Bradley Department of Electrical and Computer Engineering

Rising Junior Meeting
Spring 2018
Dr. Jaime De La Ree
ECE Advisors
Advising session agenda

- Course Request Dates
- EE and CPE New Majors
- ECE Departmental Policies (a reminder)
- Remaining Questions/Timeline

Main objective for today:
Introduce you to the new majors and provide information needed for Course Request.
Fall 2018 Course Request:

- Course request period
  - Tuesday, March 20 - Tuesday, March 27
- Add/drop period
  - Saturday, April 14 - Friday, May 25
  - Add/drop will reopen in early August

It is important that all students complete course request.
New major options for 2020 graduates

**BS Electrical Engineering**
- Electrical Engineering (general)
- Communications & Networking
- Controls, Robotics & Autonomy
- Energy & Power Electronics Systems
- Micro-Nanosystems
- Photonics
- Radio Frequency & Microwave
- Space Systems

**BS Computer Engineering**
- Computer Engineering (general)
- Chip-Scale Integration
- Controls, Robotics & Autonomy
- Machine Learning
- Networking & Cybersecurity
- Software Systems
Courses Common to All EE and CPE Majors

**First Year Courses (Common to all EE and CPE)**
- CHEM 1035 General Chemistry
- CHEM 1036 General Chemistry Lab
- ENGL 1106 First-Year Writing
- MATH 1226 Calculus of a Single Variable
- PHYS 2305 Foundations of Physics I
- ENGE 1216 Foundations of Engineering
- ECE 1574 Engineering Problem Solving w/ C++
- MATH 1114 or 2114 Linear Algebra

**Sophomore Level ECE Courses (Common to all EE and CPE)**
- ECE 2014 Eng Prof in ECE
- ECE 2004 Circuit Analysis
- ECE 2074 Circuit Analysis Lab
- ECE 2504 Intro to Computer Engineering
- ECE 2204 Electronics
- ECE 2274 Electronic Networks Lab
- ECE 2534 Microcontlr Prgrmng & Interfacing
- ECE 2704 Signals and Systems

**Other Courses (Common to all EE and CPE)**
- ISE 2014 Engineering Economy
- MATH 2214 Differential Equations
- MATH 2204 Introduction to Multivariable Calculus
- PHYS 2306 Foundations of Physics I
- ENGL 3764 Technical Writing
- STAT 4714 Probability and Statistics for EE
- Free electives (credits will vary)
Courses Common to All EE Majors

Other Courses Common to EE major options

- ECE 3004 AC Circuit Analysis
- ECE 3074 AC Circuit Analysis Lab
- ECE 3105 Electromagnetic Fields

EE Major Design Experience (common to all EE)

- ECE 4805 Senior Design Project
- ECE 4806 Senior Design Project
Almost every technology in modern life relies on electrical engineering in some way. Electrical engineers work with energy (including electricity, light, sound, and electromagnetic fields) and intelligence (algorithms, data, simulation, modeling, control). Although many of these phenomena are invisible, they extend the capabilities of modern life. EEs develop the tools and techniques to sense, measure, convert, transmit, control, and receive energy and intelligence. In doing this, EEs work on projects as small as mosquito-sized robots, to controlling massive, million-mile structures, such as the nation's power grid. EEs work closely with experts in many fields, including materials, chemistry, biology, medicine, physics, and other engineering disciplines. During a career, a single EE can work on remote sensing equipment to measure hurricanes, work on satellite communications, help improve the fuel efficiency of industrial engines, determine an algorithm to speed up a steel plant, and develop methods to protect the hearing of people working near jet engines.

EEs can work in product development, product testing, system management, sales, and consulting in industries including amusements, wireless communication, consumer electronics, power, transportation, manufacturing, automotive, chemical, pharmaceutical, defense and more. EEs have the option of staying in technical jobs or moving into administration and management. Some EEs become lawyers, doctors, and teachers. Some start their own firms.
**BSEE/Electrical Engineering**

**Typical Fall Junior Schedule**

- **ECE 3004 AC Circuit Analysis**
- **ECE 3074 AC Circuit Analysis Lab**
- **ECE 3105 Electromagnetic Fields**
- **ECE 3704 Continuous and Discrete System Theory**
- **ENGL 3764 Technical Writing**
- **STAT 4714 Probability & Statistics for EE**
BSEE/Communications & Networking

Typical Fall Junior Schedule

ECE 3004 AC Circuit Analysis
ECE 3074 AC Circuit Analysis Lab
ECE 3105 Electromagnetic Fields
ECE 3704 Continuous and Discrete System Theory
ENGL 3764 Technical Writing
STAT 4714 Probability & Statistics for EE
The foundational concept for controls, robotics and autonomy is to regulate processes, interact with the world, interpret information, learn, and make decisions without the need for continuous human intervention.

Control - the application of mechanisms to the operation and regulation of processes without continuous direct human intervention. Automatic control can be found in various applications, including manned and unmanned vehicles, robots, medical equipment, industrial processes, telecommunication systems, biotechnology and elsewhere. Examples: flight stabilization in manned air and spacecraft systems, rotor control in unmanned aerial vehicles, actuator control in humanoid robots and robotic manipulators, propeller control in autonomous underwater vehicles.

Robotics - Highly interdisciplinary area that applies knowledge from engineering and science to the design, construction, operation, and use of robots, as well as computer systems for their control, sensory feedback, information processing, and decision-making. Differentiated by their ability to interact with their environment and in some cases actively manipulate. Examples: unmanned aerial vehicles, unmanned ground vehicles, autonomous underwater vehicles, humanoid robots, etc., with applications including environmental monitoring, defense, disaster response, medicine, manufacturing.

Autonomy - an umbrella term for systems that perform behaviors or tasks without the need for continuous human intervention; An autonomous system may also learn or gain new knowledge like adjusting for new methods of accomplishing its tasks or adapting to changing surroundings; cope with environments with chaotic, unpredicted variables; can be seen as a spectrum from the fully human intervention to the completely autonomous system with no humans in the loop; a class of software that can respond to real world conditions automatically. This differs from traditional automation that requires predictable conditions to operate. Autonomous systems are often based on artificial intelligence because machine learning is required to model the complexity of real world environments. Examples: robots/vehicles with autonomous decision-making; smart infrastructure that automatically responds to environmental conditions; autonomous management of risk, quality and operations; human interaction through natural language.
Control, Robotics & Autonomy (con’t)

Career Paths? Higher Education Paths?
Control/automation engineer; robotics engineer;
Higher education paths are becoming more and more important for employment at robotics/autonomy startups and thrusts at large entities.

What do students need to know?
Machine learning; optimization; embedded systems; signals and systems;

Companies recruiting our graduates? Where are they located? Mostly West-Coast? DC Area? Government? Private?
Autonomous driving firms / startups: Ford (CA), Uber (CA), Aptiv (PA); NVIDIA (CA); Argo AI (PA); TORC Robotics (VA); GM (MI); Tesla (CA);
Google (CA); Qualcomm (CA); many others
Controls/Autonomy: Textron (Texas); General Dynamics;
Robotics firms / startups: Auro Robotics (CA); Aerotek (VA); Apple (CA); Amazon (CA); Boston Dynamics;
Defense contractors: Northrop Grumman (VA); Boeing (WA); Lockheed Martin (NJ, VA); SpaceX (CA);
Government: NASA; Air Force Research Lab (MD); Applied Physics Lab (MD); NAVAIR,
Good mixture of private / government, and small vs. larger businesses.

Starting salaries for BS, MS and PhD?
BS - average over control/automation engineer and robotics engineer - $70k
MS - average over control/automation engineer and robotics engineer - $80k
PhD - $100-$110k (slightly lower in academic positions)

What is the future of the area/major?
Aerial vehicles, vehicular networks, deep learning in robotics, autonomous decision-making, autonomous teams and swarms, human-robot interaction
BSEE/Controls, Robotics & Autonomy
Typical Fall Junior Schedule

- ECE 3004 AC Circuit Analysis
- ECE 3074 AC Circuit Analysis Lab
- ECE 3105 Electromagnetic Fields
- ECE 3704 Continuous and Discrete System Theory
- ENGL 3764 Technical Writing
- STAT 4714 Probability & Statistics for EE
The Energy and Power Electronics Systems (EPES) major embodies the present and future infrastructure that energizes the economy of the world. With the developments of the smart grid, the increase use of electric cars, energy storage, and alternative energy sources, EPES majors have a choice of jobs in a wide and diverse market. EPES can opt for the traditional monitoring, protection, control and planning jobs in electric utilities to the new and exciting jobs in green engineering and alternative energy start-ups.

Students are required to take a Junior introductory class and a lab on the modeling of basic components of power systems and power electronic devices. For their senior year EPES students are required to take a course on Power System Analysis and control where they used the models for the interlocutory class to analyze the operation of energy systems for steady state, transient, and dynamic conditions. They also take a power electronic class where they will learn about switching power converters; design of electronic power processing circuits and their control as applied to computer, telecommunication, transportation, and industrial systems. The students then can select courses in alternative energy, protection systems, smart grid, semiconductor processing, and electronic packages. The students complete their formation with a one-year senior design project focus on energy and power electronics applications to real world problems.
BSEE/Energy & Power Electronic Systems

Typical Fall Junior Schedule

- ECE 3004 AC Circuit Analysis
- ECE 3074 AC Circuit Analysis Lab
- ECE 3105 Electromagnetic Fields
- ECE 3704 Continuous and Discrete System Theory
- ENGL 3764 Technical Writing
- STAT 4714 Probability & Statistics for EE
BSEE/Micro-Nanosystems

Typical Fall Junior Schedule

- ECE 3004 AC Circuit Analysis
- ECE 3074 AC Circuit Analysis Lab
- ECE 3105 Electromagnetic Fields
- ECE 3214 Semiconductor Device Fundamentals
- ENGL 3764 Technical Writing
- STAT 4714 Probability & Statistics for EE

CLE Area 6
Photonics is about the science of generation, transmission, manipulation, and detection of light, as well as the use of light for a wide variety of applications, such as lighting, communication, imaging, and sensing. Some examples are light sources such as light emitting diodes and lasers, display technologies such as liquid crystal display, optical communication devices such as optical fibers, medical imaging, and machine vision systems and processing. In this major, the students will build a solid foundation of the fundamental principles of light and its interaction with materials. They will also be exposed to the latest innovations and applications. In the first two years, the Photonics curriculum will share with other majors the same common courses, including math, physics, electronics, circuit and signal processing. The Junior and Senior years will see advanced learning, such as electromagnetic waves (light as part of it), photonics (light-specific phenomena) and optoelectronics (light interaction with semiconductors for generation and detection).

Graduates can join the work force, or continue for graduate education. There are many career opportunities across the country, such as optical engineers in private sectors including IT and defense industries, and researchers in academia and government research agencies. Examples of employers are Apple, Google, Intel, IBM, Verizon, Cisco, Corning, Halliburton, Northrop Grumman, BAE Systems, MACOM, Hisense, Horiba, Air force/Naval research labs, and National Energy Technology Laboratory, among numerous others.
BSEE/Photonics
Typical Fall Junior Schedule

ECE 3004 AC Circuit Analysis
ECE 3074 AC Circuit Analysis Lab
ECE 3105 Electromagnetic Fields
ENGL 3764 Technical Writing
STAT 4714 Probability & Statistics for EE
Math Elective from list
Radio frequency (RF) & microwave engineering involves signals, devices, and systems in the range 300 kHz to about 300 GHz, with applications including communications, broadcasting, radar, navigation, RFID, remote sensing and astronomy, medical imaging, and electromagnetic compatibility. An important aspect of RF & microwave engineering is that the geometry and materials used in circuits are important considerations, so circuit theory alone is not sufficient. For example, the non-ideal behaviors of discrete resistors, capacitors, and inductors must often be considered, and often these components must be replaced with alternative devices employing wave principles. RF & microwave engineering also includes applications in which wave principles are of *primary* interest, including antennas and radio wave propagation. Successful RF & microwave engineers typically have strong backgrounds in circuits, electromagnetics, and communications / signal processing.

**Career opportunities**

Career opportunities include design, analysis, and test of RF circuits, antennas, radio wave communications links, and instruments for RF test, measurement, and metrology. RF & microwave engineers frequently find employment in organizations that develop RF components (including "passives", "actives", and integrated circuits), receivers & transmitters, wireless communications systems, and RF instruments. Opportunities exist in the industry, government, and non-profit/research/development sectors.
BSEE/Radio Frequency & Microwave
Typical Fall Junior Schedule

ECE 3004 AC Circuit Analysis
ECE 3074 AC Circuit Analysis Lab
ECE 3105 Electromagnetic Fields
ENGL 3764 Technical Writing
STAT 4714 Probability & Statistics for EE
Math Elective from list
The new ECE major in Space Systems Engineering is designed to prepare VT undergraduates for careers in the aerospace workforce. Opportunities comprise four main segments:

- Large and small companies like Northrop-Grumman, Lockheed-Martin, Orbital ATK, and Boeing.
- Smaller companies like Maryland Aerospace, Cubic, and AeroAstro.
- Government facilities and FFRDCs like NASA/JPL, NASA/Goddard, the Naval Research Labs, and AFRL.
- Universities with active space science and engineering graduate programs, including U. of Illinois, U. of Michigan, UC Berkeley, U. Colorado-Boulder, UC Santa Barbara, and Utah State.

Our goal is to prepare our graduates to immediately contribute to the workforce in the space systems area which involves designing, building, and testing components of spacecraft systems, and the associated flight computers, power systems, communications, attitude determination and control, and instrumentation. Systems engineering tasks involve integration and testing of all these systems into the spacecraft bus, plus environmental testing to verify that the systems can survive the stresses of launch and the radiation environment of space to meet required specifications during on-orbit operations.

Starting salaries vary depending on geographic locations and demand, but BS graduates can expect to start in the $70-80K range, while MS graduate salaries range from the low 80s to over $100K/year.
BSEE/Space Systems

Typical Fall Junior Schedule

ECE 3004 AC Circuit Analysis
ECE 3074 AC Circuit Analysis Lab
ECE 3105 Electromagnetic Fields
ENGL 3764 Technical Writing
STAT 4714 Probability & Statistics for EE
Math Elective from list
Bachelor of Science Degree in Computer Engineering

First Year Courses (Common to all EE and CPE)
- CHEM 1035 General Chemistry
- CHEM 1036 General Chemistry Lab
- ENGL 1105 First-Year Writing
- PHYS 2105 Foundations of Physics I
- ENGE 1214 Foundations of Engineering
- MATH 1225 Calculus of a Single Variable
- ENGE 1215 Foundations of Engineering
- ENGL 1106 First-Year Writing
- MATH 1226 Calculus of a Single Variable
- PHYS 2105 Foundations of Physics I
- ENGE 1216 Foundations of Engineering
- ECE 1574 Engineering Problem Solving w/ C++
- MATH 1114 or 2114 Linear Algebra

Sophomore Level ECE Courses (Common to all EE and CPE)
- ECE 2014 Eng Prof in ECE
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- ECE 2504 Intro to Computer Engineering
- ECE 2704 Signals and Systems

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- ECE 2004 Circuit Analysis
- ECE 2074 Circuit Analysis Lab
- ECE 2504 Intro to Computer Engineering
- ECE 2704 Signals and Systems

Other Courses Common to CPE major options
- ECE 2500 Computer Org & Arch
- ECE 2574 Data Structures & Algorithms
- ECE 3574 Applied Software Design
- MATH 2534 Intro to Discrete Math

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- ECE 2004 Circuit Analysis
- ECE 2074 Circuit Analysis Lab
- ECE 2504 Intro to Computer Engineering
- ECE 2704 Signals and Systems

Other Courses Common to all EE and CPE
- ISE 2014 Engineering Economy
- MATH 2214 Differential Equations
- MATH 2204 Introduction to Multivariable Calculus
- PHYS 2306 Foundations of Physics I
- ENGL 3754 Technical Writing
- STAT 4734 Probability and Statistics for EE Engineering and Science Elective
- Free electives (credits will vary)

Curriculum for Liberal Education (Common to all EE and CPE)
- Area 1: ENGL 1105 & ENGL 1106
- Area 2: Must choose 6c from approved list
- Area 3: Must choose 6c from approved list
- Area 4: PHYS 2305 & PHYS 2306
- Area 5: MATH 1225 & MATH 1226
- Area 6: Must choose 1c from approved list
- Area 7: Must choose 3c from approved list

This information is based on the 2020 checksheets. Students should consult the appropriate major approved checksheet for the recommended scheduling of classes.
Courses Common to All CPE Majors

Other Courses Common to CPE major options
- ECE 2500 Computer Org & Arch
- ECE 2574 Data Structures & Algorithms
- ECE 3574 Applied Software Design
- MATH 2534 Intro to Discrete Math

CPE Major Design Experience (common to all CPE)
- ECE 4534 Embedded System Design
Computer engineers embed computers in other machines and systems, build networks to transfer data, and develop ways to make computers, faster, smaller, and more capable. Computer engineers are improving the ability of computers to "see" and "think." They are making computers more mobile, and even incorporating computers into fabrics, clothes, and building materials.

Computer engineers are concerned with analyzing and solving computer-oriented problems. CPEs understand both the hardware and the software of computers. This enables them to choose the solution that is best, not just the one they know. Sometimes the answer to making a program more efficient is a change in the computer itself. Sometimes it’s cheaper and faster to change the software than the hardware. The knowledge of both the "body" and the "mind" of a computer helps computer engineers work at the microscopic level and on a large, system-wide scale.

Computer engineering graduates typically have some of the highest starting salaries in engineering. Computer engineers have the option of moving into hardware or software positions, or blending the two. Typical industries hiring computer engineers, include financial services, computer manufacturers, chemical companies, defense contractors, consulting, transportation, manufacturing, and consumer goods. Computer engineers are equally successful in large multinational firms and small startups.
BSCPE/Computer Engineering

Typical Fall Junior Schedule

- ECE 2204 Electronics
- ECE 2274 Electronic Networks Lab
- ECE 2704 Signals and Systems
- ECE 3544 Digital Design
- ECE 3574 Applied Software Design
- CLE (Area 2, 3, or 7)
Chip-scale integration uses the advances in integrated digital and analog electronics to improve state of the art in electronic circuits. Chips are a fundamental, enabling technology in applications that require very high efficiency and performance. Chips are at the heart of mobile applications and on the Internet of Things because they get the job done at a fraction of the energy cost of traditional board-level solutions. Chips are also at the heart of scientific supercomputing, data-crunching, and machine-learning because chips offer unprecedented computational performance and storage density. Finally, chips integrate novel sensor technologies with intelligence and give us novel capabilities in sensing and understanding our world. Chips are essential for a myriad of application domains such as communications, networking, automotive, industrial control, robotics, medical instrumentation, smart grid, smart home, and the Internet of Things. Chip-scale integration students have the opportunity to apply their skill in any of these domains.

Many of the chip-scale integration graduates become chip designers. Modern chips contain millions to billions of transistors, making chip designers the architect of structures as complex as cities. Dealing with this design complexity requires insight, an analytical mind, creativity, and team-work. Chip designers face technological challenges across multiple levels of abstraction including circuit-level, register-transfer level, micro-architecture level, architecture level and platform-level. Some of these challenges can be solved using the fundamental laws of electrical engineering, while others require the latest in computer-engineering and hardware-software codesign. Companies such as Intel, Qualcomm, Texas Instruments, Apple, as well as many others have extensive in-house chip-design activities.
Another group of chip-scale integration graduates becomes tool designers. Modern chips are well beyond the complexity level of manual design. Modern chip design is highly automated with tools that enable chip designers to describe, simulate, synthesize and verify integrated circuits. Automation is essential to meet productivity needs: a typical design cycle for a complex chip may allow for only a few months, even when the chip itself contains several millions of logic gates. Furthermore, chip design does not tolerate mistakes. Unlike software, integrated circuits cannot be fixed or updated after manufacturing. Even the smallest mistake left in a design may result in a re-spin costing millions of dollars. This requires tools that verify and test the correctness of chip design at every abstraction level. Chip-scale integration students that focus on design automation have deep technological insight into chip design as well as excellent software development skills. Companies such as Synopsys, Mentor Graphics, Cadence, and many others built commercial chip-design software.

Finally, chip-scale integration is extremely knowledge-intensive and research-intensive, since the technology keeps on evolving towards higher integration densities and the use of novel technologies. Chip-scale integration graduates have excellent prospects towards graduate school, or in long-term research positions in a company.
Typical Fall Junior Schedule

ECE 2204 Electronics
ECE 2274 Electronic Networks Lab
ECE 3004 AC Circuit Analysis*
ECE 3074 AC Circuit Analysis Lab*
STAT 4714 Probability and Statistics for EE
CLE (Area 2, 3, or 7)

*ECE 3004 requires prerequisite of ECE 2704 Signals and Systems. Students who have not yet completed ECE 2704 should complete ECE 2704 in Fall semester and delay ECE 3004/3074 to Spring. See your advisor with any questions.
The foundational concept for controls, robotics and autonomy is to regulate processes, interact with the world, interpret information, learn, and make decisions without the need for continuous human intervention.

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Control, Robotics & Autonomy (con’t)

Career Paths? Higher Education Paths?
Control/automation engineer; robotics engineer;
Higher education paths are becoming more and more important for employment at robotics/autonomy startups and thrusts at large entities.

What do students need to know?
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Companies recruiting our graduates? Where are they located? Mostly West-Coast? DC Area? Government? Private?
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Controls/Autonomy: Textron (Texas); General Dynamics;
Robotics firms / startups: Auro Robotics (CA); Aerotek (VA); Apple (CA); Amazon (CA); Boston Dynamics;
Defense contractors: Northrop Grumman (VA); Boeing (WA); Lockheed Martin (NJ, VA); SpaceX (CA);
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Good mixture of private / government, and small vs. larger businesses.

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BS - average over control/automation engineer and robotics engineer - $70k
MS - average over control/automation engineer and robotics engineer - $80k
PhD - $100-$110k (slightly lower in academic positions)

What is the future of the area/major?
Aerial vehicles, vehicular networks, deep learning in robotics, autonomous decision-making, autonomous teams and swarms, human-robot interaction
BSCPE/Controls, Robotics & Autonomy
Typical Fall Junior Schedule

ECE 2204 Electronics
ECE 2274 Electronic Networks Lab
ECE 2704 Signals and Systems
ECE 3574 Applied Software Design
STAT 4714 Probability and Statistics for EE
CLE (Area 2, 3, or 7)
Machine learning is a field that aims to give computer systems the ability to “learn” with data without being explicitly programmed. In the past few years, machine learning techniques have made a wide impact on many fields of science and engineering, giving us self-driving cars, practical speech/visual recognition, effective web search, and a vastly improved understanding of the human genome. Machine learning has also powered computer systems to reach or surpass human-level performance on face recognition and the ancient game Go. Machine learning is considered as a promising path to human-level AI.

Career opportunities in Machine Learning:
- Software engineering
- Data scientist
- Machine learning/Computer vision scientist
- Machine learning/Computer vision engineer
BSCPE/Machine Learning
Typical Fall Junior Schedule

ECE 2204 Electronics
ECE 2274 Electronic Networks Lab
ECE 2704 Signals and Systems
ECE 3574 Applied Software Design
ENGL 3764 Technical Writing
STAT 4714 Probability and Statistics for EE
Career Path: VT ECE student graduating with a bachelor’s degree majoring in networking and cybersecurity should be able to find ample employment opportunities in industry and government agencies. Many of our graduates join major IT companies (e.g., Google, Facebook, Microsoft, Cisco, Qualcomm) and numerous small and medium companies. There is a serious shortage of graduates with US citizenship who are qualified for positions in government agencies (e.g., DoD) and defense industry (e.g., Raytheon, Lockheed, Boeing, L-3 Communications). Starting salaries vary depending on industry sectors and locations and grows rapidly with experience. Newly graduated students can expect their salary offers noticeably higher than students from most other engineering majors and disciplines.

For students wishing to pursue graduate degrees, there are ample graduate programs on networking and cybersecurity to choose from among US universities. Many employers in industry and government agencies also offer paid tuition benefits if the employees wish to pursue graduate degrees on a part-time basis.

Future Prospect: Networking and cybersecurity major is the backbone of IT industry. Given that IT is the main driving force for today’s economic growth, the future of this field and employment prospect will continue to experience significant growth.
BSCPE/Networking & Cybersecurity

Typical Fall Junior Schedule

- ECE 2204 Electronics
- ECE 2274 Electronic Networks Lab
- ECE 2704 Signals and Systems
- ECE 2500 Computer Organization and Architecture
- ECE 3574 Applied Software Design
- STAT 4714 Probability and Statistics for EE
The software systems major focuses on how to write large, complex, software systems for a variety of application domains ranging from machine learning to cyber-physical systems to infrastructure software, targeting various form factors — from enterprise level servers to embedded devices. An important focus is understanding hardware/software interaction, how the interplay between the two affects various metrics of interest (e.g., performance, timing, failures), their interaction with other electro-mechanical systems, and how numerous hardware features, besides software design tradeoffs, are exploited for designing and implementing software.

The major focuses on decomposing problems, hiding complexity by organizing code into modules and libraries, and selectively revealing that complexity through interfaces. An important part of this process is abstraction, testing, debugging, and documenting these interfaces. Another important aspect of the major is learning about the details of highly complex infrastructure software systems (e.g., the Linux kernel), and understanding how such systems exploit abstraction and modularity to manage complexity. There is also a focus on learning the tools of professional programmers working on large teams.

Students selecting a primary concentration in software systems are typically interesting in working as a software engineer or software architect full time. Students selecting it as a secondary concentration are interesting in jobs that have a large programming component, but involve other related technological areas.
BSCPE/Software Systems
Typical Fall Junior Schedule

ECE 2204 Electronics
ECE 2274 Electronic Networks Lab
ECE 2704 Signals and Systems
ECE 3574 Applied Software Design
STAT 4714 Probability and Statistics for EE
CLE (Area 2, 3, or 7)
ECE Department Policies:
Force-Add Policy

- ECE force-add requests will be accepted **ONLY** from students who are **eligible to take ECE courses** but are unable to request certain ECE course(s) during the Course Request period due to a prerequisite or class restriction. Incomplete or ineligible surveys will not be reviewed and will be deleted with no notification to the student.

- ECE does not accept force-add requests based on professor, time or location preference.

- The force-add surveys for undergraduate and graduate courses will open each semester the day before Course Request and close at 5:00 pm on the Friday before the first day of classes. No force-add requests will be accepted after this date. All decisions will be made by the second day of classes. Students with approved force-adds will be notified by the second day of classes.

- During the summer, ECE classes will be opened to class capacity. This means that if the timetable is showing a course as full, then it is full to capacity and we cannot and will not add additional students.
ECE Department Policies: C- Prerequisite Policy

- CPE and EE students must earn C- or better grades in all prerequisite courses.
  - Examples:
    - MATH 1225 is a prerequisite for ECE 1574.
    - ECE 1574 is a prereq for ECE 2504 and ECE 2574.
    - ECE 2004, ECE 2074 and MATH 2214 are prereqs for ECE 2704.
  - Refer to the *Timetable of Classes* for corequisite and prerequisite information and restrictions.
  - Important distinction –
    - What is the grade point for a C-?
Students must meet minimum university, program and/or department specific criteria to be certified as making satisfactory progress toward a degree.

60 hour ECE review (when students have attempted 60 hours):
- CPE majors must have satisfactorily completed:
  - ECE 2014, ECE 2504 or 2574, MATH 2214 and (2204 or 2534), and PHYS 2306
- EE majors must have satisfactorily completed:
  - ECE 2014, ECE 2004, MATH 2214 and 2204, and PHYS 2306

90 hour ECE review (when students have attempted 90 hours):
- CPE majors must have completed a minimum of 35 in-major course credits.
- EE majors must have completed a minimum of 33 credits of in-major course credits (including ECE 2534).
- Both majors must have earned minimum 2.0 cumulative and in-major GPAs.
Timeline for approval of new majors

- The new majors are in the final steps of approval with the University. We should have final approval by the end of the month. Students will be notified of final approval via the ECE Undergraduate Listserv and via the ECE home page.

- Anticipated Questions:
  - Who can I talk to get more information regarding a specific major?
    - Answer: We will have a list of faculty contacts for each major available soon.
  - How can I declare my major?
    - Answer: We are still working with the Registrar’s office on determining this process. As soon as we have a definitive answer, we will provide that information through the ECE Undergraduate Listserv and on the ECE home page.
  - Where can I get a checksheet?
    - Answer: Official checksheets will be available on the Registrar’s homepage following final approval. In the meantime, you can request an unofficial checksheet from your ECE advisor or by emailing eceadvise@vt.edu.

- Other Questions???