Department of Electrical & Computer Engineering

Undergraduate Handbook

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HANDBOOK FOR ELECTRICAL AND COMPUTER ENGINEERING STUDENTS UNDERGRADUATE PROGRAM

2013-2014 Edition

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
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ELECTRICAL AND COMPUTER ENGINEERING HANDBOOK

This handbook has been designed to help you earn a Bachelor of Science Degree in Electrical and/or Computer Engineering at Old Dominion University. The handbook complements the ODU catalog by providing further details about the undergraduate electrical and computer engineering program. The handbook is revised periodically as the undergraduate program and departmental policies change. Comments and suggestions that will improve the handbook are welcome. Please contact:

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Appointments should be made.

or

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It is the responsibility of the individual student to be familiar with the information contained in the University Catalog. With respect to official university policy and regulations, the University Catalog takes precedence over any information contained in this handbook.

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INTRODUCTION

Welcome to the Department of Electrical and Computer Engineering. Congratulations on choosing electrical or computer engineering as your major area. We are confident that there will be exciting and challenging opportunities lying ahead for you. Of course, it does require hard work and dedication on your part. We have designed this handbook especially to aid you in your pursuit of the Bachelor of Science in Electrical Engineering or the Bachelor of Science in Computer Engineering degree. It is intended **only to complement** the information provided in the University Catalog. You must be aware that ***students are held individually responsible for knowing the information contained in the University Catalog.***

Included in this handbook is information concerning university and departmental curricula requirements as well as departmental policies and procedures. Please keep this handbook as a source of information during your studies at Old Dominion University. We wish you the best in your pursuit of the degree.

MISSION STATEMENT

The Department of Electrical and Computer Engineering at Old Dominion University is a partnership among students, faculty and staff in **S**ervice to the profession of **E**lectrical and computer engineering through academic excellence, **R**esearch and real-world experiences, dedicated to a **V**ision of the future that includes **I**ndustry and community, **C**ontinuous improvement, and personal **E**nrichment and growth (SERVICE).

ELECTRICAL AND COMPUTER ENGINEERING AT ODU

The Department of Electrical and Computer Engineering (ECE) offers a four-year baccalaureate program in electrical engineering and a four-year baccalaureate program in computer engineering. Both programs are accredited by the Accreditation Board for Engineering and Technology (ABET).

The electrical engineering program provides a solid foundation in circuits, signals and linear systems, electronics, electromagnetics, digital systems, and microelectronics. Elective freedom allows specialization in areas such as controls, communications, physical electronics, signal processing, and computers.

The computer engineering program is jointly offered with the Department of Computer Science. This program is designed to provide a broad engineering background and a comprehensive foundation in the technical principles underlying the computer area. The technical core consists of course work from electrical engineering to address hardware aspects of computer engineering, and course work from computer science to address software aspects.

Upon graduation, electrical engineers and computer engineers find employment in a wide spectrum of activities covering various fields. These include controls, image processing, communications, networks, computers, VLSI design, semiconductor and solid-state devices, physical electronics, lasers, and optics. There are many different job functions associated with these technical areas. Electrical engineers and computer

engineers are employed in systems analysis and design, engineering design and development, applications design and technical sales, production and manufacturing, field service and user training, management, and many other job titles.

OUTCOMES AND OBJECTIVES

ECE Department Program Assessments

The Accreditation Board for Engineering and Technology (ABET) has defined requirements for accreditation in "ABET 2000" criterion. These require that each program define a set of objectives and outcomes, and continually assess how well the objectives and outcomes are met, and then make adjustments as needed so that the objectives and outcomes are better met. As defined by ABET, objectives are meant to be longer-term goals, typically in terms of general characteristics graduates are expected to have several years after graduation. Outcomes are desirable abilities that graduating seniors should have. In line with this thinking, the faculty in ECE (with input from students and industry) has determined a set of outcomes and objectives for both the BSEE degree and the BSCOME degree. These outcomes and objectives are listed on the next two pages. Additionally, these program objectives are posted on the Department's web site. A link to them can be found at:
http://www.eng.odu.edu/ece/academics/undergrad/objectives.shtml

We ask that each student read these pages, and provide feedback to us in two ways. First, we will ask each student to fill out a course evaluation at the end of each semester, which will include a brief questionnaire about how the various outcomes are met in that course. We ask you to take these evaluations seriously and really tell us your opinion about how each course meets the various outcomes. Your input is critical. Secondly, if you believe that any of these outcomes or objectives should be modified, deleted or added to, please let us know, by either talking with our department chair, Dr. Khan Iftekharrudin, or emailing him (kiftekha@odu.edu) with detailed notes. One of the components of assessment is to review our objectives and outcomes and modify them as needed.

Aside from ABET requirements, the ECE department is committed to a quality undergraduate program, and we really want to do our best to continually improve. This can only happen if all of us-- students, faculty, and staff-- cooperate in constructive and open ways. Please feel free at any time to meet with your advisor, or the chief departmental advisor (Dr. Vishnu Lakdawala), or the department chair (Dr. Khan Iftekharrudin) to give us suggestions for improvement. We may not be able to directly address your concerns, but we assure you they will be given due consideration. If we are alerted to a problem that is common to many students, then we will do our best to take corrective actions.

Electrical Engineering Undergraduate Program

Program Objectives

The Electrical Engineering program seeks to prepare graduates who, after the first few years of their professional career, have:

- Established themselves as practicing engineering professionals in industry or government, or engaged in graduate study.
- Demonstrated their ability to work successfully as members of a professional team and function effectively as responsible professionals.
- Demonstrated their ability to adapt to new technology and career challenges.

Program Outcomes

Our electrical engineering graduates must attain:

1. an ability to apply knowledge of mathematics, science, and engineering.
2. an ability to design and conduct experiments, as well as to analyze and interpret data.
3. an ability to design an electrical system, component, or process to meet desired needs, considering all realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
4. an ability to function on both intra-disciplinary and multi-disciplinary teams.
5. an ability to identify, formulate, and solve electrical engineering problems.
6. an understanding of professional and ethical responsibilities.
7. an ability to communicate technical ideas effectively in writing and speaking.
8. the broad education necessary to understand the impact of electrical engineering solutions in a global and societal context.
9. a recognition of the need for, and an ability to engage in life-long learning.
10. a knowledge of contemporary issues.
11. an ability to use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.
12. an ability to apply the knowledge of advanced mathematics of differential equations, linear algebra, complex variables, vector calculus, and discrete mathematics to electrical engineering problems.

Computer Engineering Undergraduate Program

Program Objectives

The Computer Engineering program seeks to prepare graduates who, after the first few years of their professional career, have:

- Established themselves as practicing engineering professionals in industry or government, or engaged in graduate study.
- Demonstrated their ability to work successfully as members of a professional team and function effectively as responsible professionals.
- Demonstrated their ability to adapt to new technology and career challenges.

Program Outcomes

Our computer engineering graduates must attain:

1. an ability to apply knowledge of mathematics, science, and engineering.
2. an ability to design and conduct experiments, as well as to analyze and interpret data.
3. an ability to design a digital hardware and/or software system to meet desired needs, considering all realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. an ability to function on both intra-disciplinary and multi-disciplinary teams.
5. an ability to identify, formulate, and solve computer engineering problems.
6. an understanding of professional and ethical responsibilities.
7. an ability to communicate technical ideas effectively in writing and speaking.
8. the broad education necessary to understand the impact of computer engineering solutions in a global and societal context.
9. a recognition of the need for, and an ability to engage in life-long learning.
10. a knowledge of contemporary issues.
11. an ability to use the techniques, skills, and modern engineering tools necessary for computer engineering practice.
12. an ability to apply the knowledge of advanced mathematics of differential equations, linear algebra, and discrete mathematics to computer engineering problems.
13. an ability to apply advanced programming techniques to solve computer engineering problems.

THE ECE DEPARTMENT

The Department of Electrical and Computer Engineering is one of six departments in the Batten College of Engineering and Technology (BCET). There are approximately 230 undergraduate students in the electrical engineering program and approximately 125 undergraduate students in the computer engineering program, not including freshmen. There are 23 full-time faculty who hold PhD degrees conducting active research in different areas of electrical and computer engineering. A brief description of the faculty along with their ongoing research activities is given in Appendix A. Appendix B lists the instructional and research facilities available in the department.

ACADEMIC PROGRAMS

THE CORE CURRICULA

The following section outlines the core curricula for the degrees of Bachelor of Science in Electrical Engineering (127 credit hours) and the Bachelor of Science in Computer Engineering (128 credit hours). The charts on p.6 and 8 show the subject areas required for the BSEE and the BSCOME respectively. The flow charts on p. 7 and 9 show the progression of the major courses through the curriculum.

To obtain a BS in Electrical or Computer Engineering, a student must complete the undergraduate electrical or computer engineering program with a grade point average (GPA) of 2.00 or better. Students must also earn a grade point average of at least 2.00 in all major courses (those with the ECE and CS prefixes for computer engineering, and ECE for electrical engineering). Please see the individual curriculum sheets at the end of this handbook for the list of courses to be completed.

PREREQUISITE STRUCTURE

The prerequisite structure for electrical or computer engineering courses required for the BSEE or BSCOME is listed on the right side of the respective curriculum sheet (pages 42-47). When selecting a course schedule, it is imperative that this prerequisite structure be followed absolutely. ***If a student enrolls in a course which he or she subsequently drops, fails, or changes to audit status, the student must retake this course and obtain a passing grade before the next course can be taken.***

Overview of the Bachelor of Science in Electrical Engineering

MATHEMATICS 18

MATH 211	Calculus I (4)
MATH 212	Calculus II (4)
MATH 307	Differential Equations (3)
MATH 312	Calculus III (4)
ECE 304	Probability, Statistics and Reliability (3)

SCIENCE 15

CHEM 121N	Foundations of Chemistry I Lecture (3)
CHEM 122N	Foundations of Chemistry I Lab (1)
CHEM 123N	Foundations of Chemistry II Lecture (3)
PHYS 231N	University Physics (4)
PHYS 232N	University Physics (4)

ELECTRICAL ENGINEERING CORE 55

Required ECE Lecture Courses (31)
Required ECE Laboratory Courses (5)
ECE Technical Electives (12)
Senior Design Projects (7)

LOWER-DIVISION GENERAL EDUCATION 18

Additional courses selected to satisfy the general education requirements not met in the major.

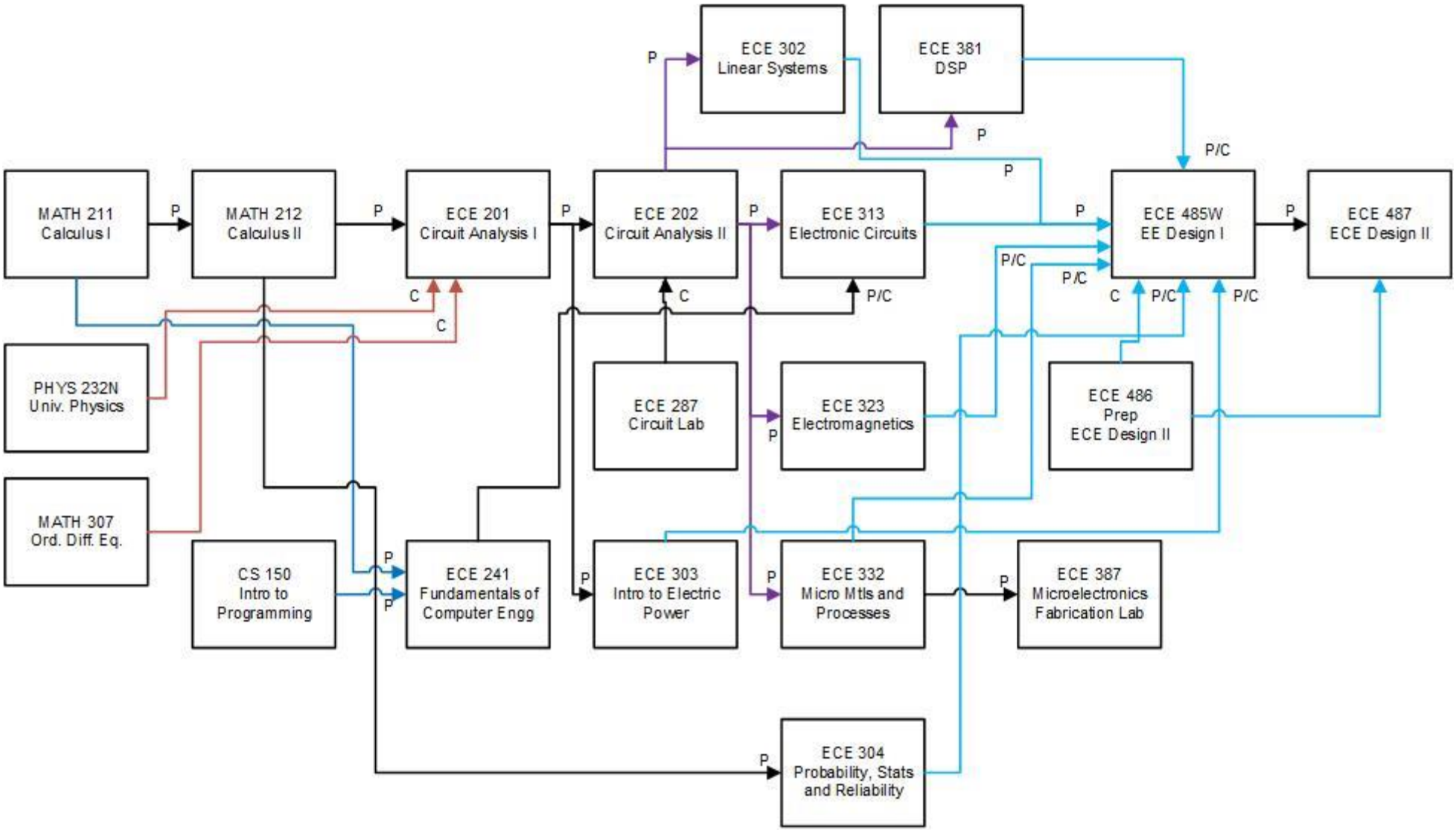
OTHER COURSES 15

ENGL 110C	English Composition I (3)
ENGL 231C	Technical Writing (3)
CS 150	Introduction to Programming (4)
ENGN 110	Introduction To Engineering (2)
Non-major Eng.	Elective (3)

UPPER-DIVISION GENERAL EDUCATION 6

May be satisfied by either an approved minor or two courses at the Upper-Level, 300/400 level, outside of and not required by the student's major or college.

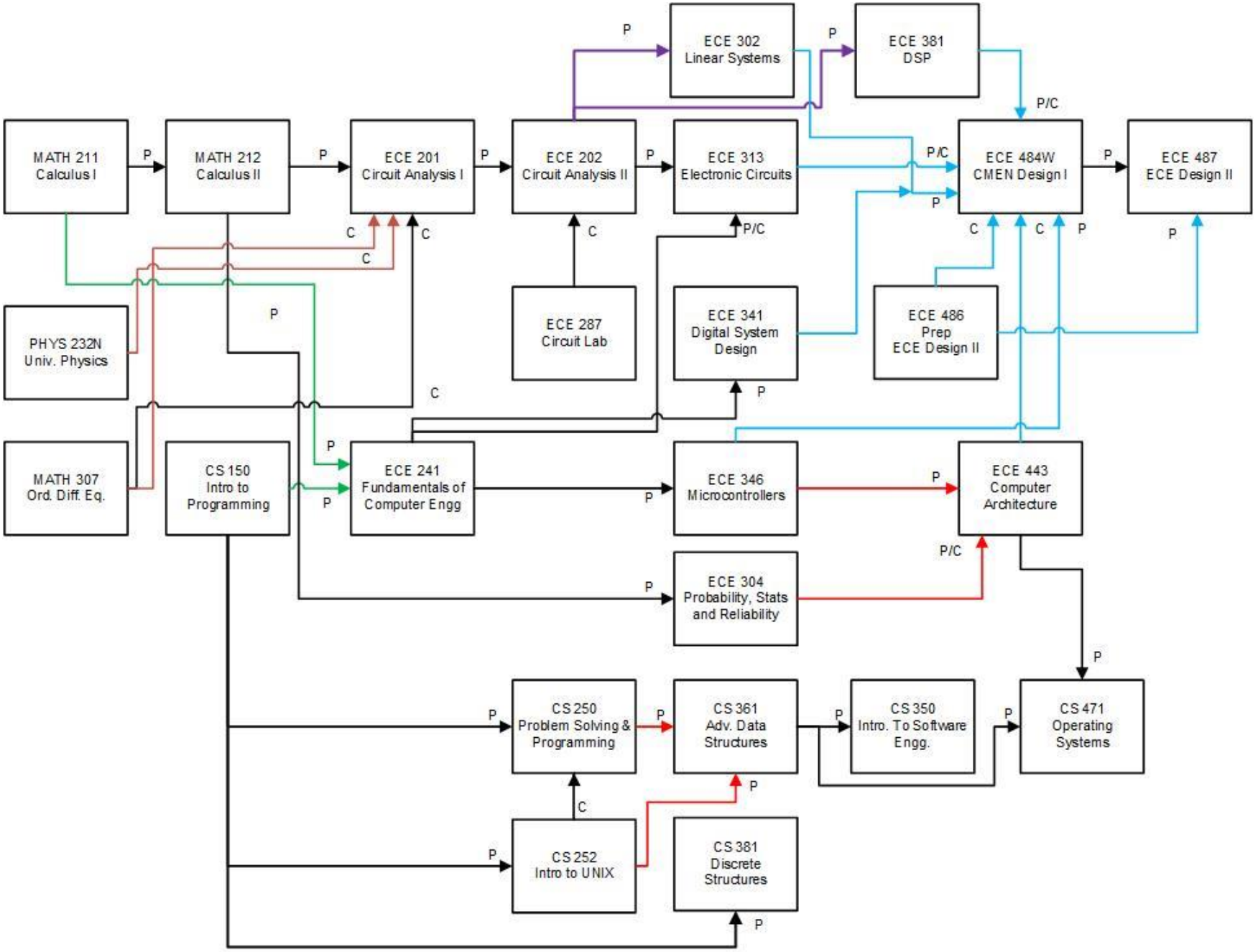
TOTAL CREDITS **127**



Flow Chart for the Electrical Engineering Core Curriculum

Overview of the Bachelor of Science in Computer Engineering

MATHEMATICS		14
MATH 211	Calculus I (4)	
MATH 212	Calculus II (4)	
MATH 307	Differential Equations (3)	
ECE 304	Probability, Statistics and Reliability (3)	
SCIENCE		15
CHEM 121N	Foundations of Chemistry I Lecture (3)	
CHEM 122N	Foundations of Chemistry I Lab (1)	
CHEM 123N	Foundations of Chemistry II Lecture (3)	
PHYS 231N	University Physics (4)	
PHYS 232N	University Physics (4)	
COMPUTER ENGINEERING CORE		69
Required CS Lecture Courses (17)		
Required ECE Lecture Courses (31)		
Required ECE Laboratory Courses (2)		
Senior Design Project (7)		
ECE Technical Electives (12)		
LOWER-DIVISION GENERAL EDUCATION		18
Additional courses selected to satisfy the general education requirements not met in the major.		
OTHER COURSES		12
ENGL 110C	English Composition I (3)	
ENGL 231C	Technical Writing (3)	
CS 150	Introduction To Programming (4)	
ENGN 110	Introduction To Engineering (2)	
UPPER-DIVISION GENERAL EDUCATION		
Met through a built-in minor in Computer Science.		
	TOTAL CREDITS	**128**



Flow Chart for the Computer Engineering
Core Curriculum

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

The University requires that all students receiving baccalaureate degrees complete a sequence of courses designed to develop language, writing, mathematics and research skills at a lower level and be able to apply these skills at the more advanced upper level. The foreign language requirement is fulfilled with completion of three years of a high school foreign language (or two years of two different languages). If you have any questions about this, please check with your advisor.

Electrical and Computer Engineering students must take lower division General Education Ways of Knowing courses, as described in the next section. Students who have received an AA or AS degree from a Virginia community college are considered by the University to have met all of the lower division requirements, regardless of the specific general education courses taken while earning the AS degree. Those who hold AS degrees in General Studies must have their transcripts evaluated individually by the Transfer department in Admissions to determine whether the program and courses are parallel to those offered at Old Dominion University.

The requirements listed in this and the next several sections represent a combination of the University general education requirements and any additional work needed to meet the accreditation requirements of the Accreditation Board for Engineering and Technology (ABET). All candidates for the degree of Bachelor of Science in Electrical Engineering (BSEE) or Bachelor of Science in Computer Engineering (BSCOME) must complete the identified minimum requirements or their equivalents.

Students admitted as Second Degree students are exempt from the University General Education Requirements. By virtue of their holding a recognized bachelor's degree from a duly accredited institution, the University considers these students to have already met all of these requirements, at both the lower and upper level.

The following is a list of coursework necessary to satisfy general education requirements:

LOWER DIVISION REQUIREMENTS

I. Skills

A. Written Communication - 6 hours. ENGL 110C and ENGL 231C within the curricula satisfy this requirement.
***Special Note: All students are required to take the Writing Sample Placement Test (WSPT, even if they have received transfer credit for ENGL 110C. Students will **NOT** be allowed to register for the ECE Senior Design course until they have passed the WSPT.*

B. Oral Communication - 3 hours. COMM 101R Public Speaking.

C. Mathematics - 8 hours. MATH 211 and MATH 212 within the curricula satisfy this requirement.

D. Languages and Culture - 6 hours. (Does not apply to students earning high school diplomas before December 31, 1985) This requirement is satisfied by the following options.

3 years of a single foreign language in high school
2 years each of 2 different foreign languages in high school
6 credit hours from one of the following course sequences

ARAB 111F	Beginning Arabic (6 credits)
CHIN 111F	Beginning Chinese (6 credits)
FARS 111F	Beginning Farsi (6 credits)
FR 101F-102F	Beginning French I and II
GER 101F-102F	Beginning German I and II
HEBR 111F	Beginning Hebrew I (6 credits)
ITAL 101F-102F	Beginning Italian I and II
JAPN 111F	Beginning Japanese (6 credits)
LATN 101F-102F	Beginning Latin I and II
PRTG 101F-102F	Beginning Portuguese I and II
RUS 101F-102F	Beginning Russian I and II
SPAN 101F-102F	Beginning Spanish I and II
SPAN 121F	Intensive Beginning Spanish (6 credits)

E. Information and Literacy - 3 hours. ECE 111 Information Literacy and Research in ECE

II. Ways of Knowing

A. Human Creativity - 3 hours. Electing one of the following courses satisfies this requirement.

ARTH 121A	Introduction to the Visual Arts
ARTS 122A	Visual Communication
COMM/THEA 270A	Film Appreciation
DANC 185A	Dance and Its Audience
MUSC 264A	Music in History and Culture
THEA 241A	The Theater Experience

B. Interpreting the Past - 3 hours. Electing one of the following courses satisfies this requirement.

HIST 100H	Interpreting the World Past Since 1500
HIST 101H	Interpreting the Asian Past
HIST 102H	Interpreting the European Past
HIST 103H	Interpreting the Latin American Past
HIST 104H	Interpreting the American Past
HIST 105H	Interpreting the African Past

C. Literature - 3 hours. Electing one of the following courses satisfies this requirement.

ENGL 112L	Introduction to Literature
ENGL 114L	American Writers, American Experiences
FLET 100L	Understanding World Literature

D. The Nature of Science - 8 hours. PHYS 231N and PHYS 232N within the curricula satisfy this requirement.

E. Philosophy and Ethics - 3 hours. ENMA 480 within the curricula satisfies this requirement.

F. Human Behavior - 3 hours. Electing one of the following courses satisfies this requirement.

AAST 100S	Introduction to African American Studies
ANTR 110S	Introduction to Anthropology
COMM 200S	Introduction to Human Communication
CRJS 215S	Introduction to Criminology
ECON 200S	Basic Economics
ECON 201S	Principles of Macroeconomics
ECON 202S	Principles of Microeconomics
FIN 210S	Personal Financial Literacy
GEOG 100S	Cultural Geography
GEOG 101S	Environmental Geography
POLS 100S	Introduction to International Politics
POLS 101S	Introduction to American Politics
POLS 102S	Introduction to Comparative Government and Politics
PSYC 201S	Introduction to Psychology
PSYC 203S	Lifespan Development
SOC 201S	Introduction to Sociology
WMST 201S	Introduction to Women's Studies

G. Impact of Technology - satisfied within the curricula.

UPPER DIVISION REQUIREMENTS

Electrical Engineering and Computer Engineering students may complete this requirement by Option A, B or C.

Option A: Any University approved minor, (minimum of 12 hours determined by the department), second degree, or second major.

Under this option any university approved minor, second degree, or second major fulfills the Upper Division requirements. However, students majoring in Electrical Engineering are encouraged to consider a minor in Computer Engineering. For this option, all the requirements listed for the minor in computer or electrical engineering

(depending on the minor taken) must be fulfilled, as mentioned previously. Although some credits may count for both the major and the minor, the student must take at least 6 credits of coursework in the minor, which do not count for the major. Students majoring in Computer Engineering automatically meet this requirement through the built-in minor in Computer Science.

Advantages of these minors include the following. Minors in electrical engineering and computer engineering have been designed to fulfill all leveling requirements needed for the master's programs for students in other engineering undergraduate majors. Another advantage of choosing a minor inside the ECE program is an increase of overall technical content in the curriculum.

Students may also wish to fulfill the Upper Division General Education requirement by choosing to complete both majors within our department. Through careful planning, this could be accomplished by taking only a few extra courses in addition to those required for the first major. The extra courses would be taken in place of the elective courses. A minimum of 129 credits are needed to complete all requirements for both majors. Students earning less than 150 credits would receive one degree listing both majors (double major), the primary major and the secondary major. Students having accumulated a total of 150 or more credit hours (mainly transfer students with extra credits) would receive two distinct degrees (double degree).

The ECE department has collaborated with the Computer Science department to make a similar double degree option available to those students who wish to complete both the Computer Engineering and the Computer Science degrees. Another approved option for a second degree is available for students wishing to pursue degrees in both Electrical Engineering and in Physics. Both of these combined programs require 150 credits or more, thus giving students two distinct degrees. For the outlines of these curricula, see Curriculum Worksheets, p. 42-47.

Option B: Any University-approved interdisciplinary minor (12 hours, 3 of which may be in the major)

12 credit hours of 300/400-level courses selected from at least three different disciplines.

The following is a list of university-approved interdisciplinary minors.

1. Administrative Leadership and Ethics for Professional Roles
   CHP 400, 450, 480; COMM 351; DNTH 416; ENGL 486; ENVH 402W; HLTH 425; MEDT 403W; MGMT 325, 350; MKTG 414; NMED 475W; NURS 480W, 490W; PAS 301; PHIL 303E, 345E; PSYC 303; SMGT 450W

2. Biomedical Engineering
   BME 401 and 402, two elective courses chosen from BIOL 446, 460, 490; BIOL/MAE 496 (topics approved by minor advisor); CHEM 443, EXSC 322,

417W; ECE 454, 462; MAE 303, 440; MATH 316; MEDT 324; MGMT 325; MSIM 351; NMED 331 and NURS 458. Students have the option to substitute one course from those that satisfy their major requirements for one of the minor electives with approval of the minor coordinator. Students interested in medical simulation are encouraged to select their electives from ECE 462, MAE 440 and MATH 316.

3. Children's Rights
   COMM 427; CRJS/SOC 403, 408; HMSV 448; PSYC 351; SOC 402; TLED 476

4. The Designed World
   ARTH 320W, 435W; ARTH 439; ENGL 382, 477; GEOG 310, 412; PSYC 344, 413; SEPS 303, 422, 423; STEM 382, 386, 417

5. Environmental Issues and Management
   CEE 350, 458; ECON 435, 447W; ENVH 301W, 402W, 420, 421, 422; GEOG 305, 306T, 400W, 420, 422W; OEAS 302, 310; PAS 300; PHIL 344E, 345E; POLS 300, 355, 401; PRTS 405; SOC 309, 320, 325, 440; SOC/CRJS 444

6. Health and Wellness
   CHP 360, 400, 420, 425, 456, 465, 470; CRJS 401; CRJS/SOC 421, 427, 441; EXSC 340, 403, 408, 415; HE 402; HPE 430; HMSV 341, 491; PE 300, 319, 409; PHIL 345E; PSYC 306, 325, 351, 352, 353, 363, 405, 408, 410, 420, 424, 431, 460, 461; SOC 440; SPED 313

7. Impact of Technology
   CHP 360; COMM 340, 372T, 400W, 401, 448; CS 300T, 312; ECON 402, 454W; ENGL 380, 382, 480; ENVH 301W, 402W; GEOG 305, 306T; HIST 304T, 389T; HIST/SCI 386T; 302T; IT 360T; MUSC 335T; OPMT 303; PHIL 355, 383T; POLS 350T; SOC 352; STEM 323, 370T, 382, 417; WMST 390T

8. The Urban Community
   ARTH 435W; CHP 415W; COMM 467; CRJS 323, 325, 355, 441; ECON 402, 455W; GEOG 310, 411, 412; PSYC 431; PRTS 433; SOC/CRJS 444

9. World Cultures: Values and Visions
   ANTR 304, 305, 320; COMM 400W; COMM 444/GER 445/FLET 445; ENGL 371W; FLET 307; FLET/JAPN 310; FLET/FR/GER 410; FLET/SPAN 471; FLET/GER 476; FR 320, 438, 469; GEOG 451, 452, 453, 455, 456; IT 425; MGMT 361; MKTG 411; PHIL 354; POLS 325W; PSYC 420; SPAN 320, 471
   Study Abroad: Any study abroad course at the 300/400-level that offers three credits can fulfill one course requirement for this minor. In cases where a study abroad course fits the themes of another interdisciplinary minor, students may request approval from the minor coordinator to use that study abroad course.

Option C: International Business and Regional Courses or an approved Certification Program such as Teaching Licensure.

Not pertinent for ECE Students.

Option D: Upper-Division Course Work from Another College Outside of and not Required by the Major

Students may take two courses (6 hours) at the Upper-Level, 300/400 level, from another college outside of and not required by the student's major.

MATH REQUIREMENTS FOR ELECTRICAL & COMPUTER ENGINEERING

Proficiency in math is the foundation of the electrical and computer engineering programs. All in-coming students without transferable credits in math must take the COMPASS Math Placement Test. The score on this test determines the particular math course the student will take in their first semester at Old Dominion University. In certain instances the SAT or ACT Math scores may also be used to place students in the appropriate math course. If a student's score places him or her in one of the lower-level courses, up to two years may be added to the total time required to complete their curriculum. Therefore, it is important that students realize that they might need to take a math class each semester until they are caught up in the curriculum.

The math courses follow a strict prerequisite structure. Each course must be successfully completed with a grade of "C" or better before the next level may be taken. Additionally, for ECE students, Calculus I and II must be completed with minimum grades of C in each before the basic ECE circuit courses may be taken. Since the ECE program is so math-intensive, students who do not build a firm foundation in math generally do not perform well in the ECE courses.

Following is a chart of Math Placement, based on the COMPASS Math Placement Score, SAT or ACT Math scores.

COMPASS Placement Score	SAT Math Score	ACT Math Score	Math Placement/Math Prerequisites
1	Any SAT Math score	Any ACT Math score	MATH 101M Intro to Mathematics
2	Any SAT Math score	Any ACT Math score	MATH 101M Intro to Mathematics
3	451-550	24-29	MATH 102M College Algebra
4	551-650	30-36	MATH 162M Pre-calculus I
5	651-700		MATH 163 Pre-calculus II
6	701 and above		MATH 211 Calculus I
-			MATH 212 Calculus II
-			MATH 307 Differential Equations
-			MATH 312 Calculus III

ACT scores only place students into MATH 101M, 102M or 162M. Placement into MATH 163 or 211 requires appropriate score on either SAT or the COMPASS Math Placement Test.

Any student may challenge his/her placement by making an appointment with the ODU Testing Center and coming to campus to take the COMPASS Math Placement Test.

DEPARTMENTAL COURSE OFFERINGS

The Department of Electrical and Computer Engineering offers most sophomore and junior courses each semester. Senior courses are offered with 2 or 3 semester rotations. Following is a complete list of all required courses for both programs. All prerequisite courses listed below in *italics* must be passed with a grade of C or better in order to proceed in the curriculum. See Minimum "C" Grade Policy, p. 37.

REQUIRED ECE COURSES

Offered both Fall and Spring Semesters unless noted

ECE 111	Information Literacy and Research for ECE (P-ENGN 110)
ECE 201	Circuit Analysis (P-*MATH 212*, MATH 307, PHYS 232N)
ECE 202	Circuits, Signals and Linear Systems (P-*ECE 201*, C-*ECE 287*)
ECE 241	Fundamentals in Computer Engineering (P-*CS 150, MATH 211*)
ECE 287	Fundamental Electric Circuits Laboratory (P-*ECE 201, CS 150,* C-*ECE 202*)
ECE 302	Linear System Analysis (P-*ECE 202*)
ECE 304	Probability, Statistics, and Reliability (P-*MATH 212*)
ECE 313	Electronic Circuits (P-*ECE 202*, P/C *ECE 241*)
ECE 381	Introduction to Discrete-time Signal Processing (P-*ECE 202*) – fall
ECE 486	Preparatory ECE Senior Design II (C-ECE 484W or 485W)
ECE 487	ECE Senior Design II (P-ECE 486)

Electrical Engineering only

ECE 303	Electrical Power (P-*ECE 201*) – fall
ECE 323	Electromagnetics (P-*ECE 202*) – fall and spring
ECE 332	Microelectronic Materials and Processes (P-*ECE 202*) – fall and spring
ECE 387	Microelectronic Fabrication Laboratory (P-ECE 332) – fall and spring
ECE 485W	EE Design I (P-ECE 302, 313, P/C-ECE 303, 304, 323, 332, 381) – fall and spring

ECE Technical Electives – 4 required (see list pages 19-20)

Computer Engineering only

ECE 341	Digital System Design (P-*ECE 241*) – fall and spring
ECE 346	Microcontrollers (P-*ECE 241*) – spring
ECE 443	Computer Architecture (P-ECE 341, 346, P/C-ECE 304, 484W) – fall
ECE 484W	CpE Design I (P/C-ECE 313, 381, P-ECE 302, 341, 346, C-ECE 443) – fall

ECE/CS Technical Elective – 4 required (see list pages 19-20)

Computer Science courses for Computer Engineering only

CS 250	Problem Solving & Programming (P-*CS 150*, C-CS 252)

CS 252 Introduction to UNIX (C-*CS 250*)
CS 361 Advanced Data Structures (P-CS *250*, 252)
CS 350 Software Engineering (P-*CS 361*)
CS 471 Operating Systems (P-*CS 361*, ECE 443)

The Computer Science Department does <u>not</u> necessarily offer all courses each semester. To be certain of availability, please consult the Computer Science department. Check Leo Online for course availability.

For more information concerning CS courses, the student is referred to the University Catalog, which contains a description of all courses.

NON-MAJOR ENGINEERING ELECTIVE

This is required for BSEE students only. The non-major engineering elective provides the student with exposure to computer science or another engineering field. Departmental approval of the selected course is required. This approval is obtained during review of the Curriculum Plan of Study. Some suggested courses are: CEE 204-Statics, MAE 201-Materials Science, MAE 204-Engineering Mechanics I-Statics, CS 250-Problem Solving and Programming, CS 381-Introduction to Discrete Structures, CS 418-Web Programming, or one of the 300/400-level ENMA courses. The non-major engineering elective may not be used as a substitute for ENGN 110 or ENGN 111. While selecting this course option, it is recommended to keep your future minor choice in mind. If you choose to minor in Computer Engineering, a CS course could possibly count for your minor in addition to the non-major engineering elective. This is also true for any of the ENMA courses if you choose Engineering Management for a minor.

TECHNICAL ELECTIVES

Technical electives are required for the electrical engineering and computer engineering undergraduate degree programs. Students must select a minimum of four technical electives from the following listing but are not required to choose all of their technical electives from one particular emphasis area. They may choose any four technical electives of interest. Courses are grouped in emphasis areas to allow students to specialize in an area of interest if they so desire. Additionally, electrical engineering students may choose technical electives from computer engineering emphasis areas and vice versa. All prerequisite courses listed below in *italics* must be passed with a grade of C or better in order to proceed in the curriculum. See Minimum "C" Grade Policy, p. 38.

<u>Electrical and Computer Engineering Emphasis Areas</u>

System Science

ECE 355 Intro to Networks and Data Communications (P-junior standing) – fall
ECE 451 Communication Systems (P-*ECE 202*, 304) – spring

ECE 455 Network Engineering and Design (P-ECE 355, or permission from instructor) – spring
ECE 458 Instrumentation (P-*ECE 202*, PHYS 102N, 112N or 232N) – spring
ECE 461 Automatic Control Systems (P-*ECE 202*) – fall

Physical Science

ECE 303 Introduction to Electric Power (P-*ECE 201*) - fall
ECE 403 Power Electronics (P-MATH 307 and ECE 303) – spring
ECE 404 Electric Drives (P-*ECE 201* and ECE 303) – fall
ECE 454 Introduction to Bioelectrics (P-MATH 200 or higher, PHYS 111N or higher) – fall
ECE 458 Instrumentation (P-*ECE 202*, PHYS 102N, 112N or 232N) – spring
ECE 472 Plasma Discharges and Materials Processing (P-ECE 323) – fall
ECE 473 Solid State Electronics (P-ECE 313, 323, 332) – fall
ECE 474 Optical Communications (P-ECE 323 and MATH 312) – spring
ECE 478 Lasers and Laser Applications in Engineering (P-ECE 313 and MATH 312) – spring

Digital Design

ECE 341 Digital System Design (P-*ECE 241*)
ECE 346 Microcontrollers (P-*ECE 241*) – spring
ECE 443 Computer Architecture (P-ECE 341, 346, P/C-ECE 304, 489W) – fall
ECE 458 Instrumentation (P-*ECE 202*, PHYS 102N, 112N or 232N) – spring

Modeling and Simulation, Medical Imaging Computer Graphics and Visualization

ECE 406 Introduction to Visualization (P-*CS 250*) – fall
ECE 407 Introduction to Game Development (P-*CS 361*or equivalent) – spring
ECE 462 Introduction to Medical Image Analysis (P-*MATH 212*)
ECE 481 Introduction to Digital Image Processing (P-*ECE 202*) – spring
CS 460 Computer Graphics (P-*CS 361)*

Computer Hardware, Embedded Systems, Real-Time Systems, FPGA/VLSI Design

ECE 332 Microelectronic Materials and Processes (P-*ECE 202*) – fall and spring
ECE 387 Microelectronic Fabrication Laboratory (P-ECE 332) – fall and spring
ECE 441 Advanced Digital Design and FPGAs (P-ECE 341) – spring
ECE 483 Embedded Systems (P-ECE 313, 346) – fall

Computer Networks, Wireless Communications, Sensor Networks, Network Security

ECE 355 Intro to Networks and Data Communications (P-junior standing) – fall
ECE 455 Network Engineering and Design (P-ECE 355, or permission from instructor) – spring
ECE 451 Communication Systems (P-*ECE 202*, 304) – spring
ECE 452 Intro to Wireless Communication Networks (P-*ECE 202*, 304) – fall

CS 472 Network Systems Security (P-*CS 361*)

Signal/Image Processing, Computer Vision, Pattern Recognition, Machine Intelligence

ECE 481 Introduction to Digital Image Processing (P-*ECE 202*) – spring
ECE 462 Introduction to Medical Image Analysis (P-*MATH 212*) – spring

Computer Science Technical Electives (for Computer Engineering majors only)

Students in the Computer Engineering program can choose an additional computer science course as one of their Technical Electives, as this strengthens their minor in Computer Science. Students may choose from the following CS courses.

CS 355 Principles of Programming Languages (P-*CS 250, 252*)
CS 390 Introduction to Theoretical Computer Science (P-*CS 250, 381*)
CS 454 Network Management (P-*CS 455*)
CS 476 Systems Programming (P-*CS 330, 361*)
CS 487 Applied Parallel Computing (P-*CS 270, 361*)
CS 488 Principles of Compiler Construction (P-*CS 361*)

DEPARTMENTAL MINORS

Minor in Electrical Engineering

An undergraduate minor in electrical engineering may be obtained by successful completion of 12 or more semester credit hours of approved electrical engineering course work at the 300 or 400 level, at least three credit hours of which must be at the 400-level. In addition, a student seeking a minor in electrical engineering must satisfy all pre- or co-requisite requirements for the courses selected.

Courses are available that allow pursuit of several areas of specialization in Systems Science, Physical Science and Digital Design. The Chief Departmental Advisor must approve the precise course of study.

For completion of a minor, a student must have a minimum grade point average of 2.00 in all courses taken toward the minor and complete at least six hours of upper-level courses in the minor requirement at Old Dominion University. Completion of a minor in electrical engineering with a GPA of 3.00 or greater satisfies the leveling requirements for a graduate degree in electrical engineering.

The following provides more information on the required core courses and elective courses for the three tracks available for pursuing a minor in electrical engineering. All prerequisite courses listed below in *italics* must be passed with a grade of C or better in order to proceed in the curriculum. See Minimum "C" Grade Policy, p. 38.

I. Systems Science Track (12 Credits)

All students are required to take three core courses:

- ECE 371 Circuit Analysis (P-*ECE 201*) 3 Credits *
- ECE 303 Intro to Electrical Power (P-*ECE 201*) – fall 3 Credits
- ECE 304 Prob., Stats, and Reliability (P-*MATH 212*) 3 Credits

Students may select one senior level course (each 3 Credits) from the following list:

- ECE 451 Communication Systems (P-ECE *202* or 371, 304) – spring
- ECE 455 Network Engineering and Design (P-ECE 355, or permission from instructor) – spring
- ECE 461 Automatic Control Systems (P-*ECE 202* or 371) – fall

* *Not available to Computer Engineering majors.*

II. Physical Science Track (12 Credits)

All students are required to take three core courses:

- ECE 304 Prob., Stats, and Reliability (P-*MATH 212*) 3 Credits
- ECE 323 Electromagnetics (P-*ECE 202* or 371) 3 Credits
- ECE 332 Micro. Materials & Proc. (P-*ECE 202* or 371) – fall 3 Credits

Students may select one senior level course (each 3 Credits) from the following list:

- ECE 472 Plasma Discharges and Materials Processing (P-ECE 323) – fall
- ECE 473 Solid State Electronics (P-ECE 313, 323, 332) – fall
- ECE 474 Optical Communications (P-ECE 323 and MATH 312) – spring
- ECE 478 Lasers and Laser Applications in Engineering (P-ECE 313 and MATH 312) – spring

III. Digital Design Track (13 Credits)*

All students are required to take three core courses:

- ECE 304 Prob., Stats, and Reliability (P-*MATH 212*) 3 Credits
- ECE 340 Digital Circuits (P-*CS 150*) 4 Credits
- ECE 341 Digital System Design (P-*ECE 241* or 340) 3 Credits

Students may select one senior level course (each 3 Credits) from the following list:

- ECE 346 Microcontrollers (P-*ECE 241* or 340) – spring
- ECE 443 Computer Architecture (P-ECE 341, 346, P/C-ECE 304) – fall

* *Not available to Computer Engineering majors.*

Minor in Computer Engineering

To complete the Minor in Computer Engineering, a student must take four courses (or equivalent) for a total of 12 or more credits. In addition, a student seeking a minor in computer engineering must satisfy all pre- or co-requisite requirements for the courses selected. The Chief Departmental Advisor must approve the precise course of study. Completion of a minor in computer engineering with a GPA of 3.00 or greater satisfies the leveling requirements for a graduate degree in computer engineering. All prerequisite courses listed below in *italics* must be passed with a grade of C or better in order to proceed in the curriculum. See Minimum "C" Grade Policy, p. 38.

All students are required to take two core courses:

- CS 333 Programming (P-*CS 150, MATH 163*) 4 Credits*
- CS 361 Data Structures (P-*CS 250*, 252) 3 Credits

Students may select two courses from the following list:

- ECE 340 Digital Circuits (P-*CS 150*) 4 Credits**
- ECE 341 Digital System Design (P-*ECE 241* or 340) 3 Credits
- ECE 346 Microcontrollers (P-*ECE 241*) – spring 3 Credits
- ECE 355 Intro to Networks and Data Comm. (P-Junior standing) – fall 3 Credits
- ECE 381 Intro to Discrete-time Signal Processing (P-*ECE 202*) – fall
- ECE 406 Computer Graphics and Visualization (P-*CS 250*) – fall 3 Credits
- ECE 441 Advanced Digital Design and FPGAs (P-ECE 341) – spring 3 Credits
- ECE 455 Network Engineering and Design (P-ECE 355, or permission from instructor) – spring 3 Credits
- ECE 483 Embedded Systems (P-ECE 313, 346) – spring 3 Credits

* *CS 250 and CS 252 satisfy this requirement.*

** *Not available to Electrical Engineering majors.*

Minor in Modeling, Simulation and Visualization Engineering

The minor in Modeling and Simulation must be approved by the advisor in the Department of Modeling, Simulation and Visualization Engineering. Please contact Trey Mayo (rmayo@odu.edu) to declare this minor. To complete the Minor in Modeling and Simulation, a student must take four courses (or equivalent) for a total of 12 or more credits. In addition, a student seeking a minor in modeling and simulation must satisfy all pre- or co-requisite requirements for the courses selected.

I. Simulation Application Track

All students are required to take three core courses:

- STAT 330 Probability and Statistics (or equivalent) 3 Credits*
- MSIM 205 Discrete Event Simulation (P-STAT 330 or equiv.) – spring 3 Credits
- MSIM 320 Continuous Simulation (P-PHYS 232N and MATH 307) – fall 3 Credits

Students are to take one of the following:

- MSIM 410 Model Engineering 3 Credits
- MSIM 451 Analysis for Modeling and Simulation 3 Credits

II. Simulation Development Track

All students are required to take three core courses:

- STAT 330 An Introduction to Probability and Statistics (or equivalent) 3 Credits
- MSIM 205 Discrete Event Simulation 3 Credits
- MSIM 331 Simulation Software Design 3 Credits

Students are to take one of the following:

- MSIM 408 Introduction to Game Development 3 Credits
- MSIM 441 Computer Graphics and Visualization 3 Credits

To pursue the minor, students must have completed calculus and one college-level computer programming course (CS 150 or equivalent).

**ECE 304 satisfies this requirement.*

Minor in Computer Science (for Computer Engineering Students Only)

Computer engineering students automatically have the minor in Computer Science built into their curriculum. This is accomplished by choosing at least one CS course as a Technical Elective. See Technical Elective list on p. 17-18.

Biomedical Engineering Interdisciplinary Minor

The interdisciplinary minor in biomedical engineering requires 12 credit hours of 300/400-level courses selected from at least two different disciplines with a maximum of six credits from any one discipline. For completion of the interdisciplinary minor, students must have a minimum overall cumulative grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses and prerequisite courses. At least six hours of upper-level courses must be taken through courses offered by Old Dominion University. Three credit hours may be in the major, if a major course is listed as an option for the interdisciplinary minor. As such, it will be credited toward both the major and the interdisciplinary minor.

All students are required to take two core courses:

- BME 401 Biomedical Engineering Design and Innovation 3 Credits
- BME 402 Biomedical Engineering Principles 3 Credits

Students must select two courses from the following list of approved electives, one which is double-counted in the major:

- BIOL 446 Comparative Biomechanics 3 Credits
- BIOL 460 Frontiers in Nanoscience and Nanotechnology 1 Credit
- BIOL 490 Advanced Human Physiology 4 Credits
- BIOL 496 Biology Topics 4 Credits
- CHEM 443 Intermediate Biochemistry 3 Credits
- EXSC 322 Anatomical Kinesiology 4 Credits
- EXSC 417W Biomechanics 4 Credits
- ECE 454 Introduction to Bioelectrics 3 Credits
- ECE 462 Introduction to Medical Image Analysis (MIA) 3 Credits
- MAE 303 Mechanics of Fluids 3 Credits
- MAE 440 Intro to Finite Element Analysis 3 Credits
- MATH 316 Introductory Linear Algebra 3 Credits
- MGMT 325 Contemporary Organization and Management 3 Credits
- MSIM 451 Analysis for Modeling and Simulation 3 Credits
- MEDT 324 Clinical Instrumentation and Electronics 3 Credits
- NMED 331 Fund Concepts in Nuclear Medicine Techn. 4 Credits
- NURS 458 Studies in Professional Nursing 3 Credits

Other popular minors for students in the electrical or computer engineering programs include minors in math, engineering management, physics and business. Please contact the Chief Departmental Advisor in the respective department for further information and/or to declare minors in these disciplines. These are only suggestions. You are free to pursue any minor of your choice.

For completion of a minor, a student must have a minimum grade point average of 2.00 in all courses taken toward the minor and complete at least 6 hours of upper division courses in the minor requirement at Old Dominion University. Students must satisfy all pre- or co-requisite requirements for the courses selected in their chosen minor.

SENIOR DESIGN

The senior design capstone courses are to be completed over two semesters in a student's final year of the program. These courses are intended to solidify the knowledge and skills obtained during the previous years of the program. The ECE Senior Design I courses, ECE 484W and ECE 485W, are courses involving well-structured projects. Concurrently, students will also take ECE 486 Preparatory ECE Design II. In this course, students form multidisciplinary teams, consisting of both electrical and computer

engineering students, to develop proposals for their final design project which is to be completed the following semester in ECE 487 ECE Senior Design II. Students wishing to continue their research started in ECE 487 (such as students in the BS-Master's program) may choose to take ECE 488 Senior Design III in lieu of one of the technical electives.

ACCELERATED BS/MASTER'S AND INTEGRATED BS/PhD PROGRAMS

The accelerated BS/Master's program in the Frank Batten College of Engineering and Technology at Old Dominion University is designed to provide an opportunity for exceptionally qualified students to obtain both a BS and a master's degree in Electrical and Computer Engineering. The program provides students with a rigorous and thorough education in the basic principles of Electrical and Computer Engineering, together with one year of graduate education. The curriculum in this program is appropriately designed so that students can advance smoothly from the undergraduate to the graduate program. The degree requirements for both degrees can be met in five years.

Successful graduates of this program will be afforded accelerated entry into higher than entry-level positions in the profession. The students' unique preparation will create opportunities for rapid advancement in their careers.

The Integrated BS/PhD program is established for students who are highly motivated to pursuing a scientific research career and have shown high academic and research achievements in their undergraduate program. The duration of the integrated BS/PhD degree is approximately eight years.

General Guidelines

- These programs will grant BS & ME, BS & MS and BS & PhD degrees.

- Entrance into one of these programs is available to suitably qualified students in the freshman, sophomore, junior years, as well as to qualified transfer students to our undergraduate programs. Junior-level transfer students admitted into the program must have a GPA of 3.25 or better in all the course work attempted at the college(s) from which they are transferring. It is preferred that students apply to the accelerated programs at the beginning of their junior year. Junior students applying to one of the BS & Master's programs should have completed all 200-level ECE courses with a 3.0 or higher GPA and have at least a 3.0 overall GPA. For the Integrated BS/PhD program, a GPA of 3.50 or higher is required for entry and continuance.

- The continuing eligibility of students in the master's programs requires them to maintain a GPA of 3.00 or better overall and in all engineering courses taken at Old Dominion University. Students that do not maintain the required minimum GPA overall and in their major will be dropped from the program.

- The accelerated BS/Master's programs require 30 credit hours; however, 6 hours of graduate coursework (taken at the 500-level or higher) can count for both the

undergraduate and graduate degrees. The 6 hours that are credited to both degrees must be paid for at the graduate tuition level. Students can choose either the MS degree or the non-thesis ME degree. The total minimum number of credits for the BS-Masters program is 151/152 hours, as compared to 157/158 total hours for the BS degree (127/128 hours) + MS degree (30 hours).

- The Integrated BS/PhD program allows a student to have a course load reduction of up to 6 credit hours and also a reduction of 6 theses credit hours. In total, students will be required to take either 42 hours of graduate classes (if MS thesis is also completed), or 48 hours of graduate classes It is expected that highly qualified students will be able to take advantage of the reduced course load to devote more emphasis to original research. Continuance in this program requires that students maintain a GPA of at least 3.50.

- Students in the accelerated BS/MS track performing exceptionally well at the end of the fifth year and wishing to transfer to the Integrated BS/PhD will have that option.

- Students admitted into any of the accelerated programs must meet with the Graduate Program Director for selection of the appropriate graduate courses (400/500 or higher-level). Students must register for the courses at the graduate-level. When taking a 500-level course, the University Catalog states "Courses at the graduate-level are available for graduate credit only and correspond to undergraduate 400-level courses. However, a different grading scale is used for 500-level registrants (grades below C- are assigned a grade of F); additional and higher quality work is required in 500-level courses."

- Deadlines for application: Fall term – February 1; Spring term – October 1

- For more information, please contact the Graduate Program Director, and visit the graduate programs website at the following address: http://www.odu.edu/ece.

COOPERATIVE EDUCATION

Cooperative education at Old Dominion University allows students to combine academic study with professional-level training. The integration of academic and professional experience provides a broader education than classroom instruction alone. The Southeastern Virginia area affords students plenty of opportunity for practical experience in area research sites, various industries, and a large number of consulting firms within and outside of the Hampton Roads region. The Engineering Co-op office is located in Kaufman Hall, Room 132. For further information, contact Bev Forbes at 683-5341 or visit the website at http://ww2.odu.edu/ao/cmc/en/index.shtml

GETTING STARTED

ADMISSIONS

Admission policies and procedures for the College of Engineering and Technology for freshmen and transfer applicants are described in the University catalog. The following sections briefly describe these procedures.

NEW STUDENTS

Before you can register for classes, you must be admitted to Old Dominion University. You may do this by completing a non-degree or a degree application through the Office of Admissions http://www.odu.edu/admission/undergraduate

Application Deadlines for Regular Admission:

Fall Deadlines

Freshman	February 1
Transfer	June 1
Second-Degree	June 1

Spring Deadlines

Freshman	October 1
Transfer	October 1
Second-Degree	October 1

Summer Deadlines

Transfer	March 15
Second-Degree	March 15

Admission applications received after these dates will be processed on a space available basis. *The priority deadline for applications and all merit-based scholarships is December 1.*

The Application for In-State Tuition Rate Form MUST be submitted to be considered for financial aid. Freshmen students MUST attend the University's orientation program, PREVIEW. The admission office will send information about PREVIEW following admission to the University.

All freshmen intending to major in electrical or computer engineering will be advised in the Engineering Fundamentals Division of the College of Engineering and Technology, located in Kaufman Hall, Room 102, phone 683-4245. Dr. Linda Vahala serves as the Director of the Engineering Fundamentals Division. Dr. Lee Belfore serves

as the ECE Freshman Advisor. Ms. Bonita Anthony serves as the Assistant Director of the Engineering Fundamentals Division.

RETURNING STUDENTS

If you have previously attended Old Dominion University on a degree-seeking basis but have not been enrolled for one full academic year or have attended college elsewhere, you must complete the readmission application form or visit the Admissions Office in Rollins Hall. http://www.odu.edu/admission/reactivation

TRANSFER STUDENTS

Transfer students must send all higher education transcripts to Old Dominion University Office of Admissions, Rollins Hall, Norfolk VA 23529, to have their credit evaluated. They should also arrange to have their high school transcripts sent to the Admissions Office if they have met the Foreign Language requirement in high school, as outlined on p.11. Transfer students who have credit for the first year of the ECE curriculum will work directly with the ECE department for articulation of transfer credit, advising, and class scheduling upon admission to the University. Students who do not have the first year of the ECE curriculum will be required to contact the Engineering Fundamentals Division of the College of Engineering and Technology, located in Kaufman Hall, Room 102. Students transferring from any community college within the Virginia Community College System will follow the curriculum specified in the Articulation Agreements, Appendix C, until further notice.

WRITING SAMPLE PLACEMENT TEST (WSPT)

All incoming students, except those possessing a bachelor's or higher degree, are required to take the Writing Sample Placement Test. The results are used for placement purposes for all first-year students, including transfer students without credit for ENGL 110C. Transfer students with credit for ENGL 110C are encouraged to take the WSPT either before or within the first few weeks of their first semester. The students must take the WSPT before they can take the writing-intensive course in their program, ECE 484W for Computer Engineering students or ECE 485W for Electrical Engineering students.

ADVISING

The ECE department provides student advising in two forms. Each student is assigned a faculty advisor. The most current list with the name of the student and their respective faculty advisor is posted on the undergraduate bulletin board, at the front desk in the office, and on the ECE website. You are strongly encouraged to check this list regularly. This information is also available on the department home page on the Web. The faculty advisor provides guidance related to choice of a minor, senior specialization and design projects as well as electrical and computer engineering career opportunities in industry and graduate programs.

Beginning with the second semester of freshman year study, each student will be required to create and maintain a curriculum worksheet or plan of study (see the sample copies in the handbook, pages 42-47). This is an important document which will assist

you in keeping on track with the degree requirements. Once each semester (excluding summer), the department conducts Group Advising sessions under the supervision of the Chief Departmental Advisor. In preparation for these sessions, students first complete the Planner in DegreeWorks listing the courses they should take in the remaining semesters of study. The Planner must be completed prior to meeting with the Undergraduate Coordinator. The proposed courses will then be listed on the departmental curriculum worksheet. Photocopies of the worksheets are distributed at the sessions. Students are then required to see their assigned faculty advisor for schedule approval. Once approved (evidenced by the faculty advisor's signature) the signed curriculum worksheets are to be returned to the Undergraduate Coordinator for removal of the Advisor Registration Block before actual registration can be made.

Students also work closely with the Undergraduate Coordinator. Under the close supervision of the Chief Departmental Advisor and Department Chair, the Undergraduate Coordinator maintains student records, assists with transfer credit evaluations, clarifies University and departmental procedures, removes the Advisor Registration Block placed on a student's record prior to the next registration cycle, and assists students in the graduation process. Students are strongly urged to personally track their own progress towards their degree by going to Leo Online, printing out a copy of their Worksheet from DegreeWorks, and bringing it with them when they meet with the Undergraduate Coordinator to discuss any discrepancies found. ***It is each student's responsibility to make sure they are on track for graduation.***

ADVISING REMINDERS FOR STUDENTS

Following is a timeline of important events during a calendar year.

JANUARY:	*GPA in major available late January
FEBRUARY:	*Apply for financial aid for fall *Seniors wishing to graduate in August should apply for graduation and make an advising appointment to review their academic record
MARCH:	*Check undergraduate bulletin board for spring advising schedule *Advising will begin mid-March
APRIL:	*Group Advising sessions held *Pre-registration begins
MAY:	*Seniors wishing to graduate in December should apply for graduation and make an advising appointment to review their academic record * Fundamentals of Engineering Examination Application due for October test (applications available in ECE front office)

JUNE-AUGUST:	*GPA in major available late June *Advising and registration of new students
OCTOBER:	*Check undergraduate bulletin board for fall advising schedule *Advising will begin mid-October *Seniors wishing to graduate in May should apply for graduation and make an advising appointment to review their academic record
NOVEMBER:	*Group advising sessions held *****Pre-registration begins
DECEMBER:	*Advising and registration of new students *Fundamentals of Engineering Examination Application due for April test

REGISTRATION

Complete information regarding registration is at the Registrar's Office website: http://ww2.odu.edu/ao/registrar/registering/index.shtml. Students may choose to either register through Leo Online or at the Registrar's Office. Advisor overrides will be required for overloads, closed classes, and students exceeding the maximum number of credit hours (18 for undergraduates). Only students with overall GPA 3.00 or greater will be granted permission to register for more than 18 credit hours per semester.

A current schedule of all ECE classes is available both in the office and on our departmental web site. *You are urged to check periodically for all changes and updates to the schedule.*

HONORS COLLEGE

Top achieving students may wish to join the Honors College. Benefits include being able to register for courses in small class settings. Instructors emphasize innovation and individualized instruction. Honors courses are not designed to be more difficult or time consuming, but to deepen and refine the undergraduate experience.

Being an Honors College student has many benefits. They have privileges at the library, early registration dates, and housing privileges. For a complete explanation of benefits and requirements, or to apply to the Honors College, please visit the website: http://ww2.odu.edu/ao/honors/

FINANCIAL AID

Information concerning federal and state aid programs and University scholarships is available from the Financial Aid Office, Rollins Hall. You can also visit their web site for more information at http://www.odu.edu//finaidoffice. In order to be considered for financial aid during the fall semester, students should be aware that the priority application deadline is February 1 for both scholarships and for the FAFSA form.

SCHOLARSHIP AND INTERNSHIP OPPORTUNITIES

Scholarship and internship information is available through several different sources. Below are highlighted some of the main opportunities for ECE students.

NASA Langley Aerospace Research Summer Scholars (LARSS) Program

A Summer, Fall, or Spring Paid Internship Opportunity that requires a research project to be completed by the student under supervision of a LaRC mentor. Stipend of $5,000 for rising juniors and seniors, and $6,000 for first-year graduate students.

Eligibility Requirements: U.S. citizen, full-time undergraduate student, rising junior or senior, or first-year graduate student, with minimum GPA of 3.00. Students must team with a faculty member and write a short research proposal outlining work to be done during funding period.

Due Dates: October 31 for Spring 2014, February 1 for Summer 2014, mid-April for Fall 2014

To Apply: Download application from website:
http://www.nianet.org/larss.

Honors College Scholarship

Honors College students are eligible to apply for the following scholarships in the spring semester each academic year:

The Cranmer-Skinner Scholarship

Eligibility Requirements:

- ODU Honors College student
- Minimum 3.25 GPA
- Participation in extra-curricular activities

Due Dates: April 1, 2014

The Brock Foundation Endowed Honors Scholarship

Eligibility Requirements:

- Junior or Rising Senior
- Good academic standing
- Willingness and ability to provide tutoring services for local high school students through the ACCESS program (a minimum of 45

hours of tutoring over the fall 14 and spring 15 semesters is required). For more information about the ACCESS program consult http://www.accesscollege.org.

To Apply: See Application Procedures listed at website:
http://ww2.odu.edu/ao/honors/about/scholarships.shtml

VMEC Scholars Research at ODU

A 10-to-13-week summer research internship at member institution or research facility, paying up to $9000 stipend. Funded by The Virginia Microelectronics Consortium for Education and Research.

Eligibility Requirements: A junior or senior engineering student interested in research

Due Dates: October of each year

To Apply: Download application from this website:
http://vmec-scholars.org/index.htm

USRP-NASA Undergraduate Student Research Program

Eligibility Requirements: Undergraduate students enrolled full-time in an accredited U.S. college or university. Applicants must be classified as rising sophomores, juniors or seniors at the beginning of the first session for which they are applying. Highly qualified applicants must be pursuing an undergraduate degree that meets NASA's critical competency needs. Eligible fields of study are academic majors or demonstrated coursework concentration in engineering, mathematics, computer science or physical/life sciences.

To Apply: http://usrp.usra.edu/

The Edgar and Kathleen Kovner Scholarships

A privately funded, renewable scholarship, for entering freshmen in the Batten College of Engineering

Eligibility Requirements: High school performance in math and sciences

Renewable for 3 years for full-time engineering students with a GPA of 3.00 or greater

Undergraduate Student Researchers Program (USRP)

This program provides opportunities for ECE undergraduate students to enhance their research skills, critical thinking, and communication skills by working closely with ECE faculty in their research programs. See Appendix A, Department Faculty, p. 51, for information on ECE Faculty and their research areas of interest.

Students can find additional information on this program at this departmental website:
http://eng.odu.edu/ece/academics/undergrad/usrp.shtml

More scholarship information is also listed at the Batten College of Engineering & Technology website:
http://www.eng.odu.edu/eng/resourcesfor/students/Scholarships.shtml

Specific scholarships listed at this website that would appear to be of interest to ECE students include:

Charles H. Eure Memorial Scholarship
ECHR (Engineering Club of Hampton Roads)
Framatome Technologies
ISA , Richmond-Hopewell Section (Instrument Society of America)
The Edgar and Kathleen Kovner Scholarships
Norfolk Foundation Scholarship
Stuart Russell Memorial Scholarship
Sumitomo
SWE - Hampton Roads Section (Society of Women Engineers)
VA Space Grant Consortium Scholarship
VSPE (VA Society of Professional Engineers)

The link, http://www.odu.edu/af/finaid/scholarship/, lists some general university-wide scholarships, most of which are not intended for ECE students, but may be of interest.

ACADEMIC CONTINUANCE

UNIVERSITY POLICIES ON ACADEMIC CONTINUANCE

Continuance regulations are based upon grade point average (GPA) computations. ODU uses the following grade system:

A = 4.0	B+ = 3.3	C+ = 2.3	D+ = 1.3	F = 0.0
A- = 3.7	B = 3.0	C = 2.0	D = 1.0	
	B- = 2.7	C- = 1.7	D- = 0.7	

Grade points (Quality Points, as listed on LEO ON LINE) are computed by multiplying the numerical grade equivalent assigned for the course by the number of credit hours. A grade of F counts toward hours attempted (except for an F earned under the Pass/Fail option), even though it carries no grade points. The following table shows an example.

Course	Grade	Course Value	Credits	Quality Points
ENGL 110C	C	2.0	X 3	= 6.0
CHEM 115N	F	0.0	X 4	= 0.0
MATH 211	A	4.0	X 4	= 16.0
SOC 201S	D-	0.7	X 3	= 2.1

Totals = 14 24.1

To arrive at a grade point average for a semester, divide the total number of Quality Points earned by the total number of GPA Hours attempted: 24.1 / 14 = 1.72 Current GPA (for one semester). To arrive at the minimum number of Quality Points needed to maintain "good standing", multiply the total number of hours attempted by two, i.e., 14 x 2 = 28 Quality Points necessary for good standing. So the student is (28 - 24.1) = 3.9 Quality Points short, or has a deficiency of 3.9 points. For example, in order to bring the GPA up to a 2.0, the student should achieve a B+ or better grade in a 3 credit hour course. (14 + 3 = 17, times 2 = 34, less current points of 24.1 = 9.9, divided by 3, =3.3, a grade of B+ needed.) This computation is easily done using the University GPA Calculator located at http://ww2.odu.edu/ao/registrar/grades/gpa/index.shtml

WITHDRAWING FROM CLASS

Under certain circumstances a student may have to withdraw from a class. Students must submit a completed drop/add form to the Office of Registration and Records or use Leo Online in order to drop or add a class. A signature is not required to withdraw from a class prior to midterm of the semester. A grade of W will be assigned for classes withdrawn during this period, up until the Withdraw Deadline. It is recommended that all students either meet with the Freshman Advisor, or the ECE Faculty Advisor, depending on who advised the student for that semester, prior to adding or withdrawing from a course. Be aware that withdrawing from a course may impact a student's financial aid eligibility.

GRADING POLICY FOR WITHDRAWAL FROM CLASSES

During the first 6 days of a fall or spring semester (first 3 days of summer session) no grade or reference to a class will appear on a student's academic record should he/she choose to drop a course(s). The date for the drop deadline is posted each semester in the University calendar. Withdrawal from a class after the first six days (or 3 days during summer sessions) will result in a W for the class. A student who stops attending a class without withdrawing will earn a WF unless the student's performance warrants an F, in which case an F will be assigned. When calculating the grade point average, the WF is treated like an F, carrying no grade points.

ACADEMIC WARNING

A student will be placed on academic warning for one semester when the student's cumulative GPA falls below 2.0 at the end of a semester, including summer sessions. A student on academic warning may not enroll in more than 14 credits per semester of attendance (no more than six credits in the summer sessions, and no more than one course in any single summer session) except under extenuating circumstances and with the permission of the dean or designee of the college in which the student is enrolled. A student on academic warning must achieve a cumulative GPA of at least 2.0 at the end of the next semester of attendance to be in good standing. Failure to achieve a cumulative GPA of at least 2.0 results in academic probation.

Old Dominion University is committed to assisting students in achieving their academic goals. Therefore, freshman students on academic warning are required to participate in a success program sponsored by University College in their next semester of attendance. Failure to complete the requirements of the success program will result in cancellation of registration for the next fall or spring semester.

Students, sophomore level and above, are encouraged to participate in University-sponsored activities designed to help improve the student's status.

ACADEMIC PROBATION

A student is placed on academic probation when the student's cumulative GPA falls below 2.0 for two consecutive semesters of attendance, including summer sessions. Students on academic probation are expected to improve their cumulative GPA by achieving a semester GPA of 2.0 or better during each semester of attendance. A student who achieves a cumulative GPA of at least 2.0 is removed from academic probation and placed in good academic standing.

Students on academic probation are **required** to meet regularly with their advisor during their next semester of attendance. A student on academic probation **may not** enroll in more than 14 credits per semester of attendance (no more than six credits in the summer sessions, and no more than one course in any single summer session).

Failure to achieve a 2.0 semester GPA at the end of a fall or spring semester while on probation results in academic suspension.

Students who receive a 0.0 GPA for two consecutive semesters (fall, spring) will be suspended immediately.

ACADEMIC SUSPENSION

Academic suspension occurs when a student on academic probation does not maintain a 2.0 SEMESTER GPA. Students who are suspended will follow the matrix below to determine how long they must separate from the University.

First Academic Suspension:

Suspended	Must Separate from ODU for:
Fall term	Spring term
Spring term	Summer and Fall terms

If this is the SECOND suspension:

Student is **no longer eligible to attend** Old Dominion University.

Students do have options as a student on Academic Suspension:

Option #1 - Appeal the Suspension

The Suspension Appeal process is provided for students who can provide **valid documentation** of extenuating circumstances which contributed to their suspension. Only students with extenuating circumstances (death in family, medical complications or chronic conditions, personal or family emergency, overwhelming work schedules, dorm mate conflict, relationship conflict or other uncontrollable circumstances) will be accepted for review by the Appeals Committee. In addition, students must provide a plan for how the extraordinary event(s) have been resolved and provide proof to the Appeals Committee that further difficulties will not occur if the student is allowed to continue coursework in the next semester. Decisions by the appeals committee are final.

NOTE: Students without documentation will not be able to appeal their suspension.

Suspension Appeal Application information is found at their website:
http://www.odu.edu/continuance

Suspension appeal guidelines are found on the paper version.

Option #2 - Accept the Suspension

For more information, contact the Office of Continuance, 757-683-3773.

ADJUSTED RESIDENT CREDIT OPTION (ARC)

Any undergraduate student who leaves Old Dominion University for at least one calendar year will be given the option of requesting a grade-point-average status equivalent to that of a student admitted as a transfer student according to the following conditions and regulations.

The following conditions governing eligibility will apply:

1. Prior to the one-year's absence, the student must have a grade point average less than 2.00. Upon returning to the University, the student must earn a minimum of 30 credits at Old Dominion University to be eligible for a degree. This must include 12 hours of upper-level courses in the department of the declared major.

2. The student must have separated from the institution for at least one calendar year. A term in which the student received W grades cannot be counted as part of the calendar year separation.

3. Upon return, a full-time student must have attained a 2.00 grade point average for all work attempted in the first semester or upon completion of the first 12 semester hours, if part-time. Non-degree credit work shall not be counted toward fulfillment of this requirement.

4. Upon satisfying the above requirements, the student must submit the application for Adjusted Resident Credit.

5. This option will be available only once during the student's career at Old Dominion University and must be elected by the end of the second semester following qualifications as described in paragraph 3 above. (In all cases, the Adjusted Resident Credit option must be elected and the student's record adjusted prior to graduation.) Upon written petition by the student and recommendation of the department chair, waivers of the time limit to elect Adjusted Resident Credit and the requirement that students have less than a 2.00 grade point average can be made by the dean of the college in which the student's major program resides.

6. Consultation and approval by the appropriate department and approval of the dean(s) of the college(s) in which the student's major program resides will be required. Once an application is approved and submitted, the student will not be permitted to change status for the purpose of computing the cumulative grade point average or application of credit toward graduation.

7. All grades received at the University will be part of the individual's official transcript and will be used to determine honor awards. However, computation of a new grade point average for graduation and continuance will be based on work performed subsequent to reinstatement.

8. Under this option: (1) eligible students will receive degree credit only for those courses in which grades of C (2.00) or better were earned prior to readmission; (2) likewise, hours attempted for courses in which grades of D or F were received prior to readmission will not be considered in computing the student's new cumulative grade point average; and (3) grade points earned for any course completed prior to readmission will not count in determining the student's new cumulative grade point average.

9. In cases of dual jurisdiction, University continuance regulations will prevail.

Students wishing to avail themselves of this policy may receive procedural information from the Office of Registration and Records.

GRADE FORGIVENESS

When students retake courses, each time the grade becomes part of the transcript and the grade point average. The Grade Forgiveness Policy (GFP) makes it possible for a student to retake a course with only the repeated grade computed in the grade point average. The following conditions apply:

1. The GFP applies to all Old Dominion undergraduate courses.
2. The GFP cannot be used once the student has graduated.
3. The GFP applies only if the course grade is C-, D+, D, D-, F, and WF.
4. An individual course can be retaken no more than once using the GFP. Grade forgiveness is automatically applied only to the first repeat of a course with an original grade of C- or less, regardless of how many times the student may elect to repeat the course for other reasons. Any grade received for a subsequent retaking of the course will be included in the grade point average.
5. A student may use grade forgiveness one time per course but only for five courses during the student's enrollment at the University. Students who have already used grade forgiveness, no matter how many times, will be able to use grade forgiveness an additional total of five times beginning fall of 2009. Once the five-time limit has been reached, grade forgiveness will not be applied, and all attempts at taking a course will be calculated into the student's attempted hours and GPA.
6. Student transcripts will continue to list all courses taken and the grades received; however, under the GFP, the grade point average includes only the repeated grade (even if it is worse). Academic suspensions will not be removed from student transcripts and Dean's list status will not be added after use of the GFP.
7. An enhanced grade point average using the GFP determines eligibility for continuance and graduation but not for graduation with honors or Dean's list.
8. Students may elect to use both the GFP and the Adjusted Resident Credit (ARC) policy. However, students cannot use the GFP for individual courses for which they have already used the ARC policy.

DEPARTMENTAL POLICIES ON ACADEMIC CONTINUANCE

In addition to continuance regulations administered through the University, the Department of Electrical and Computer Engineering has established continuance regulation policies based on a student's Major GPA.

A. Probation/Suspension Policies

Courses in the electrical engineering major are defined as courses with an ECE prefix; courses in the computer engineering major are defined as courses with an ECE and CS prefix.

1. Students will be placed on departmental academic probation whenever his or her grade point average in the major (Major GPA) falls below 2.00 after six or more hours are completed.

2. Students will be suspended indefinitely from the department if his or her record shows either of the following:

   a. A deficiency of more than 9 quality points below that required to maintain 2.00 cumulative average in the major. This rule applies to students who have attempted fewer than 35 hours in the major.

   b. A deficiency of more than 6 quality points below that required to maintain 2.00 cumulative average in the major. This rule applies to students who have attempted 35 hours or more in the major. (See p. 33 for an explanation and computation of deficiency points.)

Appeals of departmental suspension are in order if extenuating circumstances warrant. Appeals are to be made in writing to the Department Chair and will be considered by the department faculty.

B. Minimum "C" Grade Policy

In order to maintain the standards of the undergraduate programs within the Department of Electrical and Computer Engineering, a minimum grade of "C" or better is required for all sophomore-level classes (200-level), ECE 200, 201, 202, 241, and 287. As our undergraduate program in Computer Engineering is offered in conjunction with the Computer Science Department, we also adhere to their "C" grade policy for all Computer Engineering students. The Computer Science Department requires a minimum grade of "C" or better in all the major courses, CS 150, 250, 361, and 350. For both programs, EE and CpE, this means that the minimum grade of "C" must be obtained prior to taking the next course in the sequence. **A grade of "C-" does not satisfy the requirement for a "C" grade.**

APPLICATION FOR GRADUATION

ALL STUDENTS ARE REQUIRED TO APPLY TO GRADUATE. Students who have completed 102 credit hours, will be reminded vie email to their ODU email account that they are eligible to apply for graduation. First, students must print out a copy of their degree evaluation, DegreeWorks, from Leo Online and review it with the Undergraduate Coordinator to be sure they are ready to graduate. Applications are available on the Graduation Requirements and Guidelines web site at http://www.odu.edu/academics/graduation-commencement/graduation. If a student is completing a minor, they must also meet with the advisor of the minor department to be sure the minor requirements have been met.

Students are responsible for monitoring their own progress toward degree completion and for meeting all graduation requirements.

CHECK-LIST for GRADUATION

The following is a list of requirements for your Bachelor of Science degree in Electrical or Computer Engineering that must be completed. Check them off as you do each one.

- Pass the Writing Sample Placement Test. (Testing Center, 683-3699)
- Meet the Foreign Language requirements. (Admissions Office, 683-3685)
- Ensure that all transcripts of previous or additional college course work have been received by the Office of Admissions and all your transfer credits appear on your record in DegreeWorks. (If applicable)
- Meet Writing Proficiency requirements: a grade of "C" or above in ENGL 110, the second composition, either ENGL 211C or ENGL 231C, and the ECE Senior Design writing-intensive course, ECE 484W for Computer Engineering students or ECE 485W for Electrical Engineering students. (Writing Center, 683-4013)
- Submit the Application for Graduation.
- Complete the Senior Satisfaction Survey. Approximately 8 weeks prior to the graduation date, students will receive the link to do the Senior Satisfaction Survey.
- Attend the Senior Exit Interview session with the Chair of the Department of Electrical and Computer Engineering and complete the Exit Interview Survey online at our website. The link will be provided to Exit Interview participants in their final semester.
- Ensure you hold a major, minor, and overall grade point average of 2.0 or better.

STUDENT ORGANIZATIONS

AMERICAN SOCIETY OF NAVAL ENGINEERS

The American Society of Naval Engineers (ASNE) is the second oldest professional society in the country. The objectives of ASNE at Old Dominion are to advance the knowledge and practice of naval engineering. We do this by enhancing the professionalism and well-being of members through projects and networking to promote naval engineering as a career field. In addition, we work with the active local Tidewater Chapter of the national organization to fund student projects, research, and scholarships.

ETA KAPPA NU

Eta Kappa Nu, Zeta Upsilon chapter, is the national electrical engineering honor society. Outstanding students are elected to Eta Kappa Nu from the junior and senior classes. Eligibility depends on marked ability, as evidenced by scholarship, personal character, useful voluntary services, and distinguished accomplishments.

Activities sponsored by Eta Kappa Nu include Engineering Career Day during the fall semester, free tutoring services, and presentation of the Outstanding Sophomore Award to the sophomore electrical or computer engineering student with the highest grade point average and best recommendations from ECE faculty.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

The Institute of Electrical and Electronics Engineers is the world's largest technical professional society with over 300,000 members. IEEE is directed toward the advancement of the theory and practice of electrical engineering, electronics, computer engineering and the related branches of engineering and sciences. The ODU student branch offers educational films and speakers, availability to obtain discount computers, and many other activities to enhance one's future.

NATIONAL SOCIETY OF BLACK ENGINEERS (NSBE)

The National Society of Black Engineers is a student-run, non-profit organization whose mission is to recruit, retain and successfully graduate its members. The organization acts as a vehicle promoting unity through programs that encourage academic excellence, personal growth and professional development, thereby increasing the number of ethnic minority professionals who are committed to the development of the minority community.

SOCIETY OF HISPANIC PROFESSIONAL ENGINEERS

The Society of Hispanic Professional Engineers (SHPE) was founded in Los Angeles, California, in 1974 by a group of engineers employed by the city of Los Angeles. Their objective was to form a national organization of professional engineers to serve as role models in the Hispanic community. Today, SHPE enjoys a strong independent network of over 200 student chapters throughout the nation. The student chapter at ODU was founded in 2004 and it is open to Hispanic and non-Hispanic

students enrolled in any academic program at ODU, specially, students pursuing Science and Engineering degrees.

SOCIETY OF WOMEN ENGINEERS (SWE)

The Society of Women Engineers consists of nearly 100 professional sections, 300 student sections, and members-at-large in all engineering and technology disciplines, making SWE a preeminent not-for-profit organization respected among the engineering community and technical societies. The specific objectives of the society are: to inform women, their parents, counselors, and the general public of the qualifications and achievements of women engineers and the opportunities open to them; to assist women engineers in readying themselves for a return as an active work professional; to serve as a center of information on women in engineering and to encourage women engineers to attain high levels of education and professional achievement.

TAU BETA PI

Tau Beta Pi, the second oldest honor society, was founded in 1885 to recognize distinguished scholarship and exemplary character in engineering students, and to "foster a spirit of liberal culture." To be invited to join Tau Beta Pi, a student must display exemplary character and be in the top eighth of the junior class or the top fifth of the senior class of the College of Engineering and Technology. The Virginia Gamma chapter at Old Dominion University meets twice a month and performs several service projects such as offering a scholarship for juniors in engineering and providing proctors for the high school "JETS" and "TEAMS" test.

THETA TAU

Theta Tau is a professional engineering fraternity. The purpose of Theta Tau is to develop and maintain a high standard of professional interest among its members and to unite them in a strong bond of fraternal fellowship. It blends desirable features of general fraternities, technical societies, and honor societies to prepare its student members for the engineering profession.

CURRICULUM WORKSHEETS

B. S. ELECTRICAL ENGINEERING CURRICULUM

FRESHMAN FIRST SEMESTER			Term	Grade	Pre-/Co-requisites
ENGN 110	Engineering & Tech	2			P-MATH 162M
CHEM 121N	Chemistry I	3			P-MATH 102M
CHEM 122N	Chemistry I Lab	1			P-MATH 102M
MATH 211	Calculus I	4			P-MATH 163
ENGL 110C	English Comp I	3			P-pass Placement test
COMM 101R	Public Speaking	3			
FRESHMAN SECOND SEMESTER					
ECE 111	Inform. Literacy for ECE	2			P-ENGN 110
CHEM 123N	Chemistry II	3			P-CHEM 121N/122N
MATH 212	Calculus II	4			P-MATH 211
CS 150	Intro to Programming	4			P-MATH 102M
PHYS 231N	University Physics	4			P/C-MATH 211
SOPHOMORE FIRST SEMESTER					
MATH 307(280)	Differential Equations	3			P-MATH 212
ECE 201	Circuit Analysis I	3			P/C-MATH 307, PHYS 232N
PHYS 232N	University Physics	4			P-PHYS 231N
ECE 241	Fund. Comp. Engn.	4			P-CS 150, MATH 211
GEN ED	History	3			
SOPHOMORE SECOND SEMESTER					
ECE 202	Circuit Analysis II	3			P-ECE 201, MATH 307
ECE 287	Circuit Laboratory	2			P-ECE 201, CS 150, C-ECE 202
Engr	Nonmajor Engr elec	3			
MATH 312(285)	Calculus III	4			P-MATH 212
GEN ED	Human Creativity	3			
JUNIOR FIRST SEMESTER					
ECE 302	Linear System Analysis	3			P-ECE 202
ECE 303	Electrical Power	3			P-ECE 201
ECE 313	Electronic Circuits	4			P-ECE 202, P/C-241
ECE 332	Micro. Materials	3			P-ECE 202
ECE 381	Disc.-time Signal Proc.	3			P-ECE 202
JUNIOR SECOND SEMESTER					
ECE 304	Prob. Stat. & Reliab.	3			P-MATH 212
ECE 387	Microelec. Fabric. Lab	3			P-ECE 332
ECE 323	Electromagnetics	3			P-ECE 202
ENGL 231C	Technical Writing	3			P-ENGL 110C
GEN ED	Literature	3			
SENIOR FIRST SEMESTER					
ECE 485W	EE Design I	3			P-ECE 302,313, P/C-ECE 303, 304, 323, 332, 381
ECE 486	Prep ECE Design II	2			P/C-ECE 485W
ECE 4XX	Technical Elective 1	3			
ECE 4XX	Technical Elective 2	3			
ENMA 480	Engineering Ethics	3			P-Junior Standing
Upper Division General Education		3			
SENIOR SECOND SEMESTER					
ECE 487	ECE Design II	2			P-ECE 485W
ECE 4XX	Technical Elective 3	3			
ECE 4XX	Technical Elective 4	3			
Upper Division General Education		3			
GEN ED	Human Behavior	3			

Minor: _____ Minor – minimum of 12 hours

B. S. COMPUTER ENGINEERING CURRICULUM

FRESHMAN FIRST SEMESTER			Term	Grade	Pre-/Co-requisites
ENGN 110	Engineering & Tech	2			P-MATH 162M
CHEM 121N	Chemistry I	3			P-MATH 102M
CHEM 122N	Chemistry I Lab	1			P-MATH 102M
MATH 211	Calculus I	4			P-MATH 163
ENGL 110C	English Comp I	3			P-pass Placement test
COMM 101R	Public Speaking	3			
FRESHMAN SECOND SEMESTER					
ECE 111	Inform. Literacy for ECE	2			P-ENGN 110
CHEM 123N	Chemistry II	3			P-CHEM 121N/122N
MATH 212	Calculus II	4			P-MATH 211
CS 150	Intro to Programming	4			P-MATH 102M
PHYS 231N	University Physics	4			P/C-MATH 211
SOPHOMORE FIRST SEMESTER					
MATH 307(280)	Differential Equations	3			P-MATH 212
ECE 201	Circuit Analysis I	3			P/C-MATH 307, PHYS 232N
ECE 241	Fund. Comp. Engn.	4			P-CS 150, MATH 211
PHYS 232N	University Physics	4			P-PHYS 231N
GEN ED	Literature	3			
SOPHOMORE SECOND SEMESTER					
ECE 202	Circuit Analysis II	3			P-ECE 201, MATH 307
ECE 287	Circuit Laboratory	2			P-ECE 201, CS 150, C-ECE 202
CS 381	Discrete Structures	3			P-MATH 163, CS 150
CS 250	Prob Solving & Prog.	4			P-CS 150, C-CS 252
CS 252	Intro to UNIX	1			C-CS 250
ENGL 231C	Technical Writing	3			P-ENGL 110C
JUNIOR FIRST SEMESTER					
ECE 302	Linear System Analysis	3			P-ECE 202
ECE 313	Electronic Circuits	4			P-ECE 202, P/C-241
ECE 341	Digital System Design	3			P-ECE 241
CS 361	Adv. Data Structures	3			P-CS 250, CS 252
ECE 381	Disc.-time Signal Proc.	3			P-ECE 202
JUNIOR SECOND SEMESTER					
ECE 304	Prob. Stat. & Reliab.	3			P-MATH 212
ECE 346	Microcontrollers	3			P-ECE 241
CS 350	Software Engineering	3			P-CS 361
ECE 3XX	Technical Elective 1	3			
GEN ED	Human Creativity	3			
SENIOR FIRST SEMESTER					
ECE 484W	CMEN Design I	3			P/C-ECE 313,381 P-ECE 302,341,346,C-ECE 443
ECE 486	Prep ECE Design II	2			P/C-ECE 484W
ECE 443	Computer Architecture	3			P-ECE 341, 346, P/C-ECE 304, 484W
ECE 4XX	Technical Elective 2	3			
ENMA 480	Engineering Ethics	3			P-Junior Standing
GEN ED	History	3			
SENIOR SECOND SEMESTER					
ECE 487	ECE Design II	2			P-ECE 486
CS 471	Operating Systems	3			P-CS 361, ECE 443
ECE 4XX	Technical Elective 3	3			
ECE 4XX	Technical Elective 4	3			
GEN ED	Human Behavior	3			

Minor: This program automatically satisfies a minor in *Computer Science*.

B.S. ELECTRICAL ENGR., Second Major in COMPUTER ENGR./
B.S. COMPUTER ENGR., Second Major in ELECTRICAL ENGR.

FRESHMAN FIRST SEMESTER			Term	Grade	Pre-/Co-requisites
ENGN 110	Engineering & Tech	2			P-MATH 162M
CHEM 121N	Chemistry I	3			P-MATH 102M
CHEM 121N	Chemistry I Lab	1			P-MATH 102M
MATH 211	Calculus I	4			P-MATH 163
ENGL 110C	English Comp I	3			P-pass Placement test
COMM 101R	Public Speaking	3			
FRESHMAN SECOND SEMESTER					
ECE 111	Inform. Literacy for ECE	2			P-ENGN 110
CHEM 123N	Chemistry II	3			P-CHEM 121N/122N
MATH 212	Calculus II	4			P-MATH 211
CS 150	Intro to Programming	4			P-MATH 102M
PHYS 231N	University Physics	4			P/C-MATH 211
SOPHOMORE FIRST SEMESTER					
MATH 307(280)	Differential Equations	3			P-MATH 212
ECE 201	Circuit Analysis I	3			P/C-MATH 307, PHYS 232N
PHYS 232N	University Physics	4			P-PHYS 231N
CS 381	Discrete Structures	3			P-MATH 163, CS 150
GEN ED	Literature	3			
SOPHOMORE SECOND SEMESTER					
ECE 202	Circuit Analysis II	3			P-ECE 201, MATH 307
ECE 287	Circuit Laboratory	2			P-ECE 201, C-ECE 202
ECE 241	Fund. Comp. Engn.	4			P-CS 150
CS 250	Prob Solving & Prog.	4			P-CS 150, C-CS 252
CS 252	Intro to UNIX	1			C-CS 250
ENGL 231C	Technical Writing	3			P-ENGL 110C
JUNIOR FIRST SEMESTER					
ECE 302	Linear System Analysis	3			P-ECE 202
ECE 303	Electrical Power	3			P-ECE 201
ECE 313	Electronic Circuits	4			P-ECE 202, P/C-241
ECE 341	Digital System Design	3			P-ECE 241
MATH 312 (285)	Calculus III	4			P-MATH 212
CS 361	Adv. Data Structures	3			P-CS 250, CS 252
ENMA 480	Engineering Ethics	3			P-Junior Standing
JUNIOR SECOND SEMESTER					
ECE 304	Prob. Stat. & Reliab.	3			P-MATH 212
ECE 323	Electromagnetics	3			P-ECE 202
ECE 346	Microcontrollers	3			P-ECE 241
ECE 381	Disc.-time Signal Proc.	3			P-ECE 202
CS 350	Software Engineering	3			P-CS 361
GEN ED	Human Creativity	3			
SENIOR FIRST SEMESTER					
ECE 484W	CMEN Design I	3			P/C-ECE 313,381 P-ECE 302,341,346,C-ECE 443
ECE 485W	EE Design I	3			P-ECE 302,313, P/C-ECE 303, 304, 323, 332, 381
ECE 486	Prep ECE Design II	2			P/C-ECE 484W, 485W
ECE 443	Computer Architecture	3			P-ECE 341, 346, P/C-ECE 304, 489W
ECE 332	Micro. Materials	3			P-ECE 202
GEN ED	History	3			
SENIOR SECOND SEMESTER					
ECE 487	ECE Design II	2			P-ECE 486
CS 471	Operating Systems	3			P-CS 361, ECE 443
ECE 387	Microelec. Fabric. Lab	3			P-ECE 332
Tech Elec	ECE tech elective	3			
GEN ED	Human Behavior	3			

BS COMPUTER ENGINEERING and BS COMPUTER SCIENCE

			Term	Grade	Pre-/Co-requisites
FIRST YEAR FIRST SEMESTER					
ENGN 110	Engineering & Tech	2			P-MATH 162M
CS 110	Intro to CS	1			
MATH 211	Calculus I	4			P-MATH 163
ENGL 110C	English Comp I	3			P-pass Placement test
COMM 101R	Public Speaking	3			
FIRST YEAR SECOND SEMESTER					
ECE 111	Inform. Literacy for ECE	2			P-ENGN 110
MATH 212	Calculus II	4			P-MATH 211
CS 150	Intro to Programming	4			P-MATH 102M
PHYS 231N	University Physics	4			P/C-MATH 211
GEN ED	Literature	3			
SECOND YEAR FIRST SEMESTER					
MATH 307(280)	Differential Equations	3			P-MATH 212
CHEM 121N	Chemistry I	3			P-MATH 102M
CHEM 122N	Chemistry I Lab	1			P-MATH 102M
ECE 201	Circuit Analysis I	3			P/C-MATH 307, PHYS 232N
PHYS 232N	University Physics	4			P-PHYS 231N
SECOND YEAR SECOND SEMESTER					
CHEM 123N	Chemistry II	3			P-CHEM 121N/122N
ECE 202	Circuit Analysis II	3			P-ECE 201, MATH 307
ECE 287	Circuit Laboratory	2			P-ECE 201, CS 150, C-ECE 202
CS 250	Prob Solving & Prog.	4			P-CS 150, C-CS 252
CS 252	Intro to UNIX	1			C-CS 250
CS 381	Intro Discrete Structure	3			P-MATH 163, CS 150
THIRD YEAR FIRST SEMESTER					
ECE 241	Fund. Comp. Engn.	4			P-CS 150
CS 330	Obj. Orient. Progr.Dsgn.	3			P-CS 250, CS 252, MATH 163
CS 300T	Computers in Society	3			P-ENGL 110C, COMM 101R
ENGL 231C	Technical Writing	3			P-ENGL 110C
GEN ED	Human Creativity	3			
THIRD YEAR SECOND SEMESTER					
ECE 302	Linear System Analysis	3			P-ECE 202
ECE 313	Electronic Circuits	4			P-ECE 202, P/C-241, C-ECE 382
ECE 341	Digital System Design	3			P-ECE 241
ECE 381	Disc.-Time Signal Proc.	3			P-ECE 202
GEN ED	History	3			
CS 361	Adv. Data Structures	3			P-CS 250, CS 252
CS 390	Intro. Theor.Comp.Sci.	3			P-CS 250, CS 381
FOURTH YEAR FIRST SEMESTER					
MATH 316	Linear Algebra	3			P-MATH 212
ECE 304	Prob. Stat. & Reliab.	3			P-MATH 212
CS 350	Software Engineering	3			P-CS 361
ECE	Technical Elective 1	3			
ENMA 480	Engineering Ethics	3			P-Junior Standing
FOURTH YEAR SECOND SEMESTER					
ECE 346	Microcontrollers	3			P-ECE 241
ENGL 231C	Technical Writing	3			P-ENGL 110C
CS 417	Comp. Methods	3			P-CS 250, MATH 316
CS	Technical Elective 1	3			
CS 410	Prof. Workforce Dev. I	3			P-CS 300, CS 350
FIFTH YEAR FIRST SEMESTER					
ECE 484W	CMEN Design I	3			P/C-ECE 313,381,P-ECE 302,341,346,C-ECE 443
ECE 486	Prep ECE Design II	2			P/C-ECE 484W
ECE 443	Computer Architecture	3			P-ECE 341, 346, P/C-ECE 304, 484W
CS 411W	Prof. Workforce Dev. II	3			P-CS 410
CS	Technical Elective 2	3			
GEN ED	Human Behavior	3			
FIFTH YEAR SECOND SEMESTER					
ECE 487	ECE Design II	2			P-ECE 486
CS 471	Operating Systems	3			P-CS 361, ECE 443
CS	Technical Elective 3	3			
CS	Technical Elective 4	3			
ECE	Technical Elective 2	3			

BS ELECTRICAL ENGINEERING and BS PHYSICS

FIRST YEAR FIRST SEMESTER			Term	Grade	Pre-/Co-requisites
ENGN 110	Engineering & Tech	2			P-MATH 162M
CHEM 121N	Chemistry I	3			P-MATH 102M
CHEM 122N	Chemistry Lab	1			P-MATH 102M
MATH 211	Calculus I	4			P-MATH 163
ENGL 110C	English Comp I	3			P-pass Placement test
PHYS 231N	University Physics	4			P/C-MATH 211
FIRST YEAR SECOND SEMESTER					
ECE 111	Inform. Literacy for ECE	2			P-ENGN 110
CHEM 123N	Chemistry II	3			P-CHEM 121N, 122N
CHEM 124N	Chemistry II Lab	1			P-CHEM 121N, 122N
MATH 212	Calculus II	4			P-MATH 211
CS 150	Intro to Programming	4			P-MATH 102M
PHYS 232N	University Physics	4			P-PHYS 231N
SECOND YEAR FIRST SEMESTER					
MATH 307(280)	Differential Equations	3			P-MATH 212
ECE 201	Circuit Analysis I	3			P/C-MATH 307U, PHYS 232N
PHYS 323	Modern Physics	3			P-PHYS 232N
ENGL 231C	Technical Writing	3			P-ENGL 110C
COMM 101R	Public Speaking	3			
SECOND YEAR SECOND SEMESTER					
ECE 202	Circuit Analysis II	3			P-ECE 201, MATH 307U
ECE 287	Circuit Laboratory	2			P-ECE 201, CS 150, C-ECE 202
ECE 241	Fund. Comp. Engn.	4			P-CS 150
PHYS 319	Analytical Mechanics	3			P/C-MATH 307U, PHYS 232N
MATH 312(285)	Calculus III	4			P-MATH 212
THIRD YEAR FIRST SEMESTER					
ECE 302	Linear System Analysis	3			P-ECE 202
ECE 303	Electrical Power	3			P-ECE 201
ECE 313	Electronic Circuits	4			P-ECE 202, P/C-241
ECE 332	Micro. Materials	3			P-ECE 202
ECE 381	Intro Discr.-Time Sig Proc.	3			P-ECE 202
PHYS 425	Electromagnetism I	3			P/C-MATH 312, PHYS 232N
THIRD YEAR SECOND SEMESTER					
ECE 304	Prob. Stat. & Reliab.	3			P-MATH 212
ECE 387	Microelec. Fabric. Lab	3			P-ECE 332
PHYS 453/ECE 323	Electromagnetism II/Emag	3			P-PHYS 320, MATH 312, ECE 202
ECE 4XX	Technical Elective 1	3			
GEN ED	Human Creativity	3			
FOURTH YEAR FIRST SEMESTER					
ECE 485W	EE Design I	3			P-ECE 302,313, P/C-ECE 303, 304, 323, 332, 381
ECE 486	Prep ECE Design II	2			C-ECE 485W
PHYS 452	Intro Quantum Mech.	3			P-PHYS 319, PHYS 323
PHYS 4XX	411, 415, 416, or 417	3			
GEN ED	History	3			
FOURTH YEAR SECOND SEMESTER					
ECE 487	ECE Design II	2			P-ECE 486
PHYS 413	Experimental Physics	3			P-PHYS 323
PHYS 456	Intermed Quantum Mech.	3			P-PHYS 323, PHYS 352
ENMA 480	Engineering Ethics	3			P-Junior Standing
FIFTH YEAR FIRST SEMESTER					
PHYS 499W	Physics Senior Thesis	3			
GEN ED	Human Behavior	3			
GEN ED	Literature	3			
ECE 4XX	Technical Elective 2	3			
FIFTH YEAR SECOND SEMESTER					
MATH Elective	316, 401, 421, or 422	3			
PHYS 420	Computational Physics	3			P-PHYS 232N, MATH 212
ECE 4XX	Technical Elective 3	3			
PHYS 454	Thermal & Stat. Physics	3			P-PHYS 319, PHYS 323

CONTACT INFORMATION

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University

Admissions Office http://www.odu.edu/admissionsoffice	Rollins 108 admit@odu.edu	683-3685
Bookstore http://www.odu.edu/bookstore	University Village	683-3407
Career Management Center http://ww2.odu.edu/ao/cmc/index.php	2202 Webb Center cmc@odu.edu	683-4388
Cooperative Education Engineering Branch Satellite Office http://ww2.odu.edu/ao/cmc/en/index.shtml	KAUF 132	683-5341
Financial Aid Office http://www.odu.edu//finaidoffice	Rollins 121	683-3683
Office of the Registrar http://www.odu.edu//registrar	Rollins 116 register@odu.edu	683-4425
Experiential Learning and Testing Center http://uc.odu.edu/elt/	Student Success Center	683-3697
Writing Center http://al.odu.edu/writingcenter/	Student Success Center wcinfo@odu.edu	683-3699

APPENDIX A

DEPARTMENT FACULTY

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Professor of Electrical and Computer Engineering

B.S., University of Heidelberg (Germany), M.S., Purdue University, Ph.D., University of Stuttgart and Max-Planck Institute of Solid State Research (Stuttgart, Germany). Microelectronics, Semiconductor Device Processing, Integrated Circuit Fabrication Technology, IC Process Integration, Design for Yield, Yield Enhancement, Statistical Process Control, Nanotechnology and Nanoelectronics, Atomic Layer Deposition (ALD) Technology, Gate Stack Engineering, High-k Dielectrics for advanced gate stacks in CMOS and DRAM capacitor applications in sub 65nm feature size integrated circuits, BEOL Integration of low-k interconnect isolation materials with Cu dual Damascene metallization, Silicon-on-Insulator (SOI) Technology, Thin Film Materials Science.

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Associate Professor of Electrical and Computer Engineering

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Computer Vision, Image Processing, Intelligent Systems, and Statistical Analysis

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B.Tech., Indian Institute of Technology, Kharagpur; M.S., Ph.D. Texas Tech University. Atmospheric pressure plasmas, electrical discharge modeling, analog VLSI.

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B.S., University of Miami-Coral Gables (Florida); M.S., Ph.D., University of Illinois-Urbana. Ultrafast lasers, electronic materials, fabrication of thin films, laser-material processing, and surface processing.

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B.S., M.S., Indian Institute of Technology; Ph.D., Arizona State University. Physics of ultrafast phenomena and monte carlo modeling for devices applications.

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Plasma medicine, pulsed power, bioelectrics.

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B.S., M.S., and Ph.D. degrees in Electrical Engineering from The Pennsylvania State University. Brain-Computer Interfaces, digital signal and image processing, machine learning, evolutionary algorithms, artificial neural networks, and biomedical and musical applications.

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B.S., M.S., Ph.D., University of Nantes (France). Solar cells, inorganic semiconductors, fabrication of thin films and devices, materials characterization.

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B.S., M.S. Technical University Berlin (Germany); Ph.D. Humboldt University Berlin (Germany). Cardiac Arrhythmias, Biomedical Imaging, Image Processing.

APPENDIX B

DEPARTMENTAL FACILITIES

The Department of Electrical and Computer Engineering operates 4 instructional laboratories and 26 instructional/research laboratories.

Instructional Laboratories

KDH, Room 202	Circuits and Basic Electronics Laboratory
KDH, Room 222	Microcomputer Design Laboratory
KDH, Room 228	Student Resource Laboratory
KDH, Room 229/230	Computer Projects Laboratory

Instruction and Research Laboratories

KDH, Room 200	Medical Imaging, Diagnosis, and Analysis Laboratory – *Drs. McKenzie & Li*
KDH, Room 232	Cybersecurity, Communication & Networking Innovation – *Drs. Xin & Popescu*
KDH, Room 233	Systems Research Laboratory –*Drs. Gonzalez & Gray*
KDH, Room 234	Advanced Signal Processing in Engineering and Neuroscience (ASPEN) Laboratory –*Dr. Krusienski*
KDH, Room 235	Microelectronics Research Laboratory –*Dr. Marsillac*
KDH, Room 250	Photovoltaic Laboratory –*Dr. Marsillac*
IRP 1, Room 202	Vision Laboratory -*Dr. Iftekharuddin*
IRP 2, Room 369	Cardiac Electrophysiology Laboratory –*Dr. Zemlin*
PERI, Room 100	Electric Drives Laboratory –Dr. Xiao
PERI, Rooms 101,104	Applied Plasma Technology Laboratory –*Dr. Laroussi*
PERI, Room 102	Plasma Biomed Applications Laboratory –*Dr. Laroussi*
PERI, Room 105	Digital and Computer Systems Research Lab (DaCS)–*Dr. Belfore*
ARC, Room L106	Thin Films Fabrication
ARC, Room L108	Scanning Electron Microscopy
ARC, Room L110	High Resolution Transmission Electron Microscopy
ARC, Room L114	Pulsed Laser Deposition –*Dr. Elsayed-Ali*
ARC, Room L115	Transmission Electron Microscopy and Atomic Force Microscopy
ARC, Room L117	Thin Film Fabrication and X-ray Diffraction
ARC, Room L204	SIMS
ARC, Room L206	Femtosecond Laser –*Dr. Elsayed-Ali*
ARC, Room L208A	Multichannel Ion Lab –*Dr. Elsayed-Ali*
ARC, Rooms L212, L214	Atomic Layer Deposition –*Dr. Baumgart*
ARC, Room L308	Photovoltaics –*Dr. Marsillac*
ARC, Room L314	Thin Films Tech –*Dr. Namkoong*

APPENDIX C

TRANSFER AGREEMENTS

On the following pages are the specific transfer agreements between Old Dominion University and the Virginia Community College System (VCCS) and the 3+2 double degree program with Longwood University.

Virginia Community College System (VCCS)
- AS Engineering – Emphasis Electrical Engineering
- AS Engineering – Emphasis Computer Engineering

Longwood University
- 3+2 program – BS Physics, BS Electrical Engineering
- 3+2 program – BS Physics, BS Computer Engineering

General Education Transfer Equivalents
- ODU – VCCS

2013 - 2014 Old Dominion University Catalog Bachelor of Science in Electrical Engineering (with VCCS Equivalencies)

*Sample four year curriculum with a suggested ordering of courses. Students may re-order as needed. * indicates not automatically waived with transferrable associates degree, C or better required for transfer.*

YEAR 1 - FRESHMAN (33 CREDITS)

FALL SEMESTER (16 credits)		**SPRING SEMESTER (17 credits)**	
General Education Coursework:	VCCS Equivalency:	General Education Coursework:	VCCS Equivalency:
ENGN 110	EGR 120*	ECE 111	Dept. approval upon admission*
CHEM 121N/122N	CHM 111*	CHEM 123N	CHM 112*
MATH 211	MTH 173 or 273*	MATH 212	MTH 174 or 274*
ENGL 110C (C or better required)	ENG 111*	CS 150	CSC 201, EGR 125 or EGR 126* See Monarch Transfermation to ensure your institution's course will transfer.
COMM 101R	CST 100, 105 or 110*	PHYS 231N	PHY 231 or 241*

YEAR 2 - SOPHOMORE (32 CREDITS)

FALL SEMESTER (17 credits)		**SPRING SEMESTER (15 credits)**	
General Education Coursework:	VCCS Equivalency:	General Education Coursework:	VCCS Equivalency:
MATH 307	MTH 279 or 291*	ECE 202	EGR 261 or 272*
ECE 201	EGR 260 or 271*	ECE 287	EGR 262*
ECE 241	EGR 277*	Literature	See Transfer Guide
PHYS 232N	PHY 232 or 242*	MATH 312	MTH 275 or 277*
Interpreting the Past	See Transfer Guide	Human Creativity	See Transfer Guide

YEAR 3 - JUNIOR (31 CREDITS)

FALL SEMESTER (16 credits)		**SPRING SEMESTER (15 credits)**	
Major Coursework:	VCCS Equivalency:	Major Coursework:	VCCS Equivalency:
ECE 302		ECE 304	
ECE 303		ECE 387	
ECE 313		ECE 323	
ECE 332		ENGL 231C (C or better required)	
ECE 381		Non-major Engineering Elective	

YEAR 4 - SENIOR (31 CREDITS)

FALL SEMESTER (17 credits)		**SPRING SEMESTER (14 credits)**	
Major Coursework:	VCCS Equivalency:	Major Coursework:	VCCS Equivalency:
ECE 485W (C or better required)		ECE 487	
ECE 486		ECE Technical Elective	

ECE Technical Elective		ECE Technical Elective
ECE Technical Elective	Human Behavior	See Transfer Guide
ENMA 480**		Upper Division General Education
Upper Division General Education		

TOTAL CREDIT HOURS: 127

Does not include the University's General Education Language and Culture Requirement. Additional Hours may be required.

The General Education requirements in Information Literacy and Research, Impact of Technology, and Philosophy and Ethics are met through the major.

Electrical engineering majors must earn a grade of C or better in all 200-level ECE courses prior to taking the next course in the sequence.

Requirements for graduation include a minimum cumulative grade point average of 2.00 overall and in the major, a grade of C or better in all courses required for the major, including prerequisite courses, 120 credit hours, which must include both a minimum of 30 credit hours overall and 12 credit hours in upper-level courses in the major program from Old Dominion University, completion of ENGL 110C, ENGL 211C or 221C or 231C, and a writing intensive (W) course in the major with a grade of C or better, and completion of Senior Assessment.

2013 - 2014 Old Dominion University Catalog Bachelor of Science in Computer Engineering (with VCCS Equivalencies)

*Sample four year curriculum with a suggested ordering of courses. Students may re-order as needed. * indicates not automatically waived with transferrable associates degree, C or better required for transfer.*

YEAR 1 - FRESHMAN (33 CREDITS)

FALL SEMESTER (16 credits)		**SPRING SEMESTER (17 credits)**	
General Education and Major Coursework:	VCCS Equivalency:	General Education and Major Coursework:	VCCS Equivalency:
ENGN 110	EGR 120*	ECE 111	Dept. approval upon admission
CHEM 121N/122N	CHM 111*	CHEM 123N	CHM 112*
MATH 211	MTH 173 or 271*	MATH 212	MTH 174 or 274*
ENGL 110C (C or better required)	ENG 111*	CS 150	CSC 201, EGR 125 or EGR 126* See Monarch Transfermation to ensure your institution's course will transfer.
COMM 101R	CST 100, 105 or 110*	PHYS 231N	PHY 231 or 241*

YEAR 2 - SOPHOMORE (33 CREDITS)

FALL SEMESTER (17 credits)		**SPRING SEMESTER (16 credits)**	
General Education and Major Coursework:	VCCS Equivalency:	General Education and Major Coursework:	VCCS Equivalency:
MATH 307	MTH 279 or 291*	ECE 202	EGR 261 or 272*
ECE 201	EGR 260 or 271*	ECE 287	EGR 262*
ECE 241	EGR 277*	CS 250	CSC 202 or 210*
PHYS 232N	PHY 232 or 242*	CS 252	ITN 171 and 172*
Literature	See Transfer Guide	Human Creativity	See Transfer Guide
ENGL 231C (C or better required)		ENG 115 or 131*	

YEAR 3 - JUNIOR (31 CREDITS)

FALL SEMESTER (16 credits)		**SPRING SEMESTER (15 credits)**	
Major Coursework:	VCCS Equivalency:	General Education and Major Coursework:	VCCS Equivalency:
ECE 302		ECE 304	
ECE 313 (4 credits)		ECE 346	
ECE 341		CS 350	
CS 361		ECE Technical Elective	
ECE 381		CS 381	

YEAR 4 - SENIOR (32 CREDITS)

FALL SEMESTER (18 credits)		**SPRING SEMESTER (14 credits)**	
General Education and Major Coursework:	VCCS Equivalency:	General Education and Major Coursework:	VCCS Equivalency:
ECE 484W (C or better required)		ECE 487 (2 credits)	
ECE 486 (2 credits)		CS 471	

ECE 443		ECE Technical Elective
ECE Technical Elective		ECE Technical Elective
ENMA 480**	Human Behavior	See Transfer Guide
Interpreting the Past		See Transfer Guide

TOTAL CREDIT HOURS: 128

This curriculum sheet does not include the University's General Education Language and Culture requirement. Additional hours may be required.

** Meets philosophy and ethics general education requirement.

The General Education requirements in Information Literacy and Research, Impact of Technology and Philosophy and Ethics are met through the major. The upper-division General Education requirement is met through a built in minor in computer science.

The Upper Division General Education requirement is met through the built-in minor in Computer Science.

Electrical engineering majors must earn a grade of C or better in all 200 level ECE courses prior to taking the next course in the sequence.

Requirements for graduation include a minimum cumulative grade point average of 2.00 overall and in the major, a grade of C or better in all courses required for the major, including prerequisite courses, 120 credit hours, which must include both a minimum of 30 credit hours overall and 12 credit hours in upper-level courses in the major program from Old Dominion University, completion of ENGL 110C, ENGL 211C or 221C or 231C, and a writing intensive (W) course in the major with a grade of C or better, and completion of Senior Assessment.

Longwood University/Old Dominion University
ARTICULATION AGREEMENT 2011-2012
Bachelor of Science in Physics to a Bachelor of Science in Electrical Engineering

Longwood University B.S. degree in Physics				**Old Dominion University B.S. degree program in Electrical Engineering**			
Major-* require C- or better for transfer**				**Major**			
CHEM	111	***Fundamental Chemistry I	4	CHEM	121/ 122N	Foundations of Chemistry	4
CHEM	112	***Fundamental Chemistry II	4	CHEM	123/ 124N	Foundations of Chemistry	4
PHYS	201	***University Physics I	4	PHYS	231N	University Physics	4
PHYS	202	***University Physics II	4	PHYS	232N	University Physics	4
MATH	261	***Calculus I	4	MATH	211	Calculus I	4
MATH	262	***Calculus II	4	MATH	212	Calculus II	4
MATH	361	*** Calculus III	4	MATH	312	Calculus III	4
MATH	362	***Differential Equations	3	MATH	307	Ordinary Differential Equations	3
CMSC	204	***Intro Programming	3	CS	150	Problem Solving and Programming I	3
PHYS	260	Introduction to Experimental Design	2	PHYS	2ELE	Elective	2
PHYS	321	Modern Physics I	3	PHYS	323	Modern Physics I	3
PHYS	324	Thermodynamics	3	PHYS	454	Thermal and Statistical Physics	3
PHYS	352	Mechanics	3	PHYS	319	Analytical Mechanics	3
PHYS	332	Electricity and Magnetism	3	PHYS	320	Intro to Electromagnetic Theory (substitute for ECE 323)	3
PHYS	331	AC/DC Circuits	4	EET	350	Combination of PHYS 341+ 331= EET 350 (substitute for ENGN 110)	4
PHYS	341	Electronics	4	EET	350	Combination of PHYS 341+ 331= EET 350 (substitute for ECE 201)	4
PHYS	ELE	Electives (Please see Longwood catalog for list of applicable courses)	6	PHYS	ELE	Electives	6
Total in Major			**62**	**Total in Major**			**62**
General Education				**General Education**			
*ENGL	150	Writing and Research	3	ENGL	110C	English Composition	3
ART Achievement	REQ	One from ART 125, 160, or THEA 101	3	FPAP	1REQ	Human Creativity Way of Knowing	3
ENGL	REQ	Choose one literature course from ENGL 202, 201, or 203	3	LIT	1REQ	Literature Way of Knowing	3
HIST	100 or 110	Western Civilization	3	HISP	1REQ	Interpreting the Past Way of Knowing	3
Social Science	REQ	Select one from courses listed in Longwood catalog	3	SSCP	1REQ	Human Behavior Way of Knowing	3
FORGN LANG	REQ	FREN 101, SPAN 201 OR GERM 201	3	FLP	1REQ	Foreign Language	3
PHED or RECR	101	Health / Physical Education	2	PE	1ELE	Elective	2
LSEM	100	Longwood Seminar	1	UNIV	100	University Orientation	1
DIVERSITY	REQ	Select one from courses listed in Longwood catalog	3		ELE pr REQ	Elective or General Education Requirement	3
CMSC/ MATH	350	Ethics in Math or Computer Science	3	GNRL	3ELE	Upper Division Elective (substitute for ENMA 480)	3
ENGL	400	Adv Writing Seminar	3	ENGL	327W	Advance Composition (substitute for ENGL 231C)	3
Total Additional General Education			**30**	**Total Additional General Education**			**30**
Total credits earned at Longwood University			**92**	**Total Credits transferred to ODU**			**92**

Additional Requirements - ODU			
ECE	200	Engineering Analysis Tools	3
ECE	241	Fundamentals of Computer Engineering	4
ECE	202	Circuits, Signals & Linear Systems	3
ECE	287	Fundamental Circuits Lab	2
ECE	313	Electronic Circuits	4
ECE	303	Intro to Electrical Power	3
ECE	332	Microelectronic Materials & Processes	3
ECE	381	Discrete-time Signal Processing	3
ECE	304	Probability, Statistics, & Reliability	3
ECE	387	Microelectronics Fabrication Lab	3
ECE	485W	Electrical Engineering Design I	3
ECE	486	Prep to ECE Design II	1
ECE	4XX	Technical Elective I	3
ECE	4XX	Technical Elective II	3
ECE	4XX	Technical Elective III	3
ECE	4XX	Technical Elective IV	3
ENGN	401	FE Review	1
ECE	487	ECE Design II	2
Total Credits to be Taken at ODU			**50**
Total Transfer Credits in Major			62
Total Credits in General Education			30
Total Credits Earned for Dual B.S. Degree			142

Student must earn a grade of C- or better from Longwood to transfer courses to Old Dominion University. Students must complete at least 32 credit hours at Old Dominion University to receive a baccalaureate degree from the university.

Longwood University/Old Dominion University
ARTICULATION AGREEMENT 2011-2012
Bachelor of Science in Physics to a Bachelor of Science in Computer Engineering

Longwood University B.S. degree in Physics				**Old Dominion University B.S. degree program in Computer Engineering**			
Major-* require C- or better for transfer**				**Major**			
CHEM	111	***Fundamental Chemistry I	4	CHEM	121/ 122N	Foundations of Chemistry	4
CHEM	112	***Fundamental Chemistry II	4	CHEM	123/ 124N	Foundations of Chemistry	4
PHYS	201	***University Physics I	4	PHYS	231N	University Physics	4
PHYS	202	***University Physics II	4	PHYS	232N	University Physics	4
MATH	261	***Calculus I	4	MATH	211	Calculus I	4
MATH	262	***Calculus II	4	MATH	212	Calculus II	4
MATH	361	*** Calculus III	4	MATH	312	Calculus III	4
MATH	362	***Differential Equations	3	MATH	307	Ordinary Differential Equations	3
CMSC	204	***Intro Programming	3	CS	150	Problem Solving and Programming I	3
PHYS	260	Introduction to Experimental Design	2	PHYS	2ELE	Elective	2
PHYS	321	Modern Physics I	3	PHYS	323	Modern Physics I	3
PHYS	324	Thermodynamics	3	PHYS	454	Thermal and Statistical Physics	3
PHYS	352	Mechanics	3	PHYS	319	Analytical Mechanics	3
PHYS	332	Electricity and Magnetism	3	PHYS	320	Intro to Electromagnetic Theory	3
PHYS	331	AC/DC Circuits	4	EET	350	Combination of PHYS 341+ 331= EET 350 (substitute for ENGN 110)	4
PHYS	341	Electronics	4	EET	350	Combination of PHYS 341+ 331= EET 350 (substitute for ECE 201)	4
PHYS	ELE	Electives (Please see Longwood catalog for list of applicable courses)	6	PHYS	ELE	Electives	6
Total in Major			**62**	**Total in Major**			**62**
General Education				**General Education**			
*ENGL	150	Writing and Research	3	ENGL	110C	English Composition	3
ART Achievement	REQ	One from ART 125, 160, or THEA 101	3	FPAP	1REQ	Human Creativity Way of Knowing	3
ENGL	REQ	Choose one literature course from ENGL 202, 201, or 203	3	LIT	1REQ	Literature Way of Knowing	3
HIST	100 or 110	Western Civilization	3	HISP	1REQ	Interpreting the Past Way of Knowing	3
Social Science	REQ	Select one from courses listed in Longwood catalog	3	SSCP	1REQ	Human Behavior Way of Knowing	3
FORGN LANG	REQ	FREN 101, SPAN 201 OR GERM 201	3	FLP	1REQ	Foreign Language	3
PHED or RECR	101	Health / Physical Education	2	PE	1ELE	Elective	2
LSEM	100	Longwood Seminar	1	UNIV	100	University Orientation	1
DIVERSITY	REQ	Select one from courses listed in Longwood catalog	3		ELE pr REQ	Elective or General Education Requirement	3
CMSC/ MATH	350	Ethics in Math or Computer Science	3	GNRL	3ELE	Upper Division Elective (substitute for ENMA 480)	3
ENGL	400	Adv Writing Seminar	3	ENGL	327W	Advance Composition (substitute for ENGL 231C)	3
Total Additional General Education			**30**	**Total Additional General Education**			**30**
Total credits earned at Longwood University			**92**	**Total Credits transferred to ODU**			**92**

Additional Requirements - ODU			
ECE	200	Engineering Analysis Tools	3
ECE	241	Fundamentals of Computer Engineering	4
ECE	202	Circuits, Signals & Linear Systems	3
ECE	287	Fundamental Circuits Lab	2
CS	250	Problem Solving & Programming	4
CS	252	Intro to Unix	1
CS	381	Discrete Structures	3
ECE	313	Electronic Circuits	4
ECE	341	Digital System Design	3
CS	361	Advanced Data Structures & Algorithms	3
CS	471	Operating Systems	3
ECE	381	Discrete –time Signal Processing	3
ECE	304	Probability, Statistics, & Reliability	3
ECE	346	Microcontrollers	3
ECE	443	Computer Architecture	3
CS	350	Software Engineering	3
ECE	484W	Computer Engineering Design I	3
ECE	486	Prep to ECE Design II	1
ECE	4XX	Technical Elective I	3
ECE	4XX	Technical Elective II	3
ECE	4XX	Technical Elective III	3
ECE	4XX	Technical Elective IV	3
ENGN	401	FE Review	1
ECE	487	ECE Design II	2
Total Credits to be Taken at ODU			**67**
Total Transfer Credits in Major			62
Total Credits in General Education			30
Total Credits Earned for Dual B.S. Degree			159

Student must earn a grade of C- or better from Longwood to transfer courses to Old Dominion University. Students must complete at least 32 credit hours at Old Dominion University to receive a baccalaureate degree from the university.

GENERAL EDUCATION TRANSFER EQUIVALENTS

Catalog Year: 2013-2014

The ODU general education program consists of requirements all undergraduate students must complete. The number of credit hours necessary to complete these requirements may vary, depending upon the academic discipline selected by the student. The following list of courses can serve as a guide for academic planning. Additionally, major specific curriculum sheets with all VCCS transfer equivalencies are available on the ODU Transfer Advising website.

Written Communication Skills	
ODU	**VCCS**
ENGL 110C	ENG 111
ENGL 211C	ENG 112 or 210
ENGL 231C	ENG 115 or 131
Oral Communication Skills	
ODU	**VCCS**
COMM 101R	CST 100, 105 or 110
COMM 103R	CST 111 or 112
COMM 112R	CST 126
Mathematics Skills	
ODU	**VCCS**
MATH 101M	MTH 122, 152 or 182
MATH 102M	MTH 158
MATH 162M	MTH 163
MATH 163*	MTH 164
MATH 166*	MTH 166
STAT 130M	MTH 146, 157, 240, 241 or 242

Note: MATH 163 and MATH 166 are not classes that meet general education as stated in page 73 of the 2011 Undergraduate Catalog, but we list them above due to the request of students who are interested in lower division departmental requirements for some majors.

Language and Culture Skills**	
ODU	**VCCS**
ARAB 111F	ARA 101 and 102
CHIN 111F	CHI 101 and 102
FR 101F and 102F	FRE 101 and 102
GER 101F and 102F	GER 101 and 102
HEBR	None
ITAL 101F and 102F	ITA 101 and 102
JAPN 111F	JPN 101 and 102
LATN 101F and 102F	LAT 101 and 102
PRTG 101F and 102F	None
RUS 101F and 102F	RUS 101 and 102
SPAN 101F	SPA 101 or 105 and 106
SPAN 102F	SPA 102 or 107 and 108
Language and Culture Skills I and II (LC 1REQ & 2REQ)	GRE 101 and 102, HIN 101 and 102, KOR 101 and 102, VTN 101 and 102, ASL 101 and 102
**The Bachelor of Arts and the International Business major in the Bachelor of Science in Business Administration degrees require completion of the intermediate level (201-202) of a foreign language, even with the earned associate degree. A minimum of 120 credit hours is required to graduate from all bachelor degree programs (see specific degrees for exact minimum credit hours required, as some may require more).	

Information Literacy and Research Skills	
ODU	**VCCS**
IT 150G	ITE 119
CS 120G	ITE 119 or ETR 160
STEM 251G	ITE 119
Requirement can also be met by approved course	

Literature Way of Knowing	
ODU	**VCCS**
ENGL 112L	ENG 125
ENGL 114L	None
FLET 100L	None
Literature Way of	ENG 236, 237, 241, 242, 243, 244, 245, 246, 251, 252, 253,

Knowing (LIT 1REQ)	254, 255, 256, 267 or 268

Human Creativity Way of Knowing	
ODU	**VCCS**
ARTH 121A	ART 100,105, 111 or 112
ARTS 122A	ART 113, 114
COMM/THEA 270A	CST 151, 152 or 250
Human Creativity Way of Knowing (HC 1REQ)	ART 101, 102, 105, 106, 133, 150, 201 or 202, or HUM 100, 201, 202, or 260, MUS 125 or CST 231-232
THEA 241A	CST 130, 141 or 142
MUSC 264A	MUS 121 or 122
DANC 185A	None

Philosophy and Ethics Way of Knowing	
ODU	**VCCS**
PHIL 110P	PHI 100, 101 or 102
PHIL 120P	PHI 111, 112 or 115
PHIL 230E	PHI 220, 225 or 226
PHIL 250E	REL 230, 231, 232, 237 or PHI 260
Philosophy and Ethics Way of Knowing (PL or EL 1REQ)	PHI 200, 211, 212, 227, 228, 265 or 276

Interpreting the Past Way of Knowing	
ODU	**VCCS**
HIST 100H	HIS 112
HIST 101H	HIS 253 or 254
HIST 102H	HIS 101 or 102
HIST 103H	HIS 231 or 232
HIST 104H	HIS 121 or 122
HIST 105H	HIS 203 or 204
Interpreting the Past Way of Knowing (INTP 1REQ)	HIS 111, HIS 243 or 244

Human Behavior Way of Knowing	
ODU	**VCCS**
AAST 101S	HUM 220
ANTR 110S	SOC 210, 211 or 212
COMM 200S	None
CRJS 215S	ADJ 107, 201 or SOC 236
ECON 200S	ECO 120
ECON 201S	ECO 201
ECON 202S	ECO 202
GEOG 100S	GEO 210
GEOG 101S	GEO 200
POLS 100S	PLS 241 or 242
POLS 101S	PLS 130, 135, 211 or 212
POLS 102S	PLS 140
PSYC 201S	PSY 200, 201 or 202
PSYC 203S	PSY 230, 231, 232, 235 or 238
SOC 201S	SOC 200, 201 or 202
WMST 201S	SSC 210 or HUM 210
Human Behavior Way of Knowing (HB 1REQ)	PLS 120, SOC 220 or 255

The Nature of Science Way of Knowing	
ODU	**VCCS**
BIOL 115N and 116N	BIO 101 and 102
The Nature of Science Way of Knowing (NS 1REQ and 2REQ)	BIOL 106 and 107 or MAR 101 and 102 or ENV 121-122
The Nature of Science Way of Knowing (NS 1REQ)	BIO 114, 270, 278, CHM 126, ENV 195, GOL 112, GOL 207 or 225, MAR 121, 122, 201, 202, NAS 101, 102, 110, 111, 112, 120, 125 or 130, PHY 130, SCT 111 or 112
CHEM 105N-106N and 107N-108N	CHM 101 or 121 and 102 or 122
CHEM 121N-122N and 123N-124N	CHM 111 and 112
OEAS 110N	GOL 110 (required for teacher ed) (Note: A student receiving credit for 111N cannot receive credit for 110N)

OEAS 111N and 112N	GOL 105 and 106 (Note: A student receiving credit for 111N cannot receive credit for 110N)
OEAS 106N and 108N	GOL 111
PHY 101N	PHY 100 or 101
PHY 102N	PHY 102
PHY 121	PHYS 111N
PHY 122	NS 1REQ or PHYS 112N(only if optics was covered in the course)
PHY 103N and 104N	NAS 131 and 132
PHY 111N and 112N	PHY 111 and 112 or 201 and 202
PHY 231N and 232N	PHY 231 and 232 or 241 and 242

Associate Degrees-Transfer Articulation Agreements

Old Dominion University has established articulation agreements with all of the VCCS institutions which, in accordance with the State Policy on Transfer, considers the lower division general education requirements in all bachelor's degree programs satisfied for students who earn an approved Associate in Arts, an Associate in Science, or an Associates in Arts and Sciences degree at any Virginia Community College or Richard Bland College. Some degree programs require specific General Education courses to meet departmental and/or college requirements that are not automatically satisfied by the articulation agreement. Students must earn a C (2.0) or better in the specific General Education courses to receive credit for the specific General Education requirements.

APPENDIX D

UNDERGRADUATE COURSES

ECE 111. Information Literacy and Research for Electrical and Computer Engineering. Lecture 2 hours; 2 credits. Prerequisites: ENGN 110, MATH 162M. An introductory course for ECE students that explores information literacy in terms of information basics, information need, searching, locating, and evaluating information sources, citing and ethics of information in relation to development and implementation of electrical and computer engineering projects.

ECE 201. Circuit Analysis I. Lecture 3 hours; 3 credits. Prerequisite: a grade of C or better in MATH 212. Corequisites: MATH 307 and PHYS 232N. An introduction to the analysis and theory of linear electrical circuits, including relevant mathematical background. Topics include: passive component definitions and connection rules; independent and dependent sources, concepts of power & energy; Kirchhoff's laws; development of network reduction techniques; formulation of mesh-current and node-voltage equations; network theorems including Thevenin, Norton, Maximum power transfer, and superposition Theorem, Operational Amplifiers, Two Port Networks (resistive), Energy Storage Elements, and initial conditions. Basics of matrices and linear algebra with Gaussian elimination; matrix applications to linear circuit analyses; MATLAB & PSPICE with analyses and applications to passive circuits. (offered fall, spring)

ECE 202. Circuit Analysis II. Lecture 3 hours; 3 credits. Prerequisite: MATH 307 and a grade of C or better in ECE 201. Time domain analysis of first-order and second-order electrical circuits; Sinusoidal steady state analysis; Phasor representation of AC Circuits, Maximum power transfer and Thevenin-Norton theorems for AC circuits; Frequency response of circuits (with R, L, and C components), Laplace Transforms and transfer functions of linear circuits; extension to frequency domain circuit analysis including Bode plots; operational amplifiers with relevant circuit examples; two-port networks including Z- and Y-parameters; transformer concepts. PSPICE and MATLAB for DC and transient circuit analyses; theory & solution of linear ordinary differential equations with constant coefficients, complex numbers, Euler's formula and complex arithmetic; PSPICE and MATLAB implementation of AC response and analyses. (offered fall, spring)

ECE 241. Fundamentals of Computer Engineering. Lecture 3 hours; recitation 1 hour; laboratory 2 hours; 4 credits. Prerequisites: a grade of C or better in both CS 150 and MATH 211. This course develops the foundation of computer engineering for computer engineers as well as an introductory breadth appropriate for electrical engineers. Class topics include computer information, digital design (combinational and sequential circuits) and computer organization. The laboratory includes building digital circuits (focusing on programmable logic) and system interfacing. The use of a hardware description language is employed in class and the laboratory to specify, simulate and synthesize digital circuits.

ECE 287. Fundamental Electric Circuit Laboratory. Lecture 1 hour; laboratory 3 hours; 2 credits. Corequisite: ECE 202. Prerequisites: a grade of C or better in both CS 150 and ECE 201. Objective of course is to provide students in electrical and computer engineering with a "hands-on" introduction to selected topics in electrical engineering. Students will use basic circuit analysis skills and C programming skills to design, build, and test electrical networks interfacing to a microcontroller. Labs will also provide an introduction to basic measurement techniques and electrical laboratory equipment (power supplies, oscilloscopes, voltmeters, etc).

ECE 302. Linear System Analysis. Lecture 3 hours; 3 credits. Prerequisite: MATH 307 and a grade of C or better in ECE 202. Generalized sinusoids. Operations with sinusoids. Complex exponentials. Signal properties, operations with signals and useful signal models. Concept of system, system properties, classification of systems, system modeling (input-output description and state-space description) for electrical circuits. Time-domain analysis of continuous-time systems including impulse response, total system response, stability, resonance phenomenon. Graphical convolution and use of MATLAB to calculate convolution. Fourier analysis of continuous-time signals including Fourier series for periodic signals and Fourier transform for aperiodic signals. Signal transmission through LTIC systems. Ideal and practical filters. State-space analysis of LTIC systems. State equations from transfer function. System realizations. Solution of state equations. Advanced matrix operation and linear algebra. Determinants, characteristic equation of a matrix, eigenvalues and eigenvectors, functions of matrices. Using MATLAB to calculate system response and determine frequency characteristics for signals and systems. (offered fall, spring).

ECE 303. Introduction to Electrical Power. Lecture 3 hours; 3 credits. Prerequisite: a grade of C or better in ECE 201. AC steady state power, single-phase and three-phase networks, electric power generation, transformers, transmission lines, electric machinery and the use of power. Energy resources, power plants, renewable energy, electric safety. (offered fall, summer)

ECE 304. Probability, Statistics, and Reliability. Lecture 3 hours; 3 credits. Prerequisite: a grade of C or better in MATH 212. Introduction to probability, probability models, discrete and continuous random variables, statistics, reliability and stochastic processes. Examples discussed will focus on computer and electrical engineering applications that include both component- and system-level aspects. MATLAB and/or EXCEL are introduced as tools for data analysis, computation and simulation.

ECE 313. Electronic Circuits. Lecture 3 hours; laboratory 3 hours; 4 credits. Prerequisite: a grade of C or better in ECE 202. Pre- or corequisite: ECE 241. Introduction to junction diodes, bipolar junction transistors (BJTs), MOS field-effect transistors (MOSFETs) and operational amplifiers (op-amps). Design concepts for discrete analog circuits with diodes, BJTs, MOSFETs and op-amps. The lab component introduces design and techniques for implementation of analog circuits.

ECE 323. Electromagnetics. Lecture 3 hours; 3 credits. Prerequisite: a grade of C or better in ECE 202. An introduction to electromagnetic waves, wave propagation in various media; propagation across interfaces; propagation in waveguides and transmission lines. Antennas and radiation from antennas.

ECE 332. Microelectronic Materials and Processes. Lecture 3 hours; 3 credits. Prerequisite: a grade of C or better in ECE 202. An introduction to fundamentals of properties semiconductors and device fabrication processes. The topics include crystal structure, bonding, energy bands, doping, carrier densities, mobility, resistivity, recombination, drift, and diffusion. Basic structure and operations of p-n junctions, BJTs and MOSFETs and their fabrication processes, including solid state diffusion, thermal oxidation of silicon, ion implantation, chemical vapor deposition, thin film deposition, photolithography and etching. (offered fall)

ECE 340. Digital Circuits. Lecture 3 hours; recitation 1 hour; laboratory 2 hours; 4 credits. Prerequisites: a grade of C or better in CS 150 and MATH 211. Not open to electrical and computer engineering majors. This course develops the foundations of computer engineering for students outside of electrical and computer engineering. Class topics include computer information, digital design (combinational and sequential circuits) and computer organization. The laboratory includes building digital circuits (focusing on programmable logic) and system interfacing. The use of a hardware description language is employed in class and the laboratory to specify, simulate and synthesize digital circuits.

ECE 341. Digital System Design. Lecture 3 hours; 3 credits. Prerequisite: a grade of C or better in ECE 241. Tools and methodologies for top-down design of complex digital systems. Important topics include minimization, mixed logic, algorithmic state machines, microprogrammed controllers, creating and using a gold model, data and control path design and data movement and routing via buses. Design methodologies covered include managing the design process from concept to implementation, verification using a gold model, and introduction to design flow. A hardware description language is used extensively to demonstrate models and methodologies, and is also used in design exercises and projects. (offered fall, spring)

ECE 346. Microcontrollers. Lecture 3 hours; 3 credits. Prerequisite: a grade of C or better in ECE 241. A hands-on approach to microprocessor and peripheral system programming, I/O interfacing, and interrupt management. A sequence of projects requiring the programming and integration of a microcontroller-based system is conducted. Project assignments require a microcontroller evaluation board and accessories supplied by the student. (offered spring)

ECE 355. Introduction to Networks and Data Communications. Lecture 3 hours; 3 credits. Prerequisites: ECE 304 and a grade of C or better in ECE 241. This course introduces the basic concepts of computer networks and data communications. Topics include protocol layers, the application layer, the transport layer, the network layer, the data link layer, and the physical layer. Students will learn how to use network packet analyzer tools to do simple network analysis. Emphasis is on gaining an understanding of network engineering as it relates to hardware configuration, system operation and maintenance.

ECE 367. Cooperative Education. 1-3 credits (may be repeated for credit). Prerequisite: approval by the department and Career Management in accordance with the policy for granting credit for Cooperative Education programs. Available for pass/fail grading only. Student participation for credit based on the academic relevance of the work experience, criteria, and evaluative procedures as formally determined by the department and Career Management prior to the semester in which the work experience is to take place. (offered fall, spring, summer) (qualifies as a CAP experience)

ECE 368. Student Internship. 1-3 credits (may be repeated for credit). Prerequisite: Approval by department and Career Management. Available for pass/fail grading only. Academic requirements will be established by the department and will vary with the amount of credit desired. Allows students to gain short duration career related experience. (qualifies as a CAP experience)

ECE 369. Practicum. 1-3 credits. Prerequisite: approval by department and Career Management. Academic requirements will be established by the department and will vary with the amount of credit desired. Allows students an opportunity to gain short duration career related experience. (qualifies as a CAP experience)

ECE 371. Circuits and Systems. Lecture 3 hours; 3 credits. Prerequisite: a grade of C or better in ECE 201. Corequisite: ECE 287. Frequency-domain analysis of linear electrical circuits. Laplace transforms and Laplace transform analysis of circuits. Classification of systems; Time and frequency domain representation of linear systems. Methods of linear system analysis including convolution and Laplace transforms. Frequency domain representation of signals including Fourier series, Fourier transforms. Application of analysis techniques to electrical filters, signal sampling, and signal multiplexing. This course is intended for non-ECE students. (offered fall, spring)

ECE 381. Introduction to Discrete-time Signal Processing. Lecture 3 hours; 3 credits. Prerequisite: a grade of C or better in ECE 202. This course covers fundamental digital signal processing techniques that form the basis to a wide variety of application areas. Topics include discrete-time signals and systems, time domain analysis, solutions of difference equations, Z-transform analysis, discrete Fourier transforms (DFT), sampling theorem, transform analysis of linear time-invariant systems, structure of discrete-time systems and introduction to power spectrum estimation. (offered fall)

ECE 387. Microelectronics Fabrication Laboratory. Lecture 1 hour; laboratory 4 hours; 3 credits. Prerequisite: ECE 332. The laboratory course will enable students to fabricate MOSFETs, MOS capacitors, diffused resistors and p-n diodes. Students will be trained to operate the equipment required for wet and dry oxidation, thin film deposition, solid state diffusion, photolithography, and etching. Students will fabricate and analyze the devices by current-voltage characteristic, capacitance-voltage characteristic, film thickness and conductivity measurements. (offered spring)

ECE 395, 396. Topics in Electrical and Computer Engineering. Lecture 1-3 hours; 1-3 credits. Prerequisite: departmental approval.

ECE 403/503. Power Electronics. Lecture 3 hours; 3 credits. Prerequisites: MATH 307 and ECE 303. Power electronics provides the needed interface between an electrical source and an electrical load and facilitates the transfer of power from a source to a load by converting voltages and currents from one form to another. Topics include: alternating voltage rectification, Pulse Width Modulation (PWM), DC converters (Buck, Boost, Buck-Boost, Cuk and SEPIC converters), negative feedback control in power electronics, isolated switching mode power supply, flyback and forward power supply, solid state power switches, AC inverter.

ECE 404/504. Electric Drives. Lecture 3 hours; 3 credits. Prerequisites: ECE 201 and ECE 303. Electric drives efficiently control the torque, speed and position of electric motors. This course has a multi-disciplinary nature and includes fields such as electric machine theory, power electronics, and control theory. Topics include: switch-mode power electronics, magnetic circuit, DC motor, AC motor, Brushless DC motor, induction motor, speed control of induction motor, vector control of induction motor, stepper-motor.

ECE 406/506. Computer Graphics and Visualization. Lecture 3 hours; 3 credits. Prerequisite: a grade of C or better in CS 250. Introduction to computer graphics and visualization with emphasis on using 3D application programmer's interface (API) libraries. It covers mathematical foundations, rendering pipeline, geometrical transformations, 3D viewing and projections, shading, texture mapping, and programmable shaders. Various visualization applications are covered. (cross listed with MSIM 441/541)

ECE 407/507. Introduction to Game Development. Lecture 3 hours; 3 credits. Prerequisite: CS 361 or equivalent. An introductory course focused on game development theory and practices using Microsoft XNA Game Studio with emphasis on educational game development. Topics covered include game architecture, computer graphics theory, user interaction, audio, high level shading language, animation, physics, and artificial intelligence. Students will develop games related to science (e.g., physics, chemistry, and biology), technology, engineering, and mathematics (STEM) education. The developed games can run on a variety of platforms, including Microsoft Windows, Xbox 360, Windows Phone 7 and Zune Digital Media Player. (cross listed with MSIM 408/508)

ECE 410/510. Model Engineering. Lecture 3 hour; 3 credits. Prerequisites: MSIM 205. Pre/co-requisite MSIM 320. The goal of this course is to develop understanding of the various modeling paradigms appropriate for capturing system behavior and conducting digital computer simulation of many types of systems. The techniques and concepts discussed typically include UML, concept graphs, Bayesian nets, Markov models, Petri nets, system dynamics, Bond graphs, etc. Students will report on a particular technique and team to implement a chosen system model. (cross-listed with MSIM 410/510)

ECE 441/541. Advanced Digital Design and Field Programmable Gate Arrays. Lecture 3 hours; 3 credits. Prerequisite: ECE 341. Course will provide a description of FPGA technologies and the methods using CAD design tools for implementation of digital systems using FPGAs. It provides advanced methods of digital circuit design, specification, synthesis, implementation and prototyping. It introduces practical system design examples. (Offered spring)

ECE 443/543. Computer Architecture. Lecture 3 hours; 3 credits. Corequisites: ECE 304 and 484W. Prerequisites: ECE 341, 346. An introduction to computer architectures. Analysis and design of computer subsystems including central processing units, memories and input/output subsystems. Important concepts include datapaths, computer arithmetic, instruction cycles, pipelining, virtual and cache memories, direct memory access and controller design. (offered fall)

ECE 451/551. Communication Systems. Lecture 3 hours; 3 credits. Prerequisites: ECE 304 and a grade of C or better in ECE 202. Fundamentals of communication systems engineering. Modulation methods including continuous waveform modulation (amplitude, angle). Design of modulation systems and the performance in the presence of noise. Communication simulation exercises through computer experiments.

ECE 452/552. Introduction to Wireless Communication Networks. Lecture 3 hours; 3 credits. Prerequisite: ECE 304 and a grade of C or better in ECE 202. Introduction to current wireless network technologies and standards. The radio spectrum and radio wave propagation models (pathloss, fading, and multipath). Modulation, diversity, and multiple access techniques. Wireless network planning and operation. Current and emerging wireless technologies (satellite systems, vehicular/sensor networks).

ECE 454/554. Introduction to Bioelectrics. Lecture and design 3 hours; 3 credits. Prerequisites: PHYS 111N or higher; MATH 200 or higher. A one-semester course covering the electrical properties of cells and tissues as well as the use of electrical and magnetic signals and stimuli in the diagnosis and treatment of disease. Typical topics to be covered include basic cell physiology, endogenous electric fields in the body, electrocardiography, cardiac pacing, defibrillation, electrotherapy, electroporation, electrotherapy in wound healing. In addition, ultrashort electrical pulses for intracellular manipulation and the application of plasmas to biological systems will be covered. (Cross-listed with ENGN 454/554)

ECE 455/555. Network Engineering and Design. Lecture and design 3 hours; 3 credits. Prerequisite: ECE 355 or permission of the instructor. This course is an extension of ECE 355 into a semester long project. Emphasis is on gaining an understanding of networking design principles that entails all aspects of the network development life cycle. Topics include campus LAN models and design, VLANs, internetworking principles and design, WAN design, design of hybrid IP networks, differentiated vs. integrated services, traffic flow measurement and management. (offered spring)

ECE 458/558. Instrumentation. Lecture 2 hours; laboratory 2 hours; 3 credits. Prerequisites: PHYS 102N, 112N, or 232N, and a grade of C or better in ECE 202. Computer interfacing using a graphical programming language with applications involving digital-to-analog conversion (DAC), analog-to-digital conversion (ADC), digital input output (DIO), serial ports, and the general-purpose instrument bus (GPIB). Analysis of sampled data involving the use of the probability density function, mean and standard derivations, correlations, and the power spectrum. ECE 558 Students are required to do a semester long project on LabVIEW implementation. (offered spring, summer)

ECE 461/561. Automatic Control Systems. Lecture 3 hours; 3 credits. Prerequisite: a grade of C or better in ECE 202. Analysis and design of control systems via frequency and time domain techniques. Root locus, Bode and Nyquist techniques. Stability, sensitivity, and performance specifications. Cascade and feedback compensation. Computer-aided analysis and design. Pole placement through state variable feedback.

ECE 462/562. Introduction to Medical Image Analysis (MIA). Lecture 3 hours; 3 credits. Prerequisite: a grade of C or better in MATH 212. Introduction to basic concepts in medical image analysis. Medical image registration, segmentation, feature extraction, and classification are discussed. Basic psychophysics, fundamental ROC analysis and FROC methodologies are covered.

ECE 463/563. Biomedical Applications of Low Temperature Plasmas. Lecture 3 hours; 3 credits. This course is cross listed between ECE and Biology. It is designed to be taken by senior undergraduate students and first year graduate students. The course contents are multidisciplinary, combining materials from engineering and the biological sciences. The course covers an introduction to the fundamentals of non-equilibrium plasmas, low temperature plasma sources, and cell biology. This is followed by a de-tailed discussion of the interaction of low temperature plasma with biological cells, both prokaryotes and eukaryotes. Potential applications in medicine such as wound healing, blood coagulation, sterilization, and the killing of various types of cancer cells will be covered.

ECE 472/572. Plasma Processing at the Nanoscale. Lecture 3 hours; 3 credits. Prerequisite: ECE 323. The science and design of partially ionized plasma and plasma processing devices used in applications such as etching and deposition at the nanoscale. Gas phase collisions, transport parameters, DC and RF glow discharges, the plasma sheath, sputtering, etching, and plasma deposition.

ECE 473/573. Solid State Electronics. Lecture 3 hours; 3 credits. Prerequisites: ECE 313, 323 and 332. The objective of this course is to understand basic semiconductor devices by understanding semiconductor physics (energy bands, carrier statistics, recombination and carrier drift and diffusion) and to gain an advanced understanding of the physics and fundamental operation of advanced semiconductor devices. Following the initial introductory chapters on semiconductor physics, this course will focus on p-n junctions, metal-semiconductor devices, MOS capacitors, MOS field effect transistors (MOSFET) and bipolar junction transistors.

ECE 474/574. Optical Fiber Communication. Lecture 3 hours; 3 credits. Prerequisites: ECE 323 and MATH 312. Electromagnetic waves; optical sources including laser diodes; optical amplifiers; modulators; optical fibers; attenuation and dispersion in optical fibers; photodectors; optical receivers; noise considerations in optical receivers; optical communication systems.

ECE 478/578. Introduction to Lasers and Laser Applications. Lecture 3 hours; 3 credits. Prerequisites: ECE 313 and MATH 312. Introduction and review of electromagnetic theory; atomic physics and interactions of radiation with matter; two- and three-level systems, and rate equations; gain; single-vs.-multimode; homogeneous and inhomogeneous broadening; Q-switching and mode-locking; semiconductor lasers; vertical cavity surface emitting lasers (VCSELs); Raman spectroscopy, remote sensing and ranging; holography; and laser ablation.

ECE 483/583. Embedded Systems. Lecture 3 hours; 3 credits. Prerequisite: ECE 346. This course covers fundamentals of embedded systems: basic architecture, programming, and design. Topics include processors and hardware for embedded systems, embedded programming and real time operating systems.

ECE 484W. Computer Engineering Design I. Lecture 3 hours; 3 credits. Prerequisite: A grade of C or better in ENGL 211C or 221C or 231C; ECE 302, 341 and ECE 346. Pre/corequisite: ECE 313, 381. Corequistie: ECE 443. Emphasis is on the design of a complex digital circuit and microcontroller interfacing. A semester-long project involves the design, simulation and testing of a digital architecture and software GUI. Several moderate scale digital modules are designed, simulated, implemented and tested during the semester. Design methods incorporate CAD design tools, implementation with advanced integrated circuit technology and contemporary software tools. Oral and written communication skills are stressed. (This is a writing intensive course.) (offered fall) (qualifies as a CAP experience).

ECE 485W. Electrical Engineering Design I. Lecture 1 hour; laboratory 4 hours; 3 credits. Prerequisite: A grade of C or better in ENGL 211C or 221C or 231C; ECE 302, 313. Corequisites: ECE 303, 304, 323, 332, and 381. Part one of the senior capstone design experience for electrical engineering majors. Lectures focus on providing professional orientation and exploration of the design process. Small group design projects focus on the development of electronic subsystems. Oral and written communication skills are stressed. (This is a writing intensive course.) (offered fall, spring) (qualifies as a CAP experience).

ECE 486. Preparatory ECE Senior Design II. Lecture 1 hour; 1 credit. Co- or Prerequisites: ECE 484W or 485W. The course is the preparatory, proposal development section of part two of the senior capstone design experience for electrical engineering and computer engineering majors. The course will focus on developing a proposal for a group design project. The senior design projects aim at developing engineering design skills of a complete computer/electrical system. Elements of developing a successful proposal are emphasized along with written communication skills. Industry-sponsored multi-disciplinary design projects are an option. (qualifies as a CAP experience).

ECE 487. ECE Senior Design II. Lecture 1 hour; laboratory 2 hours; 2 credits. Prerequisite: ECE 486. Part two of the senior capstone design experience for electrical engineering and computer engineering majors. In this course, students will implement the design proposal developed in ECE 486. The senior design projects aim at developing engineering design skills of a complete computer/electrical system. Oral and written communication skills are emphasized. Industry-sponsored multi-disciplinary design projects are an option.

ECE 488. ECE Senior Design III. Lecture 2 hours; laboratory 2 hours; 3 credits. Prerequisite: ECE 487. Part Three of the senior capstone design experience for electrical and computer engineering majors. Individual and group design projects focus on the development of complete electrical and computer systems. Oral and written communication skills are stressed. Industry-sponsored multi-disciplinary design projects are an option. (qualifies as a CAP experience).

ECE 491. Microelectronics Design Experience. 3 credits. Prerequisite: junior standing in electrical or computer engineering. This is a Virginia Microelectronics Consortium (VMEC) hands-on, state-of-the-art summer research experience. The VMEC internship provides excellent technical knowledge as well as industrial and academic contacts for career development. Students complete a 10-13 week summer project on a microelectronics research or design activity at an engineering school or in the State-of-the-Art Cleanroom of industry members of the VMEC at Micron Technology, Inc in Manassas, VA or at British Aerospace Engineering (BAE). For eligibility, the student has to apply to the VMEC program and must be selected as a VMEC Student Scholar in a competition held late in the fall semester of each academic year. Each student will be required to give a least two formal oral reports and one formal poster presentation summarizing the research results at the end of the summer session. The project must be completed at an institution other than Old Dominion University. Students will be supervised by faculty or industry mentors at the summer location, but must also have an Old Dominion University co-advisor and instructor of record for the course.

ECE 495/595, 496/596. Topics in Electrical and Computer Engineering. Lecture 1 to 3 hours; 1 to 3 credits each semester. Prerequisite: departmental approval.