteria can be found in this handbook on p. 6. (See also question # 13).

10. What requirements can ECE 2066 be used to fulfill?

ECE 2066 can be used as a science elective or an unrestricted elective. It is not an ECE elective or a tech elective.

11. I heard that some physics and MSE courses can be used to satisfy the ECE electives requirement. Is that true?

Yes. The ECE Department has developed an ECE class that is cross listed with MSE 6167: Electronic, Optical and Magnetic Properties of Material. In addition, MSE 3670: Materials for Electronic, Magnetic and Optical Applications may be used as an ECE elective.

12. Can I deviate from the curriculum a little bit?

Deviation from the curriculum requires the approval of the Undergraduate Curriculum Committee. You must petition to the Undergraduate Curriculum Committee for any deviation. Petition should be discussed with your adviser, and should be sent by email to Professor Lloyd Harriott (lrh8t@virginia.edu).

13. Can I use ENGR 4010 and ENGR 4020 as ECE electives?

If you want to use ENGR 4010/4020 to fulfill the MDE requirement, you may petition to use ENGR 4010 as an ECE elective. The Undergraduate Curriculum Committee will approve the petition based on the actual Electrical Engineering contents of your project. ENGR 4020 cannot be used as an ECE elective.

14. I have placed out of a required course, but I did not receive credit. What should I take in place of this course?

Students that have placed out of a required course but not received credit may replace that course with an unrestricted elective. This substitution must be approved by the student's academic advisor and recorded in SIS.

Suggested Application Areas

Electrical Engineering is a very broad discipline with applications to many areas within and without the engineering profession. As you decide how to use your Electrical Engineering, technical and unrestricted electives, we recommend that you consider the application areas and courses suggested below, or work with your advisor to identify an appropriate set of courses for your area of interest. Note that many classes listed have prerequisites.

Controls: ECE 4850: Linear Controls, ECE 4855: Control Lab, ECE 4860: Digital Control, ECE 6851: Linear Automatic Control (Students may NOT receive credit for both ECE 6851 and ECE 4850)

Digital Systems: ECE 4332: Intro to VLSI, ECE 4434: Dependable Computing Systems, ECE 4435: Comp. Design, ECE 4440: Embedded Sys Design, ECE 4457: Computer Networks, ECE 6331: Adv. Switching Theory

Applied Electrophysics: ECE 4332: Intro to VLSI, ECE 5150: IC Fabrication, ECE 4255: IC Fabrication Lab, ECE 5260: Microwave Engr., ECE 4265: Microwave Lab, ECE 6163: Semicond. Device Theory, ECE 4209: RF Circuit Design and Wireless Systems, MSE 6670: Prop. of Materials, PHYS 5310: Optics, PHYS 5320: Fund. of Photonics

Communication & Signal Processing: ECE 4710: Communications, ECE 4715: Communications Lab, ECE 5260: Microwave Engr., ECE 4265: Microwave Lab, ECE 5750: Dig. Sig. Proc., ECE 6713: Comp. Sys. Engr.

Microelectronics: ECE 4332: Intro to VLSI, ECE 4907: Prop. of Materials, ECE 4209: Wireless Circuits, ECE 4435: Comp. Organ. & Des., ECE 4660: Analog Integrated Cir., ECE 5150: Microelect. IC Fab., ECE 4155: IC Fabrication Lab

Electromechanics: ECE 3250: Electromechanical Energy Conversion, MAE 4710: Mechatronics

Energy: ECE 3250: Electromechanical Energy Conversion, MAE 2100: Thermodynamics, MAE 3120: Thermal Systems Analysis, ECE 6502: Photovoltaics, CHE 5561: Energy Outlook and Technical Options

Business: COMM 1800: Making Business Work, ECON 2010: Microeconomics, COMM 2010: Intro to Financial Accounting, STS 4510: The Technology and Product Development Life Cycle, COMM 4240: Electronic Commerce, COMM 4250: Innovation and Technology Management, COMM 4270: Information Technology Project Practicum, COMM 4280: Data Communications

Music: MUSI 2350: Technosonics: Digital Music and Sound Art Composition, MUSI 3390: Introduction to Music and Computers, MUSI 4535: Interactive Media, MUSI 4540: Computer Sound Generation and Spatial Processing, MUSI 4545: Computer Applications in Music

Drama: DRAM 2110: Lighting Technology, DRAM 2130: Production Laboratory: Lighting and Sound, DRAM 2240: Digital Design: Remaking and Reimaging, DRAM 2620: Sound Design, DRAM 4110: Lighting Design

Art: ARTS 2220/2222: Intro to Digital Art I & II, ARTS 3220/3222: Intermediate Digital Art I&II, ARTS 4220/4222: Advanced Digital Art I&II

Environment and Sustainability: CE 2100: Intro to Environmental Engineering, EVSC 3020: GIS methods, EVSC 4010: Intro to Remote Sensing, EVSC 4490: Air Pollution, EVSC 4040: GIS and Arc/Info, EVSC 4070: Advanced GIS

Medicine and Health: BME 2101: Physiology I, BME 3636: Neural Network Models of Cognition and Brain Computation, BME 4311: Bioinstrumentation and Design, BME 4641: Bioelectricity, BME 4783: Medical Image Modalities, BME 4784: Medical Image Analysis, NUIP 4001: Evaluating and Using Information Technology in Health Care, NUIP 4004: Strategies for Prehospital Emergency Care

Architecture: ARCH 3230: Building and Climate, ARCH 5300/5301: ecoMOD Seminar, ARCH 6410: CAAD 3D Modeling and Visualization, ENGR 4595/4599: Sustainable Building Design and Construction

Education: EDIS 5330: Science in the Elementary School, EDIS 5450: Teaching Mathematics in Secondary Schools, EDIS 5050/5051: Teaching Science in Secondary Schools, EDIS 5052: Models of Science Instruction Lab

MINOR PROGRAMS

Electrical Engineering

Students who wish to earn a minor in electrical engineering should complete the following list of courses:

ECE 2330 – Digital Logic Design

ECE 2630 – Introductory Circuit Analysis/ECE Fundamentals I (Fall 2014 and beyond)

ECE 2660 – Electronics 1/ECE Fundamentals II (Spring 2015 and beyond)

Plus three other ECE courses at the 3000 level or above. At least one must be 4000 level.

Minors in Other Areas

The Electrical and Computer Engineering Department has prepared brochures describing sample curricula to fulfill a minor in other engineering disciplines while majoring in electrical and computer engineering. Of particular interest are minor programs in **Biomedical Engineering** and **Systems & Information Engineering**. These brochures are available from the Electrical and Computer Engineering Office, C-210 Thornton Hall.

DUAL MAJOR (EE & CPE) -- Class of 2017

COMBINED Electrical Engineering & Computer Engineering Curriculum

Major	Major credits	65	Total credits	128
CS 111x	Intro Programming	3	Math	Credits 15
CS 2110	Software Devlpmnt Meth	3		
CS 2102 #	Discrete Math	3	APMA 1110	Single Variable Calculus 4
ECE 2630	ECE Fundamentals I	4	APMA 2120	Multivariable Calculus 4
ECE 2660	ECE Fundamentals II	4	APMA 2130	Ordinary Diff EQ 4
CS 2150 %	Program/Data Rep	3	APMA 3100	Probability 3
ECE/CS 2330	Digital Logic Design	3		
ECE 3750	ECE Fundamentals III	4		
CS 3240	Advanced SW Devlpmnt	3	SEAS requirements & Electives	48
ECE 3430	Intro Embedded Comp Sys	4		
CS/ECE 4457	Computer Networks	3	STS 1010	Intro Lang, Comm & Tech 3
CS 4414	Operating Systems	3	STS 2--	STS Elective (2000 or above) 3
ECE 4435	Comp Arch and Design	4.5	STS 4500	STS & Engineering Practice 3
ECE 4440	Embed'd Sys Dsgn (MDE)	4.5	STS 4600	Engr Ethics & Prof Respsblty 3
			CHEM 1610	Intro Chem. Engineers (& Lab) 4
ECE 3209 *	Electromagnetic Fields	4	ENGR 1620	Introduction to Engineering 4
ECE	ECE Elective (3000 or higher)	3	SCI	Science Elective 3
ECE	ECE Elective (3000 or higher)	3	PHYS 1425	Physics I & Lab 4
ECE	ECE Elective (4000 or higher)	3	TECH	Technical elective (for EE) 3
ECE	ECE Elective (4000 or higher)	3		
			3 HSS	Humanities & Social Sci. Elect. 9
# counts as math elective for EE			3 UE	Unrestricted Elect. 9

% Cannot count as tech elective for EE since it's 2000 level

* Satisfies the requirement for PHYS 2415 & 2419

Electrical Engineering + TLP Schedule (2017 + class)

First Semester	15	Second Semester	17
APMA 1110 Single Variable Calculus	4	APMA 2120 Multivariable Calculus	4
CHEM 1610 Intro Chem. Engineers	3	CS 111x Intro Programming	3
CHEM 1611 Intro Chem. Engineers Lab	1	PHYS 1425 General Physics I	3
ENGR 1620 Introduction to Engineering	4	PHYS 1429 Physics I Workshop	1
STS 1500 Science, Tech, Contemp Issues	3	SCI Science Elective	3
		HSS 1 HSS elective	3
Third Semester	17	Fourth Semester	16
APMA 2130 Ordinary Diff EQ	4	TECH 1 Technical Elective	3
CS 2110 Software Devlpmnt Meth	3	APMA/Math Math Elective	3
ECE/CS 2330 Digital Logic Design	3	ECE 2660 ECE Fundamentals II	4
ECE 2630 ECE Fundamentals I	4	STS 2*** STS Elective	3
SYS 2001 Systems Engineering Concepts	3	SYS 2502 Intro Electromech Sys	3
Fifth Semester	15	Sixth Semester	15
ECE 3430 Intro Embedded Comp Sys	4	APMA 3100 Probability	3
ECE 3750 ECE Fundamentals III	4	ECE ECE Elective	3
ECE 3209 Electromagnetic Fields	4	ECE ECE Elective	3
MAE 4710 Mechatronics	3	HSS 2 HSS Elective	3
		SYS 3502 Design Clinic	3
Seventh Semester	16.5	Eighth Semester	16.5
ECE ELE Elective (Major Design Exp)	3	ECE 6 ECE Elective	3
ECE Lab 1 ECE Lab Elective	1.5	ECE 7 ECE Elective	3
ECE 4 ECE Elective	3	ECE 4908 Capstone part 2	3
ECE 5 ECE Elective	3	HSS 3 HSS Elective	3
STS 4500 STS & Engineering Practice	3	STS 4600 Engr Ethics Prof Respsnbl	3
UE Unrestricted Elective	3	ECE Lab 2 ECE Lab Elective	1.5

Total Credits 128