Welcome to the Department of Electrical Engineering and Computer Science, where great people learn how to do great things with technology!

The U.S. Army succeeds by exploiting cutting-edge technology better than any other army in the world. Today, the rise in importance of the Cyber Domain of warfare is fundamentally changing the nature and opportunities of Army leadership. Our courses provide a foundation critical for leadership in this Army of the twenty-first century. We also prepare our cadets for admission to top graduate schools and enable them to embrace the challenge of life-long learning. ABET accreditation keeps our electrical engineering, computer science, and information technology majors at the forefront of undergraduate education in America.

Cadets who major in our programs select from a rich collection of exciting subjects, including software design, robotics, cyber security, electronics, information systems, telecommunications, computer networks, and systems integration.

Our senior project program for each major is second to none. Interdisciplinary teams design and build systems that consistently win national competitions and meet real needs of customers throughout the Army, DoD, and for National agencies.

For majors in other departments, the Cyber Engineering Sequence introduces cadets to the secure design, implementation, and defense of information systems. The Electrical Engineering Core Engineering Sequence emphasizes the study of electronic and robotic systems with enormous future implications for the Army.

Learn about the technologies that underlie the world where you live and the Army where you will lead the world’s best soldiers! Prepare yourself for the future by selecting an EECS major or sequence!

Our department is committed to the best possible education for cadets at West Point. We ensure that our courses are current, comprehensive, challenging, and exciting. Our modern undergraduate laboratories are excellent. Graduates of our nationally accredited programs rank with those of the best schools in the country.

Come join us. We’ll be happy to see you!

James J. Raftery, Jr., Ph.D.
Colonel, Professor USMA
Head of the Department

United States Military Academy

The Academy provides a broad undergraduate education leading to the Bachelor of Science degree and ensures that each graduate can meet the physical, military, intellectual, and ethical challenges that a U.S. soldier and leader may face.

Mission

USMA Mission: To educate, train, and inspire the Corps of Cadets so that each graduate is a commissioned leader of character committed to the values of Duty, Honor, Country and prepared for a career of professional excellence and service to the Nation as an officer in the United States Army.

Academic Program

The United States Military Academy envisions that graduates will be . . . commissioned leaders of character who, in preparation for the intellectual and ethical responsibilities of officership, are broadly educated, professionally skilled, morally ethical and physically fit, and are committed to continued growth and development both as Army officers and as American citizens.

Goals:

The Overarching Academic Program Goal: Graduates integrate knowledge and skills from a variety of disciplines and respond appropriately to opportunities and challenges in a changing world.

The seven Academic Program goals are as follows:

- Communication: Graduates communicate effectively with all audiences.
- Critical Thinking & Creativity: Graduates think critically and creatively.
- Lifelong Learning: Graduates demonstrate the capability and desire to pursue progressive and continued intellectual development.
- Ethical Reasoning: Graduates recognize ethical issues and apply ethical perspectives and concepts in decision making.
- Science, Technology, Engineering, and Mathematics: Graduates apply science, technology, engineering, and mathematics concepts and processes to solve complex problems.
- Humanities and Social Sciences: Graduates apply concepts from the humanities and social sciences to understand and analyze the human condition.
- Disciplinary Depth: Graduates integrate and apply knowledge and methodological approaches gained through in-depth study of an academic discipline.
Each cadet completes a broad core curriculum that covers the humanities, social sciences, basic and applied sciences, and engineering. Most of the Academy’s curriculum objectives are accomplished through 30 core courses distributed among math, science, engineering, humanities, social sciences, and information technology. Taking at least 10 electives in a chosen field satisfies the requirement for study in depth. Including the core curriculum, each cadet has the opportunity to pursue a 40 to 44 course program that leads to a major in a discipline supported by one of the thirteen academic departments.

The Department of Electrical Engineering and Computer Science supports the Academy’s intellectual outcome and academic study-in-depth program goals by providing cadets a broad foundation in electrical engineering, computer science, or information technology. Our department’s mission is to educate and inspire cadets to be leaders of character, prepared to think critically and apply engineering and technology expertise as Army Officers. In order to accomplish this mission, we have adopted the following goals.

**Department of Electrical Engineering & Computer Science goals:**

- Our graduates possess knowledge of state-of-the-art engineering and technology that meets Army needs; they are able to master and apply new technologies throughout a career of service.
- Our teaching makes cadets responsible for their own development in an environment of exceptional resources, guidance, and encouragement to succeed.
- Our programs are nationally accredited and highly regarded within the community of college education.
- Our faculty and staff are a diverse team of professionals, each making his or her personal best contribution to our mission and valuing the contributions of others.
- Our climate prizes initiative, innovation, and accomplishment for the department team, underpinned by enthusiasm for learning in all our disciplines.
- Our centers of excellence integrate externally resourced, Army-relevant research and outreach projects with cadet education and faculty professional development.
- Our organization is kind and fair to people, assigning work equitably, honoring preference, rewarding excellence, and enabling continued professional success.
- Our support activities provide a practically constraint-free environment for accomplishing the mission.

Through these departmental goals, the Electrical Engineering, Computer Science and Information Technology programs provide a basic technical understanding of modern society, develop creative problem-solving techniques, provide an understanding of the engineering thought process, instill a solid technical background for further study within the disciplines, and enhance communication skills.

The United States Military Academy provides cadets the opportunity to participate in summer training, enabling them to apply the academic skills learned in the classroom. The Department of Electrical Engineering and Computer Science sponsors the academic individual advanced development (AIAD) program for cadets interested in majoring or taking a sequence in Electrical Engineering, Computer Science and Information Technology. Cadets conduct world-wide research in Army, Department of Defense, National, and other government or civilian laboratories under the direct supervision of a research scientist or engineer.

Recent participants in the program include:

<table>
<thead>
<tr>
<th>Organization</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Security Agency</td>
<td>Army Research Labs</td>
</tr>
<tr>
<td>National Reconnaissance Office</td>
<td>US Cyber Command</td>
</tr>
<tr>
<td>MIT Lincoln Laboratory</td>
<td>Facebook</td>
</tr>
<tr>
<td>Institute for Creative Technologies</td>
<td>Cisco</td>
</tr>
<tr>
<td>Boeing</td>
<td>IBM (UK)</td>
</tr>
<tr>
<td>Def. Adv. Research Projects Agency</td>
<td>FBI</td>
</tr>
</tbody>
</table>

Areas of research include:

- Signal processing and analysis
- High speed parallel computing
- Simulation and virtual reality
- Network analysis
- Optical engineering
- Artificial intelligence
- Distributed databases
- Microcontrollers
- Control systems
- Satellites
- Robotics
- Cybersecurity
Research Opportunities

The Photonics Research Center (PRC) studies applications of light-based technologies to solve Army/DoD problems. From advanced night vision systems to help soldiers “see in the dark” to laser based communications to opto-electronic signal processing, the PRC conducts basic and applied research in the area of lasers and photonics. The center is interdisciplinary and a consortium of the Electrical Engineering & Computer Science, Physics and Chemistry Departments. The PRC brings together a unique combination of personnel including Ph.D. faculty, rotating military faculty, and enthusiastic cadets from the three departments. Established in 1987, the research center has a world-class research program and is recognized by the National Research Council as an approved postdoctoral research site. EE&CS research projects include investigation of silicon optoelectronic circuits; fabrication and characterization of optical and optoelectronic devices; photonic analog-to-digital conversion; optical digital image half toning; and all optical fiber switching. The research programs and student projects use an assortment of commercial high and low power, tunable lasers. The Photonics Research Center also collaborates with Army research and development programs and conducts research in support of specific Army requirements. In its support role, the PRC provides direct technical support to the Army Research Office, Army Research Laboratory, Edgewood Chemical and Biological Command, U.S. Army Special Operations Command, National Reconnaissance Office, National Security Agency, Defense Threat Reduction Agency, Ballistic Missile Defense Office, Natick RDT&E Center, Program Executive Offices, National Missile Defense Program, Ground Based Radar System, and the Department of Energy. The PRC receives external funding from several agencies such as the Army Research Office and the Defense Advanced Research Projects Agency.

The Cyber Research Center’s primary mission is to support the USMA educational mission through curriculum development, research, and outreach to Army, DoD, and federal agencies. The primary focus areas for the center are the acquisition, use, management, and protection of information. To address the many challenges that our Army and Nation face in these areas, the CRC brings together a unique combination of personnel including senior faculty at the Ph.D. level, rotating military faculty with Masters degrees, and enthusiastic and highly motivated undergraduate cadets. Current research areas for the CRC include: cyber warfare, information security, online privacy, usable security, and security data visualization. As the nation’s first undergraduate institution recognized as an NSA Center of Excellence in Information Assurance Education a major emphasis of the center is the annual, NSA-sponsored, Cyber Defense Exercise. Sponsors of CRC research programs include the National Security Agency, US Cyber Command, Army Cyber Command, the Department of Defense Information Assurance Program, the National Reconnaissance Office, and Army Program Managers. In addition to project, research, and outreach work, the CRC is involved in teaching Computer Science and Information Technology courses at USMA, organizing academic workshops and conferences, and sponsoring the cadet run West Point chapter of the ACM Special Interest Group for Security, Audit, and Control (SIGSAC – the information warfare club) as well as C3T (Cadet Competitive Cyber Team).

The Robotics Research Center is the Academy’s resource for expertise and academic scholarship in the field of robotics that enables interdisciplinary cooperation and concentrates Academy-wide research efforts in robotic systems. The center supports margin-of-excellence educational, scholarship, and extracurricular activities focused on autonomous systems to educate and inspire leaders of character who are prepared to think critically, innovate, and apply robotic systems in the Army. The center is also a host for a drone racing team where cadets may compete while learning the field of robotics.
Laboratory Facilities

The Department of Electrical Engineering and Computer Science has many resources to provide a high caliber of instruction to cadets. The department maintains facilities that provide everything from general support to specialized instruction.

Computer Laboratories

**General Purpose Computing Labs.** Nine laboratories are used primarily for IT105 and CY305. IT105 is the core introductory information technology course taken by all freshmen; CY305 is the core course taken by all juniors who are not majoring in engineering or CS. Common software utilization in these courses includes the Microsoft Office suite of office productivity tools, Python programming tools and development environment, and a host of network access tools including web browsers. Instruction that occurs in these laboratories utilizes both wired and wireless networks and students receive and submit assignments electronically.

**Special Purpose Computing Labs.** Three laboratories are typically used for courses taken by both majors and non-majors in the Information Technology Program and the Computer Science Program. Common software utilization includes Eclipse, JUnit, Scalac, Wingman Python IDE, IDLE Python GUI, Ruby and its Rails framework, and the X-ming X-server package to interface with the department’s Red Hat Enterprise Linux servers and resources.

**Cyber Engineering Network Labs.** The two Cyber Engineering Laboratories each contain 42 Cisco 2900 series routers, 42 Cisco 3560 Switches, 21 MacMini servers and 21 HP server class desktop computers. From individual desks in the room, students can configure their own router, switch, and server combination to apply concepts covered in networking courses. The hardware is all part of an “air-gapped” network that provides maximum learning potential in a risk-free environment. The room also has wired and wireless access to the department and Academy networks to support classroom activities that require standard networked resources.

**Linux Lab.** One laboratory contains 22 workstations running Red Hat Linux with Gigabit Ethernet connections to department file and computer servers.

**Advanced Studies Lab.** The Advanced Studies Laboratory (ASL) is configured on demand for specific student and faculty research projects. It has twenty-four network ports and equipment to meet various requirements including Macintosh computers, UNIX systems, and a multimedia station. Support technicians can configure workstations in the ASL to interface with the rich server resources available within the department according to the individual needs of students and faculty.

**Information Warfare Analysis and Research (IWAR) Laboratory / Cyber Defense Exercise Lab / Classroom XXI.** This laboratory is part of an Army-wide distance education initiative. The laboratory is equipped with video cameras throughout the room, including one at each of the 18 student workstations. Classroom activity can be recorded and/or broadcast to other similarly enabled classrooms on various Army installations.

This laboratory also hosts the CS482 Cyber Security course for IT & CS majors and is used for various faculty and student research projects. Student teams learn about information assurance concepts and conduct practical exercises in the laboratory on a LAN which is not connected to the departmental LAN and is not connected to the Internet to prevent accidental damage to production resources.

A wide variety of servers and workstations support this laboratory; each student team participating in the course is assigned a desk that includes a workstation running Windows 10 and a KVM switch that allows them to connect to a server on the isolated LAN. Those servers, running Windows Server Web or Standard edition, host independent virtual machines for other operating systems including Red Hat Linux. Using these different environments, students learn to defend against and conduct attacks on a “victim” network composed of servers, workstations, and network components of various architectures and operating systems.

Other computer science and information technology elective courses are also taught in this laboratory using the workstations with a standard laboratory image. Accordingly, the laboratory has wired and wireless access to the department and Academy networks to support classroom activities that require available networked resources. Students use the KVM switch to alternate between machines that interface with the standard network and the information assurance LAN.

This laboratory also houses many servers and workstations that are not connected to the departmental LAN or to the Internet. The machines can be specially configured to support student projects or faculty research that may not be appropriate for the department’s network. Projects include running and analyzing malware and performing detailed network analysis.

**Servers.** Numerous servers provide infrastructure services including database servers, file servers, web servers, license servers, a print server, administrative servers for scanning, and patching and monitoring departmental assets. The server environment is self contained with climate control, humidity control, an uninterrupted power supply, and a Sensaphone device for contacting support personnel in emergency situations. Principal server resources include the following:

- Four Linux servers including 1 Dell PowerEdge R510 and 3 Dell PowerEdge 710 models
• Three VMware ESXi servers Dell PowerEdge R730 models, supporting 33 Windows 2012 R2 and 8 Red Hat virtual servers.
• Together these servers host 5 SharePoint Servers, 3 Microsoft SQL servers, 6 file servers and multiple EECS required applications servers.
• A Storage Area Network with a capacity of approximately 82 terabytes
• One Dell ML6000 Tape Library with 64 terabytes of storage that is physically separated for catastrophe management.

Server resources are separated into three categories: student development, production environment, and administrative support so that the data and applications from the categories do not overlap on the same physical device. This separation provides maximum flexibility to students and teachers while minimizing the risk of data loss or exposure to malicious users. The department uses the distributed file system and server proxies to present a logically connected, intuitive interface to the students and faculty so that the physical separation is transparent.

The EECS Department has taken significant steps to improve technical support to its programs through a private cloud. The EECS Cloud provides a pool of configurable computing resources shared by staff and faculty as well as cadets. It is based on the VMware vSphere Enterprise Plus suite of tools, comprised of six servers providing fault tolerance and a EMC SAN, all on a 10GB Ethernet network. The EECS Cloud creates a high availability environment with access to virtualized servers and storage in its initial rollout, and will eventually include applications and networks.

Our motivations are typical for organizations which are transitioning from a high server density, direct attached storage environment to cloud services. Among them are rapid provisioning of resources, flexibility, and cost savings. Rapid provisioning of servers with minimal management overhead allows department members to more effectively engage in varied teaching and research initiatives. The uncertainty of future equipment needs, and the ability to meet those needs in a timely fashion, is mitigated with our ability to efficiently provision server and storage resources. Lower costs in infrastructure (power, HVAC, and potentially service technicians) will also result from a reduction in the number of physical machines supporting our programs.

**Electrical Engineering Laboratories**

The electrical engineering laboratories at West Point are among the best undergraduate electrical engineering laboratories in the country. They contain state-of-the-art equipment with a total value in excess of $10 million and provide ready access to modern engineering hardware tools such as Keysige instruments and software tools such as Cadence PSpICE; NI LabView & MultiSim; NETWARS & OPNET; Mathworks MATLAB & SimuLink; Altera Quartus II; and Agilent IC-CAP, BenchVue & LogicWare.

**Electronics Laboratory I & II.** These laboratories provide opportunities in low-to-mid frequency electronic circuit design and analysis. They also offer the student the capability to design, build, and test microelectronic devices: diodes, field effect and bipolar junction transistors, and integrated differential and discrete operational amplifiers. These labs are used in the Introduction to Electrical Engineering, Basic Electrical Engineering, Introduction to Electronics, and Electronics Design courses.

**Digital Logic and Computer Architecture Laboratory.** This lab also serves as a classroom and is fully equipped with digital trainers, workstations, and software capable of programming digital systems, such as Field Programmable Gate Arrays (FPGAs), single-board computers, and microcontrollers. Students in Digital Computer Logic, Computer Architecture, and Embedded Systems use this lab.

**Control Systems Laboratory.** This laboratory provides facilities to support hardware design and experimentation experience for feedback controls system study. This lab supports the Dynamic Modeling and Control course.

**Network and Communications Laboratory.** Provides facility and equipment to support communications circuit and network design and analysis. Provides capability and support for audio, video and data analog communication, digital communication, network communication, digital signal processing, software defined radio, and radio frequency communications in the HF, VHF and UHF bands. Automatic measurement instrumentation with the following general capabilities: network analysis up to 26.5 GHz; noise figure; spectrum analysis to 50 GHz. This lab supports the communications systems courses.

**Robotics Research Center (RRC).** The RRC consists of three laboratories and an administrative office, all of which are conveniently located within Thayer Hall. Its mission is to provide cadets an unparalleled educational opportunity to design, build, and operate a wide variety of ground and aerial robotic platforms so that they are better prepared to lead in an Army more reliant on unmanned systems.

**Aerial Robotics Laboratory.** This lab supports the research, development and testing of robotic systems. With a mezzanine and high ceiling, the laboratory is well-suited for the testing of aerial drones. The lab is equipped with measurement and testing tools including a camera based visual tracking system and a global positioning system simulator. Students in the Robotics depth thread depth option and senior design projects use this lab.

**Mechatronics and Embedded Systems Laboratory.** This lab provides cadets with the ability to design, build, and test mechatronic and embedded systems. The lab contains workstations, digital oscilloscopes, dynamometers, microcontrollers, single-
board computers, robots, actuators, and an array of sensors. The accessibility of these components offer cadets an unparalleled ability to explore the programming and interfacing of electronics inherent with the fields of robotics, mechatronics, and embedded systems. Students in the Robotics depth thread depth option and senior design projects use this lab.

**Robotics Capstone and Independent Study Laboratory.** Provides facility and equipment to support robotic system engineering and an advanced capability to support undergraduate design and research projects in robotics. Students working on senior capstone projects and independent research studies utilize this lab.

**Photronics Engineering Laboratory.** This lab contains lasers, oscilloscopes, spectrum analyzers, and other equipment for the generation of optical signals and their transmission through free space and fiber optic cables. The equipment provides cadets with hands-on demonstrations of the fundamentals of geometrical optics, lasers, LEDs, photodetectors, holography, and fiber optic communication systems. The Photronics Lab is primarily used by the Photronics Engineering and Fiber Optic Communications courses as well as by students working on senior design and independent study projects.

**Power Engineering Laboratory.** This laboratory contains integrated workstations for the study of AC and DC power fundamentals: generation, transmission, transformation, utilization, and systems. The lab also includes a test station for the characterization of small DC motors consisting of a 160A DC power supply, dynamometer, and torque/speed controller. Students in the Electric Power Engineering and Mechatronics courses and students working on senior design projects use this lab.

**Engineering Support Laboratories.** These labs include facilities for rapid prototyping of printed circuit boards, computer aided machining and general engineering support. They provide cadets and faculty the ability to design and construct enclosures for projects, create mockups and models of electronic devices, and design, layout and fabricate printed circuit boards. The staff of experienced machinists and electronics technicians is available to advise and assist in these projects. These facilities are used extensively by cadets working on senior design and independent study projects.

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**The Electrical Engineering Program**

**Electrical Engineering** is the underlying discipline that enables many of the technological innovations in modern society. On the battlefield, these innovations directly support the warfighter. Our Army is fighting a global war on terror while also preparing for major conventional operations and cyber operations.

Army transformation and modularization is heavily invested in advanced technology to lighten the force while increasing its lethality and survivability. The general categories of technological innovations include computer, communications, and network technologies for cyber operations, unmanned vehicle and robotic technologies to reduce battlefield exposure, laser and advanced optical systems, advanced and distributed sensors to provide improved multispectral sensing, global positioning and guidance systems for precision strike capability, electric and hybrid power systems for propulsion and weapons - just to name a few. **Electrical Engineering** is the enabling discipline for these and many other technological innovations.

The Army needs technically competent leaders in all branches and at all echelons who understand the underlying concepts and can effectively employ these new technologies. Leaders will have to understand and exploit all the tools at their disposal in an increasingly complex battlefield environment.

The courses you will take in our electrical engineering curriculum are directly applicable to the Army you will lead. You have a unique opportunity to define your future through your course of study at West Point. Becoming an electrical engineer is challenging; being an electrical engineer is both challenging and rewarding. We look forward to including you as a member of our team! Don’t take my word for it. Here are some emails from graduates.

**Nicholas Barry, MAJ, EN, Commander HHC, 40th BN, HAVOC!, Class of 2006**

“I believe that I have discussed the benefits of my EE education with you before after my first deployment. In my second one (Afghanistan this time), I used those skills even more…I designed and built the entire power grid on the COP…We set up our own AFN so that we could watch TV. Aligning that dish took some math and at least a rudimentary understanding of how satellite signals work. It helps to be able to look at simple circuit boards and determine what they might have been used for. While it is an uncommon tactic for the enemy to use, it does happen”

-Hang Li, Armor, Class of 2009

“I branched armor and … in Mar 2010 I reported to my unit, 2nd Cavalry Regiment (Stryker BCT), in Vilseck, Germany, and in June I deployed to Afghanistan as a Scout Platoon Leader, almost exactly 1 year after I graduated. … The engineering mind set and problem-solving attitude was definitely instrumental in helping me get through my 1 year deployment as a PL.”

-Aaron St. Leger, Ph.D.
Associate Professor
Electrical Engineering Program Director

Aaron St. Leger
Opportunities in Electrical Engineering

Electrical Engineers design and build many of the warfighting systems that enable the Army to dominate present and future battlefields. These include autonomous and robotic systems, optical and radio communications systems, cyber-physical systems, and power systems. Every branch of the Army is dependent upon the technology that electrical engineers create and implement.

Electrical Engineering students at USMA apply creativity, analytical skills, and state-of-the-art computer and instrumentation tools to the study of electrical, electronic, and computer systems. Hands-on laboratory and computer experience, teamwork, and exciting interdisciplinary capstone projects are hallmarks of the Electrical Engineering Program. Our courses are current and relevant. Our laboratory facilities are among the best in the world. Our faculty is unique among EE faculty in that they are leaders of soldiers, experts in their discipline, and world-class teachers.

Electrical Engineering students study digital logic, electronics, circuits, computer architecture, signals and systems, electromagnetic fields, electric power, and participate in a 2-semester design project that helps solve real-world problems relevant to our Army such as designing and building an automatic mortar fuze setter, aerial or ground robotic systems, or a small satellite; developing and testing control and security algorithms for a smart grid; or managing a power grid on a FOB. Cadets can concentrate in robotics, communications, cyber engineering, alternative energy, or opto-electronics.

Electrical Engineering is one of the most challenging, and therefore rewarding, majors at the Academy. To successfully meet the challenge, cadets should have a sincere interest in the discipline, good time management skills, a thirst to know how things work, and the desire to apply math and science skills to real world problems. The Electrical Engineering Major is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

We also offer a 3-Course Engineering Sequence that exposes cadets to the technology employed in the Army with a focus on Robotics and Robotic Systems.

Soldier at Fort Benning testing the cadet capstone project referred to as 'Demon Eye' which won the Best Project Award in 2017. The device uses a laser along with other sensors and processing to rapidly provide precise positioning information on enemy targets.

Electrical Engineering Outcomes & Objectives

Our outcomes describe specifically what you will be able to do upon completion of the Electrical Engineering major. Our objectives describe what you will be able to do as you meet the challenges 5-7 years after graduation.

Student Outcomes. Upon graduation, cadets who major in electrical engineering can:

- Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- Communicate effectively with a range of audiences
- Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- Acquire and apply new knowledge as needed, using appropriate learning strategies

Program Educational Objectives. Five to seven years after graduation, cadets who major in Electrical Engineering will have been successful Army officers who have:
## Electrical Engineering Major
**Class of 2022**
**Code EEN1**

<table>
<thead>
<tr>
<th>Fourth Class</th>
<th>Third Class</th>
<th>Second Class</th>
<th>First Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA103</td>
<td>MA104</td>
<td>MA205</td>
<td>EE302</td>
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<td>CH101</td>
<td>PH205</td>
<td>EE360</td>
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<tr>
<td>EN101</td>
<td>EN102</td>
<td>SS201</td>
<td>SS202</td>
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</table>

**Required Courses:**

<table>
<thead>
<tr>
<th>Core Electrical Engineering Courses</th>
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</thead>
<tbody>
<tr>
<td>EE302 Intro to Electrical Engineering</td>
</tr>
<tr>
<td>EE360 Digital Logic w/ Embed Sys</td>
</tr>
<tr>
<td>EE362 Intro to Electronics</td>
</tr>
<tr>
<td>EE375 Computer Architecture</td>
</tr>
<tr>
<td>EE377 Electrical Power Engineering</td>
</tr>
<tr>
<td>EE381 Signals and Systems</td>
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<tr>
<td>EE383 Electromagnetic Fields</td>
</tr>
<tr>
<td>EE400 EE Professional Considerations</td>
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<tr>
<td>EE462 Electronic Design</td>
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<tr>
<td>EE401 Integrative System Design I</td>
</tr>
<tr>
<td>EE402 Integrative System Design II</td>
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<tr>
<td>MA205 Calculus 2</td>
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<tr>
<td>MA364 Engineering Math</td>
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<th>Breadth Course</th>
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<tbody>
<tr>
<td>MC311 Thermal-Fluid Systems I</td>
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</table>

**Choose 1 of 5 Depth Options:**

**Optoelectronics**

| EE486 Solid State Electronics          |
| EE483 Photonics Engineering            |
| EE480 Optical Fiber Communications     |
| or                                     |

**Communications**

| EE477 Digital Communication Systems   |
| EE482 Wireless Comm Systems Engr      |
| EE480 Optical Fiber Communications    |
| or                                     |

**Alternative Energy**

| EE486 Solid State Electronics         |
| XE472 Dynamic Modeling and Control    |
| XE442 Alternative Energy Engineering  |

**Robotics**

| EE477 Digital Communications Systems |
| EE487 Embedded Systems Development   |
| EE472 Dynamic Modeling & Controls    |
| EE475 Mechatronics                   |

**Cyber Engineering**

| CY300 Programming Fundamentals        |
| CY350 Net. Engr. & Management         |
| CY450 Cyber Security Engineering      |
| EE477 Digital Communication Systems   |

**Choose 1 EECs Elective:**

| Except for the Robotics or Cyber Engineering Depth Options since they already have a directed elective |
| CY300 Programming Fundamentals        |
| CS393 Database Systems                |
| EE477 Digital Communication Systems   |
| EE480 Optical Fiber Communications    |
| EE482 Wireless Comm Systems Engr      |
| EE483 Photonics Engineering           |
| EE485 Special Topic in EE*            |
| EE486 Solid State Electronics         |
| EE487 Embedded Systems Develop.       |
| EE489 Advanced Individual Study       |
| EE489A Advanced Individual Study      |
| EE490 EE Summer Research              |
| XE442 Alternative Energy Engineering  |
| XE472 Dynamic Modeling & Controls     |
| XE475 Mechatronics                    |
| XE492 Disruptive Innovations          |

**Electrical Engineering Major (EEN1)**

Complete the **core** curriculum.

**Complete the twelve courses listed below:**

<table>
<thead>
<tr>
<th>EE302</th>
<th>EE360</th>
<th>EE362</th>
<th>EE375</th>
<th>EE377</th>
<th>EE400</th>
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</thead>
<tbody>
<tr>
<td>Intro to Electrical Engineering</td>
<td>Digital Logic with Embedded Systems</td>
<td>Introduction to Electronics</td>
<td>Computer Architecture with Microprocessors</td>
<td>Electrical Power Engineering</td>
<td>Signals and Systems</td>
</tr>
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<tr>
<th>EE462</th>
<th>EE472</th>
<th>EE480</th>
<th>EE482</th>
<th>EE485</th>
<th>EE490</th>
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</thead>
<tbody>
<tr>
<td>Electronic Design</td>
<td>Dynamic Modeling and Control</td>
<td>Optical Fiber Communications</td>
<td>Wireless Communications</td>
<td>Special Topics in EE</td>
<td>Disruptive Innovations</td>
</tr>
</tbody>
</table>

**Engineer Elective**

<table>
<thead>
<tr>
<th>XE477</th>
<th>XE486</th>
<th>XE487</th>
<th>XE489</th>
<th>CY300</th>
<th>CS393</th>
</tr>
</thead>
</table>

**Take the Electrical Engineering Seminar in the second term of the First Class year:**

<table>
<thead>
<tr>
<th>EE400</th>
<th>EE Professional Considerations</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

**Complete one of the depth options listed below:**

**EE487 Embedded Systems Development | EE472 Dynamic Modeling and Control | EE482 Wireless Communications | EE475 Mechatronics | EE480 Optical Fiber Communications |


**Complete one of the depth options as approved by the Head of the Department from the list below:**

<table>
<thead>
<tr>
<th>XE442</th>
<th>Alternative Energy Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>XE472</td>
<td>Dynamic Modeling &amp; Control</td>
</tr>
<tr>
<td>XE475</td>
<td>Mechatronics</td>
</tr>
<tr>
<td>XE486</td>
<td>Solid-State Electronics</td>
</tr>
<tr>
<td>XE487</td>
<td>Embedded Systems Development</td>
</tr>
<tr>
<td>CY300</td>
<td>Advanced Individual Study in Electrical Engineering</td>
</tr>
</tbody>
</table>

**Complete one breadth course listed below:**

<table>
<thead>
<tr>
<th>MC311</th>
<th>Thermal-Fluid Systems - I</th>
</tr>
</thead>
</table>

**MC311**

**MC311**
Electrical Engineering Honors Major

The Electrical Engineering Honors Major offers cadets the opportunity for additional depth of study in Electrical Engineering. It is expected that cadets graduating from the Electrical Engineering Honors Major will be among the highest achieving majors in Electrical Engineering, will be recognized as participating in the Honors Program of the Department of Electrical Engineering and Computer Science, and will have “Electrical Engineering Honors Major” annotated on their official USMA transcript.

In order to qualify for the Electrical Engineering Honors Major, cadets will be required to meet grade-point thresholds, complete an additional course and participate in either an undergraduate research experience or report on their engineering design experience. The research or design experience will include writing a research or engineering paper suitable for submission to a conference or engineering design competition. Research-focused programs will typically include enrollment in EE489: Advanced Individual Study in Electrical Engineering (or its variants, EE489A or EE490) or in XE492: Disruptive Innovations. The engineering design experience can result from participation in XE401: Integrative System Design I and XE402: Integrative System Design II.

For those cadets who enroll in EE489 or XE492 to satisfy this requirement, the course grade is also based on the honors major research paper. For those cadets who use the XE401 – XE402 engineering design series instead, the engineering paper should be based on activities completed within the two classes, but beyond their normal coursework.

Requirements

- A cadet majoring in Electrical Engineering will normally petition for entry into the Electrical Engineering Honors Major at the beginning of the spring term of the Second Class year.

- Successful completion of the Electrical Engineering Honors Major requires:
  - Successful completion of the Academy Core Curriculum with a minimum 3.0 grade point average.
  - Successful completion of courses required for the Electrical Engineering major with a minimum 3.5 grade point average.
  - Successful completion of an additional course from the list of approved electives for the EEN1 major. This course could be used to fulfill the research or engineering requirement.
  - Successful completion of a research or engineering paper requirement.

- The undergraduate research or engineering experience for the Electrical Engineering Honors Major consists of a written research or engineering paper should be of a depth and quality suitable for publication in an undergraduate conference proceeding.
  - The research or engineering project will be affiliated with a 400-level Electrical Engineering course, traditionally EE489, XE492, or the XE401 and XE402 capstone design experience. The research may build on an existing project completed in the course, or may be a new project inspired by the course. In either case, the research project may be completed during a subsequent semester, but must be completed before graduation.
  - The research or engineering project must reflect individual effort, although it may build on an existing group project, especially in the context of XE401 and XE402.
  - The research project must be conducted under the supervision and mentorship of a member of the faculty. The topic and mentor must be approved by the Electrical Engineering Program Director before the beginning of the graduating term.
  - The final report must be approved by both the faculty mentor and the Electrical Engineering Program Director.

The Redhawk capstone team won second place in the department’s 2017 project’s day award luncheon. The team investigated ways to geolocate radio frequency (RF) transmitters using miniaturized antennas and computers mounted on unmanned vehicles. Pictured from left to right are: Dr. Suzanne Matthews, Cadets Rachel Kim (CS), Hannah Grosso (EE), Kyle Broughton (EE), Jeffrey Schanz (CS), and Orion Boylston (EE).
Robotics Engineering Sequence
Class of 2022

We also offer a 3-Course Engineering Sequence that exposes cadets to the technology employed in the Army focused on Robotics and Robotic Systems. These three courses are listed below and described in detail in the course descriptions included at the end of this booklet.

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>Prerequisites</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE300 Fundamentals of Digital Logic</td>
<td>NONE</td>
<td>1</td>
</tr>
<tr>
<td>EE350 Basic Electrical Engineering</td>
<td>PH205, MA104</td>
<td>2</td>
</tr>
<tr>
<td>EE450 Military Robotic Systems</td>
<td>(EE300 or EE360) and</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(EE350 or EE301 or EE302)</td>
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</table>

Below is a typical course plan for a cadet who selects the 3-Course Robotics Engineering Sequence:

<table>
<thead>
<tr>
<th>Fourth Class</th>
<th>Third Class</th>
<th>Second Class</th>
<th>First Class</th>
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</thead>
<tbody>
<tr>
<td>MA103</td>
<td>MA104</td>
<td>MA206</td>
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<td>CH101</td>
<td>PH205</td>
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<td>HI108X</td>
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<td>LX204</td>
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<td>PL100</td>
<td>IT105</td>
<td>PY201</td>
<td>EV203</td>
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<td>SS201</td>
<td>SS202</td>
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<td>HI102</td>
<td>SS307</td>
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<td></td>
<td></td>
<td>MX400</td>
<td>LW403</td>
</tr>
</tbody>
</table>

Ribbon Cutting Ceremony for the Robotics Research Center (RRC) in 2017: LTC Christopher Korpela (RRC Director), Dr. Robert Sadowski (Army Chief Roboticist), BG Cindy Jebb (USMA Dean), and COL Barry Shoop (former EECS Department Head).

The Computer Science Program

https://westpoint.edu/academics/academic-departments/electrical-engineering-and-computer-science/computer-science

Recent military operations have repeatedly demonstrated the value of information dominance and the application of computing technology across a range of operational environments. The Army recognizes that victory in today’s conflicts is dependent upon Army leaders who can think critically and apply technology across the full spectrum of operations. To this end, the 2014 Army Strategic Planning Guidance sets the priority to create “adaptive Army leaders for a complex world” and calls for developing “leaders who are proficient in cyberspace.”

The 2018 National Defense Strategy further identifies the need for our nation to “invest broadly in military application of autonomy, artificial intelligence, machine learning…cyber defense…and the continued integration of cyber capabilities into the full spectrum of military operations.” The strategy also calls for “developing resilient, survivable…networks and information ecosystems…[and] capabilities to gain and exploit information, deny competitors those same advantages, and enable us to provide attribution while defending against and holding accountable state or non-state actors during cyberattacks.”

The Computer Science program supports these strategic goals by developing Army officers who have a deeper understanding of the technologies pervasive in our daily lives, who understand the capabilities and limitations of these technologies, and who can imagine innovative ways to use them to fight and win our nation’s wars. Those who immerse themselves in the Computer Science Major will develop an understanding of underlying fundamental principles in areas such as software development, programming languages, computer networks, and information assurance. The Computer Science major is accredited by the Computing Accreditation Commission of ABET, www.abet.org.

For those cadets pursuing degrees in other departments, the Computer Science program also offers a Cyber Engineering 3-Course Engineering Sequence. Just as computing technologies have been found to assist most Army missions, a fundamental understanding of basic computing themes and concepts can enhance experiences in virtually all academic areas. The Cyber Security Minor, available to majors and non-majors, alike, extends the Cyber Engineering Sequence with a policy, legal, or ethical course and additional technical electives.

We are continually updating our courses, our computing equipment, and our software tools to prepare those willing to seize the exciting opportunities that lie ahead. Are you ready? See any member of our department faculty to request an academic counselor who can discuss alternatives with you. Or come speak directly with me—it’s your move!

Alexander S. Mentis, Ph.D.
Lieutenant Colonel, Signal Corps
Computer Science Program Director
Opportunities in Computer Science …

Computer Science is not just about using computers, writing computer programs, or building computers. Computer Science is the study of the theoretical foundations of information and computation, and of practical techniques for their implementation and application in computer systems. Consequently, Computer Science continues to permeate the application of nearly all other science and engineering disciplines and play an increasing role as these disciplines are integrated to solve increasingly complex problems.

The fundamental question underlying all of computing is: what computational processes can be efficiently automated and implemented? In fact, the solution of many computer science problems may not even require the use of computers—just pencil and paper. Cadets who study Computer Science acquire extensive critical thinking skills as they study the very nature of computing to determine which problems are (or are not) computable. If you are interested in problem solving and technology, numerous opportunities, in a variety of computing technology fields, await your exploration and contributions!

For cadets who pursue a major in another area but who want a unified set of “hands-on” experiences with computing technologies, the Cyber Engineering 3-course engineering sequence may be an ideal choice. Here, introductory courses in programming and network engineering and management allow later study of, and practical experience in, protecting a network from intrusions.

Together with the Information Technology Program, we also offer four individual service courses in computing beyond IT105 and CY305 to help you effectively use information technologies now and in the future.

- **CS393, Database Systems** gives cadets the necessary information technology skills to design, build, and test relational database systems.
- **IT383, User Interface Development** provides a practical, hands-on exposure to concepts and strategies for designing good human interfaces to computer systems as well as the tools and techniques for implementing them.
- **IT460, Cyber Operations** takes a high-level approach to the tactics, techniques and procedures involved with computer network attack and defense, while also addressing the politics, ethics, and strategies of information warfare.
- **IT394, Distributed Application Development** teaches cadets how to build distributed web applications.

IT460 builds on knowledge gained in IT105. CS393 and IT383 each build on CY305 and CY300, and a cadet may take IT394 after successfully completing CS393.

Computer Science Outcomes & Objectives …

The Computer Science major prepares you for your career in the Army and a lifetime of dealing with rapid advances in computing technologies. Our outcomes listed below describe more specifically what you will be able to do upon completion of the Computer Science major.

Upon graduation, cadets who major in computer science will have met the following outcomes:

- Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
- Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program’s discipline.
- Communicate effectively in a variety of professional contexts.
- Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- Function effectively as a member or leader of a team engaged in activities appropriate to the program’s discipline.
- Apply computer science theory and software development fundamentals to produce computing-based solutions. [CS]

Our program will prepare you to deal with the constant evolution of computing technologies as you assume progressively greater responsibilities in your career in the Army. The Program Educational Objectives for Computer Science are that, five to seven years after graduation, cadets who major in Computer Science will have, as successful Army officers:

- Initiated and completed tasks that identify aspects of a complex situation that can be enhanced by using computing technology.
- Applied computing knowledge and skills while using an engineering process, individually or in diverse teams, to develop computing technology applications.
- Used effective communication to explain new computing technology to warfighters in support of current and emerging Army warfighting doctrine.
- Grown professionally through self-study, continuing education, and professional development.
Computer Science is a 41 course major, with 18 courses being CS-related. Curriculum is designed to remain relevant long after graduation. The major includes an advanced version of the CY305 Cyber Foundations Core Course. Double-majoring or obtaining a minor can be possible.

### Course Requirements

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<tbody>
<tr>
<td>MA103</td>
<td>MA104</td>
<td>MA206</td>
<td>PY201</td>
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<td>CH101/PH205</td>
<td>PH205</td>
<td>SS202</td>
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<td>IT105</td>
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<td>CS384</td>
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<td>CY355</td>
<td>MA372</td>
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<table>
<thead>
<tr>
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<th>PH205</th>
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<tr>
<td>CH275</td>
<td>CH102</td>
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<tr>
<td>CS484</td>
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<tr>
<td>SS307</td>
<td>HI302</td>
</tr>
</tbody>
</table>

**Math elective**

<table>
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<th>MA205/255</th>
<th>Calculus II</th>
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</thead>
<tbody>
<tr>
<td>MA371</td>
<td>Linear Algebra</td>
</tr>
<tr>
<td>MA376</td>
<td>Applied Statistics</td>
</tr>
<tr>
<td>MA383</td>
<td>Foundations of Math</td>
</tr>
<tr>
<td>MA385</td>
<td>Chaos and Fractals</td>
</tr>
<tr>
<td>MA386</td>
<td>Introduction to Numerical Analysis</td>
</tr>
<tr>
<td>MA388</td>
<td>Sabermetrics</td>
</tr>
<tr>
<td>MA391</td>
<td>Mathematical Modeling</td>
</tr>
<tr>
<td>MA394</td>
<td>Fundamentals of Network Science</td>
</tr>
<tr>
<td>MA461</td>
<td>Graph Theory and Networks</td>
</tr>
<tr>
<td>MA462</td>
<td>Combinatorics</td>
</tr>
<tr>
<td>MA464</td>
<td>Applied Algebra w/ Cryptology</td>
</tr>
<tr>
<td>MA466</td>
<td>Abstract Algebra</td>
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<tr>
<td>MA476</td>
<td>Mathematical Statistics</td>
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</tbody>
</table>

**Networking Group**

<table>
<thead>
<tr>
<th>CS484</th>
<th>Computer Networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CY350</td>
<td>Network Engineering &amp; Management</td>
</tr>
</tbody>
</table>

**Computer Science Electives**

Complete two additional courses from the Computer Science Electives group:

<table>
<thead>
<tr>
<th>CS393</th>
<th>Database Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS394</td>
<td>Distributed Application Engineering</td>
</tr>
<tr>
<td>CS473</td>
<td>Computer Graphics</td>
</tr>
<tr>
<td>CS482</td>
<td>Cyber Security Engineering</td>
</tr>
<tr>
<td>CS483</td>
<td>Digital Forensics</td>
</tr>
<tr>
<td>CS484</td>
<td>Computer Networks</td>
</tr>
<tr>
<td>CS485</td>
<td>Special Topics in CS</td>
</tr>
<tr>
<td>CS486</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>CS489</td>
<td>Advanced Individual Study in Computer Science</td>
</tr>
<tr>
<td>CY350</td>
<td>Network Engineering &amp; Management</td>
</tr>
<tr>
<td>EE487</td>
<td>Embedded Systems Development</td>
</tr>
<tr>
<td>IT383</td>
<td>User Interface Development</td>
</tr>
<tr>
<td>EE492</td>
<td>Disruptive Innovations</td>
</tr>
</tbody>
</table>

CS majors complete many projects and have exciting opportunities with AIADs, cadet clubs, and other activities. The year-long capstone design project, culminating on Projects Day, is one exciting experience all CS majors undertake. For this project, CS cadets work in teams of 4-7 that include cadets in other majors.

The CS Honors major is very achievable by high-performing cadets (>3.5 in-major and 3.0 in Core courses), requiring only one extra course and a small Honors project. Cadets from most recent class year groups have successfully published academic research and competed for scholarships.
Honors Program in Computer Science
Class of ‘22

The Computer Science Honors Program offers cadets the opportunity for additional depth of study in Computer Science, which earns the annotation of “Computer Science Honors Program” on their official USMA transcript. A cadet majoring in Computer Science can declare entry into the Computer Science Honors Program starting in Second Class year. Continuation in the program requires the grade point averages listed below.

Successful completion of the Computer Science Honors Program requires:

1) Completion of all Computer Science Major requirements

2) Completion of one Computer Science Honors Elective, which cannot be double-counted with electives used to meet the CS Major requirements.

   CS394  Distributed Application Engineering
   CS473  Computer Graphics
   CS483  Digital Forensics
   CS484  Computer Networks
   CS485  Special Topics in Computer Science
   CS486  Artificial Intelligence
   CS489  Advanced Independent Study in CS
   CS490  CS Summer Research
   EE487  Embedded Systems Development
   XE492  Disruptive Innovations

3) Completion of the Research Requirement.
   • Consists of both a written document and an oral presentation of a depth and quality suitable for submission to a professional conference.
   • The research will normally be accomplished as an extension of a project begun in the CS Honors Elective. The research must reflect individual effort, although it may build on an existing group project (especially in the context of XE401/402).
   • Neither the project/research work nor the resulting paper and presentation need be completed during the same semester they are begun, but must be complete by the end of the TEE period of semester 8.
   • The project/research must be conducted under the supervision/mentorship of a member of the faculty, normally the instructor of the corresponding course.
   • The final written document and oral presentation must be approved by both the research mentor and the Computer Science Program Director.

4) Grade Requirements. Attain an APSC of at least 3.0 in the core curriculum and an APSC of at least 3.5 in the major. Please note that CY300, CY355, CY350/CS484, and XE401 are counted as core courses.

Cyber Engineering Core Engineering Sequence
Class of 2022

For cadets who pursue a major in another area but who want a unified set of “hands-on” experiences with computing technologies, the Cyber Engineering 3-Course Engineering Sequence may be an ideal choice.

   o CY300, Programming Fundamentals
   o CY350, Network Engineering & Management
   o CY450, Cyber Security Engineering

We also offer four individual service courses in computing beyond the 3-course engineering sequence, CY105 and CY305 to help you effectively use information technologies now and in the future.

   o CS393, Database Systems
   o IT383, User Interface Development
   o IT460, Cyber Operations
   o IT394, Distributed Applications Development

Typical

<table>
<thead>
<tr>
<th>Fourth Class</th>
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<tr>
<td>MA103</td>
<td>MA104</td>
<td>MA205</td>
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<td>CH101</td>
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<td>HI302</td>
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<tr>
<td>Required Courses:</td>
<td>Prerequisites</td>
<td>Term</td>
<td></td>
</tr>
<tr>
<td>CY300 Programming Fundamentals</td>
<td>IT105</td>
<td>1 2</td>
<td></td>
</tr>
<tr>
<td>CY350 Network Engineering &amp; Management</td>
<td>CY305, CY300</td>
<td>1 2</td>
<td></td>
</tr>
<tr>
<td>CY450 Cyber Security Engineering</td>
<td>CY350</td>
<td>1 2</td>
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</tbody>
</table>
Information Technology is the most hands-on and applied branch of the computing discipline.

"IT programs exist to produce graduates who possess the right combination of knowledge and practical, hands-on expertise to take care of both an organization’s Information Technology infrastructure and the people who use it. IT specialists assume responsibility for selecting hardware and software products appropriate for an organization, integrating those products with organizational needs and infrastructure, and installing, customizing, and maintaining those applications for the organization’s computer users. Examples of these responsibilities include the installation of networks; network administration and security; the design of web pages; the development of multimedia resources; the installation of communication components; the oversight of email systems; and the planning and management of the technology lifecycle by which an organization’s technology is maintained, upgraded, and replaced."

-- Association for Computing Machinery Computing Curricula 2005 Report
The program educational objectives of the Information Technology Program are that five to seven years after graduation, cadets who major in Information Technology will have been successful Army officers who have:

- Identified and exploited opportunities to improve Army operations by applying best practices in Information Technology.
- Effectively communicated Information Technology to a range of audiences.
- Grown professionally through self-study, continuing education, and professional development.

The student outcomes for the program are that the Information Technology Program enables students to attain, by the time of graduation the ability to:

(1) Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
(2) Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program’s discipline.
(3) Communicate effectively in a variety of professional contexts.
(4) Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
(5) Function effectively as a member or leader of a team engaged in activities appropriate to the program’s discipline.
(6) Identify and analyze user needs and to take them into account in the selection, creation, integration, evaluation, and administration of computing-based systems. [IT]

Tanya T. Estes, Ph.D.
Colonel, Aviation
Information Technology Program Director

The Information Technology Major consists of four threads shown at the left that build on the USMA core program. Each of the four threads consists of 2 or more courses and culminate in a year-long Integrative Experience.

<table>
<thead>
<tr>
<th>Fundamental Skills</th>
<th>Integrate software to build tools that</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>• explore and manipulate the local file system and the network,</td>
</tr>
<tr>
<td></td>
<td>• communicate with network services such as web servers and database servers, and</td>
</tr>
<tr>
<td></td>
<td>• communicate with other tools</td>
</tr>
</tbody>
</table>

| System Integration | • Strong information management skills relevant to junior officers. |
|--------------------| • Database design using Unified Modeling Language and web-based servers. |
|                    | • Web site development in an n-tier environment. |

| Network Integration | • Design and manage multiple computers connected by a network. |
|---------------------| • Defend information resources, networks, and services from attack and compromise. |
|                     | • Learn how to defend against Red Team attackers in a Cyber Defense Exercise. |

| IT Application Studies | • Choose an Information Technology application area to study (such as geographic information systems or remote sensing) |

| Integrative Experience | • A year long project in the First Class year using Information Technology to solve a real problem for a real client. |

### Information Technology Major
#### Class of 2022
#### Code ITE1
#### Sample 8TAP

<table>
<thead>
<tr>
<th>Fourth Class</th>
<th>Third Class</th>
<th>Second Class</th>
<th>First Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA103</td>
<td>MA206</td>
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<tr>
<td>EN101</td>
<td>CY355</td>
<td>IT392</td>
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| MA104        | PY201       | PL300        | LW403       |
| CH101/PH205  | SS202/EV203 | HI302        | EE360       |
| HI108        | LX204       | SS307        | IT400       |
| PL100        | IT384       | IT383        | XE402       |
| EN102        | CY350       | IT394        | IT APP      |

* IT APP refers to a cadet-selected IT Application Study such as remote sensing, geographic information systems, terrorism and others.

* CH275 (Biology) may be replaced with CH102 (General Chemistry II) or PH206 (Physics II) based on cadet interest.

### Graduation Requirements

- Complete the **core** curriculum.
  - CY355 Cyber Foundations – Computing

- Complete the Fundamental Skills Thread:
  - CY300 Programming Fundamentals
  - IT384 Network System Programming
  - EM411 Project Management
  - IT460 Cyber Policy, Strategy & Operations
  - EE360 Digital Logic w/ Embedded Systems

- Complete the System Integration Depth Thread:
  - IT393 Database Systems
  - IT394 Distributed Application Development
  - IT383 User Interface Development

- Complete the Network Integration Depth Thread:
  - CY350 Network Engineering & Management
  - IT392 Network Services Management
  - CY450 Cyber Security Engineering

- Complete an IT Application Depth (one of the following sets):
  - EV398 Geographic Information Systems
  - EV498 Advanced Geographic Information Systems
  - EV377 Remote Sensing
  - EV477 Advanced Remote Sensing
  - SS464 Homeland Security
  - SS465 Terrorism: New Challenges
  - DS345 Military Innovation
  - DS475 Strategic Decision Making
  - (select 2 of the 3 below to form this thread):
    - PL250 Neurocognitive Foundations of Behavior
    - PL392 Cognitive Psychology
    - PL394 Anthropometrics & Biomechanics

- Complete the Integrative Capstone Experience and IT Seminar
  - XE401 Integrative System Design I
  - XE402 Integrative System Design II
  - IT400 IT Professional Considerations
Honors Program in Information Technology
Class of 2022

A cadet majoring in Information Technology will normally declare entry into the Information Technology (IT) Honors Program at the beginning of the spring term of the Second Class year. This requires a 3.0 cumulative grade point average in the Academy Core Curriculum at the time of entry.

Successful completion of the IT Honors Program requires:

(a) Successful completion of the IT major with a 3.5 academic performance score (APS).
(b) Successful completion of the Academy Core Curriculum with a 3.0 APS average.
(c) Successful completion of the research requirement consisting of enrollment in a 3.0 credit IT independent study course (IT493) or XE492 (Disruptive Innovations) that is not otherwise part of the IT major requirements. The independent study course will include completion of both a written report and an oral presentation. The report and presentation should be of a depth and quality suitable for professional publication.
(d) Successful completion of one more additional course, bringing the total number of unique courses upon graduation to 42. Suggested courses include:

- XE492 Disruptive Innovations
- PY326 Cyber Ethics
- CS481 Operating Systems
- CS403 Object Oriented Concepts
- CS384 Data Structures
- CS380 Computer Organization
- SM484 System Dynamics Simulation

*Other courses may be approved per the discretion of the IT Program Director.

For calculation of the gpa, CY355, CY300, CY350, and CY450 will be included as part of the Academy Core Curriculum mentioned in (b) above. The IT major mentioned in (a) is the remaining 12 courses of the IT academic major.

Electronic and Information Technology Systems

Opportunities in EITS …

EITS -- a focus on innovative ways to use technology.

Topics such as:
- Defending computer networks
- Building robotic devices
- Building web-enabled databases
- Building remote sensor networks

It can be any one of these or some combination of them.

It gives you choices.

In fact, EITS is more like a framework that allows you to build your own major.
**EITS Choices . . .**

The EITS major is all about flexibility. By an appropriate choice of 3-course threads, the EITS major can become very specialized in a topic that interests you. Alternatively, you can choose a broader selection of threads that introduces you to many topics without becoming a specialist.

To design your EITS program, you

- Complete the 24-course USMA core program (which includes either CY355 or CY305),
- XE401 Integrative System Design I
- EE360 Digital Logic w/ Embedded Sys
- Select one of three:
  - CS400 CS Professional Considerations
  - IT400 IT Professional Considerations
  - EE400 EE Professional Considerations
- Select either
  - the Cyber Engineering sequence
  - the Robotics Engineering sequence,
- Select two of the 25 three-course threads and four additional courses as required to ensure the 8TAP has 40 total unique academic courses.

**For more information about EITS . . .**

Contact:

Dr. Leonowich-Graham
EITS Academic Counselor
Thayer Hall room 117, x5011
Peggy.Leonowich-Graham@usma.edu
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<tr>
<th>THREADS</th>
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ADDITIONAL ELECTIVES:

- XE402 Integrative System Design II
- XE492 Disruptive Innovations
- EE381 Signals and Systems
- MA365 Adv Math for Engrs/Scientists
- MC311 Thermal-Fluid Systems I
## Recommended EE-EITS Focus Areas

### ROBOTICS
- XE401 Integrative System Design I
- EE360 Digital Logic w/ Embedded Systems
- EE400 EE Professional Considerations

Robots Engineering
- EE300 Fundamentals of Digital Logic
- EE350 Basic Electrical Engineering
- EE450 Military Robotic Systems

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### COMPUTER ENGINEERING
- XE401 Integrative System Design I
- EE360 Digital Logic w/ Embedded Systems
- EE400 EE Professional Considerations

Robots Engineering
- EE300 Fundamentals of Digital Logic
- EE350 Basic Electrical Engineering
- EE450 Military Robotic Systems

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## Recommended CS/IT-EITS Focus Areas

### CYBER DEFENSE
- XE401 Integrative System Design I
- EE360 Digital Logic w/ Embedded Systems
- IT400 IT Professional Considerations

Cyber Engineering Sequence
- CY300 Programming Fundamentals
- CY350 Network Engineering & Management
- CY450 Cyber Security Engineering

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### PROGRAMMING
- XE401 Integrative System Design I
- EE360 Digital Logic w/ Embedded Systems
- CS400 CS Professional Considerations

Cyber Engineering Sequence
- CY300 Programming Fundamentals
- CY350 Network Engineering & Management
- CY450 Cyber Security Engineering

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Computer Science Course Descriptions

CS380 Computer Organization
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: CY300 and EE360; Disqualifier: EE375

This course provides an introduction to computer organization and architecture. Emphasis is placed on understanding the implications of computer hardware, the operating system, and compilation system, on the performance and security of written code. Students learn basic computer organization and the IA32 assembly language. Topics covered include basic computer organization, reverse engineering, buffer overflow, pipelining, the memory hierarchy, code optimization, and process creation. Students also gain exposure to topics in concurrency and parallel computing through the POSIX API. In addition to theory, students gain practical real-world experience using tools for profiling and debugging, including Valgrind and GDB. By the end of this programming intensive course, students will understand how the fundamental principles of computer organization impact their ability to write efficient code.

CS384 Data Structures
3.0 Credits (BS=0.0, ET=3.0, MA=0.0); Prerequisite: CY300

This course is designed to build on the cadet's basic programming knowledge. Major emphasis is placed on object-based design, programming methodology, algorithms and algorithm analysis, data structures, and abstract data types as tools for the analysis, design, and implementation of software modules to meet specified requirements. Cadets will learn and employ several well-known algorithms and data structures. Techniques of searching, sorting, recursion, and hashing will be examined. Data structures such as sets, heaps, linked lists, stacks, queues, and trees will be covered. A block-structured programming language reflecting comprehensive support for good software engineering principles will be the foundation of application-oriented exercises. Cadets will design software solutions by employing problem decomposition and selecting the appropriate algorithms and abstract data types.

CS385 Design and Analysis of Algorithms
3.0 Credits (BS=0.0, ET=0.0, MA=0.0); Prerequisites: CS384 and MA372

This course studies analysis of algorithms and the relevance of analysis to the design of efficient computer algorithms. Algorithmic approaches covered include greedy, divide and conquer, and dynamic programming. Topics include sorting, searching, graph algorithms, and disjoint set structure.

CS394 Distributed Application Engineering
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Co requisite: CS403; Disqualifier: IT394

Building on the foundations of algorithm implementation, data representation, web development, and basic networking, this course focuses on the principles of constructing a modern distributed application. Cadets study the principles, construction, and interaction of user interface, network, web server, and database components to produce an effective distributed application. Cadets will learn new tools and skills working as a team to analyze, design, and implement a system that solves a given problem.

CS400 Professional Considerations
3.0 Credit Hour (BS=0.0, ET=0.0, MA=0.0); Corequisite: XE401

This course addresses the professional considerations of Computer Scientists, primarily focusing on non-technical considerations and the development of communication skills. Coursework includes significant emphasis on written work that is based on relevant reading assignments, class discussions, individual research, distinguished guest speakers, and personal reflection. Content will address current, emerging, and relevant topics in the computing profession. Students will develop the ability to recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles. They will also learn to identify and discuss local and global impacts of computing solutions on individuals, organizations, and society. Students will demonstrate the ability to communicate effectively in writing in a variety of professional contexts, including an iterative writing experience.

CS403 Software Testing & Development
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: CS384 and CS350

This course builds on the fundamental programming skills from prerequisite courses to explore advanced concepts used in modern object oriented software design to create software that is robust, reusable, and extensible in varying problem domains. Cadets gain confidence in their abilities to model, implement, and test solutions to demanding programming problems.

CS473 Computer Graphics
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: CS384, MA205 and PH201/251

This course concerns computer programs that draw two- and three-dimensional objects on computer output devices and receive input from users through graphical input devices. Cadets implement interactive programs through a commonly available graphical application programmers’ interface (API). They learn about graphical hardware devices and the elegant algorithms that underlie the API, including elementary computational geometry, homogeneous transformations, parametric forms, clipping, shading, color, and surface rendering. These concepts are all illustrated with examples of military data visualization including two-dimensional maps and three-dimensional battle simulation and terrain visualization.

CS474 Fundamentals of Computer Theory
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Co prerequisite: CS385

Grounds the cadet in the essentials of theory of computation: formal languages, automata, and computability theory. Frames computation in the context of the Chomsky hierarchy, the polynomial and exponential time hierarchies, and decidability hierarchy. Explores fundamental limits on computation: what problems can never be solved, what
problems can be solved but are intractable, and the class NP of problems that are thought to be intractable, but for which no proof of intractability exists to date.

CS478  Programming Languages
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: CS384
Concepts of high-level programming language design are explored in detail. Cadets will examine the fundamental issues of programming language design and use this knowledge as a framework for comparison of different high-level language. Cadets will study concepts from some or all of the imperative, functional, object-oriented, concurrent, and logic programming language paradigms.

CS481  Operating Systems
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: CS380, CS403
The operating system controls the computer itself and provides a useful interface for users and application programs. The operating system controls all the computer resources: processors, main storage, secondary storage, I/O devices, and files. It determines which programs will be in memory at any given time and the order in which programs will run. The operating system should resolve conflicts between processes, attempt to optimize the performance of the computer, allow the computer to communicate with other computers, and maintain a record of actions performed as it goes about its system tasks. This course investigates the basic design issues encountered in order to produce an operating system that can address the above problems in an efficient manner. These concepts are reinforced by a series of programming projects that include both design and implementation.

CS483  Digital Forensics
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: CS380 and CS481
Digital Forensics will explore the evidence left behind when malicious activity occurs on an information system. The material in this course will build on your knowledge of Operating Systems, file formats, file system structure, computer architecture, and networking. The course begins with an overview of these areas, then examines how to find and extract digital evidence. During the course, you will be challenged with three projects (subjects to be chosen by you) and in class challenges that will allow you to demonstrate your understanding of the material.

CS484  Computer Networks
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisites: CS384 or CY350
This course provides cadets with an introduction to computer networks by breaking the subject into comprehensible parts and building a survey of the state of the art. The goal of the course is to provide each cadet with basic concepts necessary to understand the design and operation of computer networks. Taking a layered approach, it examines the internet with an emphasis on the TCP/IP protocol suite. Additionally, basic principles including multiplexing, switching, flow control, and error control are covered. Internetworking and its application to both local and wide area networks are also investigated. The course offers an understanding of the current status and future directions of technology and how technology relates to standards.

CS485  Special Topics in Computer Science
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: Permission of the department head
This course provides in-depth study of a special topic in computer science not offered elsewhere in the USMA curriculum. Course content will be based on the special expertise of the visiting professor or a senior computer science faculty member.

CS486  Artificial Intelligence
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: CS384 and (EE336 or EE300)
The course provides an introduction to the field of Artificial Intelligence (AI). Cadets will develop an appreciation for the domain of AI and an understanding of the current interest and research in the field. The historical ideas and techniques of AI and the resulting set of concepts will be covered. Classic programs will be covered as well as underlying theory. Topics include: history of computer problem solving, heuristic search techniques, knowledge representation, knowledge engineering, predicate calculus, and expert and/or rule based systems. Advanced topics that may be covered include intelligent agents, genetic algorithms, neural networks, fuzzy logic, robotics, vision, natural language processing, learning, and the programming languages of AI. The course will emphasize the practical application of artificial intelligence to industry and business as well as DOD.

CS488  Language-Based Simulation and Modeling
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: CS403 and CS477
This course applies nearly all previous study of computer science to a specific problem domain essential to the Army – simulation technology. Cadets will learn the fundamental principles of event-based simulation, language based representation of simulation models, and how models are implemented efficiently. Finally, they will learn how simulations are assessed and validated to determine their usefulness. A series of progressive implementation put learned concepts into practice.

CS489  Advanced Individual Study in Computer Science
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: Permission of the Department Head
This course provides cadets with an introduction to computer networks by breaking the subject into comprehensible parts and building a survey of the state of the art. The goal of the course is to provide each cadet with basic concepts necessary to understand the design and operation of computer networks. Taking a layered approach, it examines the internet with an emphasis on the TCP/IP protocol suite. Additionally, basic principles including multiplexing, switching, flow control, and error control are covered. Internetworking and its application to both local and wide area networks are also investigated. The course offers an understanding of the current status and future directions of technology and how technology relates to standards.

CS489A  Advanced Individual Study in Computer Science
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite:Permission of the Department Head
Same as CS489.

CS490  Computer Science Summer Research
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: Permission of the Department Head
This course is designed to familiarize the cadet with advanced techniques for independent research in computer science. The course will normally require research, development, and implementation of a novel idea or concept. An oral presentation and a written project report will be completed under the supervision of an USMA faculty member who serves as project advisor. The course requires three full weeks of study, completed in conjunction with the Academic Individual Advanced Development Program. Scope, depth, and material covered will meet the requirements of a three-credit course in computer science.

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CS490A  Computer Science Summer Research
2.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: Permission of the Department Head

Same as CS490. The course requires three weeks of study, completed in conjunction with the Academic Individual Advanced Development Program. Scope, depth, and material covered will be equivalent to two credits of course work in computer science.

CS490B  Computer Science Summer Research
1.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: Permission of the Department Head

Same as CS490. The course requires three weeks of study, completed in conjunction with the Academic Individual Advanced Development Program. Scope, depth, and material covered will be equivalent to one credit of course work in computer science.

XE401  Integrative System Design I
3.5 Credit Hours (BS=0.0, ET=3.5, MA=0.0); Prerequisite: CS403 or EE362 or IT394

This course is a team-based capstone design experience in electrical engineering, computer science and information technology. It provides an integrative experience, presenting each cadet team with a professionally relevant, open-ended situation including professional, ethical, social, security, legal, economic, and political dimensions, where an engineering approach has strong potential to produce benefits. Under the guidance of a faculty advisor for each project team, cadets develop client-focused products, applying the principles of design and implementation to effect an optimal outcome for the circumstances presented to the team by creating a product or service that meets requirements and constraints negotiated with the client.

XE402  Integrative System Design II
3.5 Credit Hours (BS=0.0, ET=3.5, MA=0.0); Prerequisite: First Class standing in an academic major offered by the Department of Electrical Engineering and Computer Science.

This course is a team-based capstone design experience in electrical engineering, computer science and information technology. It provides an integrative experience, presenting each cadet team with a professionally relevant, open-ended situation including professional, ethical, social, security, legal, economic, and political dimensions, where an engineering approach has strong potential to produce benefits. Under the guidance of a faculty advisor for each project team, cadets develop client-focused products, applying the principles of design and implementation to effect an optimal outcome for the circumstances presented to the team by creating a product or service that meets requirements and constraints negotiated with the client.
**EE300  Fundamentals of Digital Computer Logic**

3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: None. Disqualifier: EE360.

This is a course for non-electrical engineering majors that covers the analysis, design, simulation, and construction of digital logic circuits and systems. The material in this course provides the necessary tools to design digital hardware circuits such as clocks and security devices, as well as computer hardware. The course begins with the study of binary and hexadecimal number systems, Boolean algebra, and their application to the design of combinational logic circuits. The first half of the course focuses on combinational logic designs. The second half of the course emphasizes sequential logic circuits like memory systems, counters, and shift registers. Laboratory work reinforces the course material by requiring cadets to design and implement basic digital circuits. Throughout the course, the focus is on how the various digital hardware devices are used to perform the internal operations of a computer.

**EE301  Fundamentals of Electrical Engineering**

3.5 Credit Hours (BS=0.0, ET=3.5, MA=0.0); Prerequisites: MA205 and PH202 or equivalents. Disqualifiers: EE350, EE302.

This first course in electrical engineering for the non-electrical engineering major provides a solid foundation in basic circuit theory and analysis, power in circuits and electric power systems, and analog electronics. Lectures, laboratory work, classroom demonstrations and discussions showing practical applications emphasize and illustrate the fundamental theories and concepts presented in the course. Engineering design is reflected in laboratory work and minor design problems.

**EE302  Introduction to Electrical Engineering**

3.5 Credit Hours (BS=0.0, ET=3.5, MA=0.0); Co-requisites: MA205 and PH202 or equivalents. Disqualifiers: EE350, EE301.

This first course in electrical engineering provides a solid introduction to electric circuit theory. Fundamental principles and network theorems are developed using DC resistive circuits. The complete responses of RC, RL, and RLC circuits are obtained using classical and Laplace-transform techniques to solve the related differential equations. Electrical system transfer functions, time-domain and frequency-domain relationships, stability, frequency response, steady-state ac analysis, and power are also studied. Laboratory work, practical applications, and classroom demonstrations emphasize and illustrate the fundamentals presented in the course.

**EE305  Basic Electrical Engineering**

3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisites: MA104 and PH205 or equivalents. Disqualifiers: EE301, EE302.

This is a course for non-electrical engineering majors that provides a foundation in basic circuit theory and analysis, power in circuits and electric power systems, and analog electronics. Lectures, laboratory work, classroom demonstrations and discussions showing practical applications illustrate the fundamental theories and concepts presented in the course. Engineering science is reflected in laboratory work.

**EE360  Digital Logic with Embedded Systems**

3.5 Credit Hours (BS=0.0, ET=3.5, MA=0.0); Prerequisite: IT105 or equivalent. Disqualifier: EE300.

This course covers the analysis, design, simulation, and construction of digital logic circuits and embedded systems. The material in this course provides the necessary tools to design digital hardware circuits based on design techniques such as Karnaugh maps and Finite State Machines. The course begins with the study of binary and hexadecimal number systems, Boolean algebra, and their application to the design of combinational logic circuits. The first half of the course focuses on designs using medium-scale integration (MSI) circuits, and Field Programmable Gate Arrays (FPGAs) to implement combinational logic functions. The second half of the course emphasizes sequential logic circuits. Laboratory work in this half of the course focuses on using very high speed integrated circuit hardware description language (VHDL) to simulate digital systems and to program those systems in hardware. As a final project, cadet teams design, build, and test a digital logic system.

**EE361  Computer Architecture with Microprocessors**

3.5 Credit Hours (BS=0.0, ET=3.5, MA=0.0); Prerequisite: EE302/EE301.

This course provides an introduction to computer architecture and organization using modern microprocessors. It builds on digital logic theory and embedded systems to develop more complex systems. Emphasis is placed on hands-on understanding of the basics of computer system organization, design, and operation. This includes the use of Register Transfer Language (RTL) to describe the movement of data in the computer and assembly language programming to control the system at a higher level. Additionally, students are introduced to modern engineering design tools through several labs using VHDL (VHSIC Hardware Description Language) to design, simulate and program a simple processor. Other topics such as microprogram control, RISC architectures, arithmetic processing, input/output, and memory design are introduced.

**EE365  Electric Power Engineering**

3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: EE301 or EE302.

This course covers the study of the fundamentals in two areas of electric power engineering: electromechanical energy conversion and electric power systems. Steady-state behavior in single-phase and balanced three-phase power circuits is emphasized. The concept of per unit analysis is introduced and used throughout the course. Transformers, AC & DC machines, transmission lines, power systems, power electronic devices and renewable energy sources are studied. Laboratory exercises demonstrate the electrical,
mechanical, and physical characteristics of several of the systems studied. The cadet will apply analysis, design, build, and/or test techniques to a power related project.

EE381 Signals and Systems
3.5 Credit Hours (BS=0.0, ET=3.5, MA=0.0); Prerequisite: EE301/EE302; Corequisites: MA206, MA364/MA365.

This course provides a general study of linear system theory and signal representation techniques as preparation for continued study in communications, control, and electronic systems. Topics include the resolution of continuous time signals and discrete time sequences into their images as frequency functions using Fourier series and transforms. The study includes singularity functions, convolution, convergence properties, and transform properties. The Laplace transform and its inverse provide a method for determining the system function for systems described by differential equations, while the z-transform and its inverse provide a method of analysis for difference equations. The course includes a brief study of communication system principles to include sampling and a study of analog and digital (both finite and infinite impulse response) filter design. In addition to exposing students to the engineering software program MATLAB, laboratory periods provide opportunities for instructor-assisted problem solving.

EE383 Electromagnetic Fields and Waves
3.5 Credit Hours (BS=0.0, ET=3.5, MA=0.0); Prerequisites: PH206/PH256; Corequisite: MA365

This course is an introduction to electromagnetic fields, which are the foundation of electrical engineering. The course begins with transmission line analysis using circuit models and reviews the mathematical tools (vector algebra and calculus) that are used to describe electromagnetic phenomena. Maxwell's equations are solved to describe time-harmonic fields under various boundary conditions and at interfaces between dissimilar media. Additional topics include the applications of electromagnetic field theory to transmission lines, antennas and waveguides, and the role of electromagnetics in science, technology and society. Laboratory periods provide opportunities for instructor-assisted problem solving. Additionally, Cadets complete a computer project on finding the numerical solutions to Maxwell’s equations.

EE400 EE Professional Considerations
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: XE401; Corequisite: XE402

This course addresses the concerns of professional electrical engineers such as engineering ethics, economics, licensing, manufacturability, sustainability, reliability, safety, and design methodologies. It includes Fundamentals of Engineering Exam preparation and supports the USMA writing program as a Writing in the Major course. The course includes all first class cadets majoring in electrical engineering. Guest lecturers from military, industrial, and academic communities will present some of the material.

EE450 Military Robotic Systems
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisites: EE300 and EE350

This is the capstone course of a three course series of courses designed to introduce non-electrical engineering majors to the fundamentals of electrical engineering. These key concepts are then used to interface various sensors and actuators with a simple microprocessor using experiments that demonstrate some basic applications of microprocessor control of a simple robot. Finally, cadets design a robot to autonomously navigate a simple maze that simulates some practical military robotics applications.

EE462 Electronic Design
3.5 Credit Hours (BS=0.0, ET=3.5, MA=0.0); Prerequisites: EE360 and EE362

This course focuses on the design, simulation, building, and testing of a wide variety of application-oriented circuits based upon the bipolar junction transistor (BJT) and operational amplifier (OPAMP). Applications of the BJT include current sources, active loads, differential amplifiers, and power amplifiers. OPAMP applications include active filters, oscillators, and comparators. Themes common to both the BJT and OPAMP include frequency response and feedback. The classroom material is supplemented with six labs, computer-aided simulations using modern circuit simulation software and a comprehensive design project.

EE477 Digital Communications Systems
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisites: EE362, MA206, and EE381

This course examines modern digital communications networks, with particular emphasis on wired networks at the physical layer and the TCP/IP network model above the physical layer. The study of digital communications systems includes waveform sampling, time multiplexing, line coding, digital modulation, and clock recovery techniques. Time and frequency domain analysis are the basis for study of bandwidth considerations, filtering, and channel and communication system modeling. Network topology, traffic representation, and link capacity assignment schemes are analyzed. Cost and time delay optimization for centralized and distributed networks are investigated. Queuing theory is presented with application to buffer modeling, buffer design considerations, and throughput constraints. Basic network design algorithms and flow control schemes are also covered. A communications system project brings these concepts to reality.

EE480 Optical Fiber Communications
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: EE383/XE383

The study of fiber optics provides insight into the enabling technology of the global Internet and modern day telecommunications. This course develops understanding of the devices and key components that comprise a fiber based optical communications system. Students will develop an understanding of the fundamental properties of silica based fibers and the principal components required to exploit this medium. Topical coverage of the fiber medium includes modal fields, attenuation, and dispersion for both single mode and multimode fibers. Several device types will be studied to include transmitters, receivers, multiplexers, amplifiers, specialty optical fibers, and selected state-of-the-art components. Software tools and measurement equipment will be used to characterize fiber and device properties. The course culminates with students designing, building, and characterizing a fiber optic communications link.

EE482 Wireless Communication Systems Engineering
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: EE381; Corequisite: EE383.

This course provides an introduction to wireless systems engineering with applications to voice and data networks. Description of well known systems such as cell phones, pagers, and wireless LAN’s is presented along with the design considerations for deployment of wireless networks. Wireless radio channel modeling along with common impairments such as multipath fading are introduced and modulation techniques well suited to the wireless applications are presented. Receivers for the various modulation schemes are analyzed in terms of performance and the trade-offs offered by source and channel coding are presented. Multiple access techniques used in wireless applications are introduced and the design of networks described. The course concludes with an analysis and description of deployed systems along with their standards and services provided.
This course is an introduction to optoelectronic devices and systems. It begins with a review of the fundamental electromagnetic field theory, quantum mechanics, and solid state electronics that characterize optoelectronic device behavior. The course then addresses essential concepts from geometrical and physical (wave) optics. Building upon these fundamental principles, the course addresses the operating principles and design considerations of photoemitters (lasers and LED's), photodetectors, optical waveguides and signal modulators. Finally, the cadet incorporates the individual devices in the design, building and testing of a fiber optic data link.

EE485 Special Topics in Electrical Engineering
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: Permission of senior faculty member or visiting professor

This course provides an in-depth study of special topics in electrical engineering not offered elsewhere in the USMA curriculum. Course content will be based on expertise of a senior electrical engineering faculty member or a Visiting Professor.

EE486 Solid State Electronics
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: EE362

The course covers device physics, operating principles and applications of diodes, bipolar junction transistors, and field effect transistors (FET). It begins with basic properties of crystalline solids, energy diagrams, and thermal physics. P-N junction diodes are the first semiconducting device explored with further study into MOS capacitor and MOSFET based digital circuits. The course normally covers layout of complementary metal oxide semiconductor (CMOS) gates on an integrated circuit chip. Throughout the course, a number of modern electronic devices are introduced including digital memories, charge coupled devices, solar cells, photodiodes, and light emitting diodes. The laboratories are focused on integrated circuit design and layout, device characterization, and simulation using computer aided design (CAD) tools.

EE487 Embedded Systems Development
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: EE375 or equivalents

This course teaches students how to employ microcontrollers in the design of an embedded system. Cadets are introduced to the C programming language, which is the foundation for programming embedded systems. Students conduct a detailed study of common microcontroller peripheral devices with emphasis on their application to real-time control design. Cadets practice top-down design of both hardware and software components of moderately complex digital systems throughout the semester. Cadets are exposed to addressing, serial and parallel input and output, timing, interrupts, A-to-D and D-to-A conversion. Additionally, real-time operating systems will be introduced through the use of programmable devices and soft-processors. The cadets will learn the basics of implementing an operating system on an embedded device and linking peripherals to the processor via the operating system.

EE489 Advanced Individual Study In Electrical Engineering
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisites: EE362 and permission of the Department Head.

Course requirements will be tailored to the needs and qualifications of the individual cadet. The course will normally involve a project requiring research, experimentation, and the submission of a report under the guidance of a departmental advisor. Alternatively, study may take the form of a tutorial course covering material not available in the regular elective course offerings.

EE489A Advanced Individual Study In Electrical Engineering
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisites: EE362 and permission of the Department Head.

Same as EE489.

EE490 Electrical Engineering Summer Research
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: EE362 and permission of the Department Head.

This course is designed to familiarize the cadet with advanced techniques for independent research in electrical engineering. The course will normally require research, development, and experimental implementation of a novel idea or concept. An oral presentation and a written project report will be completed under the supervision of a USMA faculty member who serves as project advisor. The course requires three full weeks of study, completed in conjunction with the Academic Individual Advanced Development Program. Scope, depth, and material covered will meet the requirements of a three-credit course in electrical engineering.

EE490A Electrical Engineering Summer Research
2.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: EE362 and Department Head permission.

This course is designed to familiarize the cadet with advanced techniques for independent research in electrical engineering. The course will normally require research, development, and implementation of a novel idea or concept. An oral presentation and a written project report will be completed under the supervision of a USMA faculty member who serves as project advisor. The course requires three weeks of study, completed in conjunction with the academic individual advanced development program. Scope, depth, and material covered will be equivalent to two credits of course work in electrical engineering.
EE490B  Electrical Engineering Summer Research
1.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: EE362 and Department Head permission.

This course is designed to familiarize the cadet with advanced techniques for independent research in electrical engineering. The course will normally require research, development, and experimental implementation of a novel idea or concept. An oral presentation and a written project report will be completed under the supervision of a USMA faculty member who serves as project advisor. The course requires three weeks of study, completed in conjunction with the academic individual advanced development program. Scope, depth, and material covered will be equivalent to one credit of course work in electrical engineering.

XE442  Alternative Energy Engineering
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: EE301 or EE302

This course provides a study of the fundamentals of alternative energy generation, storage, integration and efficient use. Solar power (both solar thermal and photovoltaic), wind power, hydro power, fuel cells and other sources of energy are covered. Focus is placed on energy conversion, modeling alternative energy sources, and integration of these sources into the power grid. The technical, economic, and political challenges associated with these alternative energies is covered in depth.

XE472  Dynamic Modeling and Control
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: EE301 or EE302

This course covers dynamic modeling and control of linear systems. The course provides an overview of classical control theory as the foundation for control applications in electrical, mechanical, and aeronautical systems. Topics here include system modeling using Laplace transform, frequency domain, and state variable methods. Mathematical models are developed for electrical, mechanical, aeronautical, chemical and other physical control systems. Control systems analysis and design techniques are studied within the context of how each system is physically controlled in practice. Laboratory exercises include feedback design and system identification. Computer design exercises include dynamic modeling and control of various engineering systems.

XE475  Mechatronics
3.5 Credit Hours (BS=0.0, ET=3.5, MA=0.0); Corequisite: EE472

XE475 is a comprehensive introductory course in the field of mechatronics. Mechatronics is the crossroads in engineering where mechanical engineering, electrical engineering, computer science, and controls engineering meet to create new and exciting real-world systems. Knowledge of mechanical and electrical components, controls theory, and design are integrated to solve actual physical design applications.
XE492 Disruptive Innovations  
3.0 Credit Hours (BS=0.5, ET=2.5, MA=0.0); Prerequisites: None

The course begins by developing the background understanding of what disruptive technology is and a historical context about successes and failures of social, cultural, and religious acceptance of technological innovation. To develop this framework, students read several texts underlying the innovator's dilemma, how scientific revolutions are structured, and cultural distinctions found between the sciences and humanities. For each class meeting, students read current scientific and technical literature and come prepared to discuss current events related to technological innovation. Each student researches potential disruptive technologies and prepares a compelling argument of why the specific technologies are disruptive so they can defend their choice and rationale. Cadets also interact with national level innovators throughout academia, industry, and government.

Information Technology Course Descriptions

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours (BS=ET, ET=MA)</th>
<th>Prerequisites</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CY300</td>
<td>Programming Fundamentals</td>
<td>3.0 Credit Hours (BS=0.0, ET=2.5, MA=0.0)</td>
<td>IT105/155 or validation</td>
<td>This is the foundational programming course for CS and IT majors, as well as the first course for the cyber engineering sequence. Cadets learn fundamental computing concepts that will allow them to design, build and test small to medium programs using a high-level programming language. Key concepts include applying appropriate aspects of a structured problem solving process, applying a standardized design notation such as the Unified Modeling Language (UML) to communicate their design, and iteratively testing their program.</td>
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<tr>
<td>CY305</td>
<td>Cyber Foundations</td>
<td>3.0 Credit Hours (BS=0.0, ET=1.5, MA=0.0)</td>
<td>IT105/155</td>
<td>This course builds on the foundations of Information Technology (IT) acquired during the first two years of cadet experiences to ensure graduates have the capacity and confidence to employ information technology—hardware, software, and networks—to empower people and organizations to acquire, manage, communicate and defend information, solve problems, and adapt to change. It provides a deeper understanding of sensor and communications technologies; computer processing, storage, and networks; cyberspace operations, planning and management; interaction of IT components; IT-enabled decision making; and the evolving legal and ethical framework surrounding use of IT and operating in the cyber domain. Information Assurance issues are addressed throughout the course. Cadets complete projects throughout the course using specified information systems to meet given requirements.</td>
</tr>
<tr>
<td>CY350</td>
<td>Network Engineering &amp; Management</td>
<td>3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0)</td>
<td>IT105/IT155 or CY300/CY305; Corequisite: CY300; Disqualifier: IT350</td>
<td>This course addresses the analysis, design, building, and testing of modern computer networks. Network implementation techniques and considerations are discussed and practiced extensively. Key concepts include analysis and design using standardized network models, protocols and practices such as the Open Systems Interconnect (OSI) network model, subnetting, static/dynamic routing, switching, and access control. Practical skills implementing network designs are also reinforced through a number of hands-on laboratory exercises using commodity network hardware.</td>
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<tr>
<td>CY355</td>
<td>Cyber Foundations - Computing</td>
<td>3.0 Credit Hours (BS=0.5, ET=1.5, MA=0.0)</td>
<td>IT105/155; Disqualifier: IT305, CY305</td>
<td>Special requirements: CY355 is designed primarily for CS and IT majors and Cyber minors. Enrollment by other cadets with permission of the Department Head. Provides a more in-depth study of computing for cadets who have demonstrated ability beyond the level of CY305. The course covers material presented in CY305 at an accelerated pace to provide cadets additional opportunities for application and hands-on experience with cyber principles and concepts such as encryption and machine learning, with less emphasis on networking.</td>
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<tr>
<td>CY450</td>
<td>Cyber Security Engineering</td>
<td>3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0)</td>
<td>CS484 or CY350</td>
<td>The focus for this course is to design, build and test secure networked computer</td>
</tr>
</tbody>
</table>
systems. Topics covered include operating system and network security, secure network architecture, and offensive and defensive information operations. Practical exercises that give students hands-on experience with current network security tools and techniques complement a series of laboratory exercises that have small groups of cadets secure their own small network. In a culminating exercise, cadets design, build and test defensive measures to protect a production network from intrusions.

IT105  Introduction to Computing and Information Technology
3.0 Credit Hours (BS=0.0, ET=0.5, MA=0.0); Prerequisite: None. Disqualifier: IT155
This course provides an introduction to the principles and practices of computing and information technology. The course presents foundational program design and construction techniques, with consideration given to principles of software engineering. Problem solving using computing devices as tools is a central theme throughout the course as students employ various design methodologies. Students utilize an integrated development environment and contemporary application software. Emphasis is placed on critical thinking, creativity, and learning how to learn. Students are introduced to legal, ethical, professional, and security issues and the challenges, opportunities, and attributes of the cyber domain.

IT155  Advanced Introduction to Computing and Information Technology
3.0 Credit Hours (BS=0.0, ET=0.5, MA=0.0); Prerequisite: Placement by performance in IT105
IT155 provides a more advanced study of computers, information technology and programming for cadets who have demonstrated ability beyond the level of the IT105 course. The course studies advanced microcomputer technology and advanced programming techniques. All graded material is identical to that in IT105.

IT383  User Interface Development
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: CY300
This course provides a practical introduction to user interface development and usability engineering of interactive applications. The disciplines of Human-Computer Interaction (HCI) and Software Engineering guide these endeavors, but our focus here is more applied than theoretical. Major emphasis is on the principles and techniques for human-centered design and implementation of graphical user interfaces (GUIs) within a software development lifecycle. Cadets will extend their knowledge of programming in a high-level language by learning how to use an interface builder to create a fully functional GUI. Cadets will learn and practice human-centered problem analysis techniques and usability testing methodologies to ensure that their interfaces are usable. A hypothetico-deductive approach to design is emphasized throughout their development efforts. Fundamentals taught in this course will prepare cadets for more advanced software development, development of physical devices, or a deeper theoretical look at HCI topics.

IT384  Network System Programming
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: CY300
This course applies fundamental programming skills to automate interactions with a computer, a local operating system, or the Internet and so use and manage resources and services. Examples of the resources and services that the programming in this course will address include file systems, web servers, mail servers, database servers, image and audio files, compressed and encrypted files and files used in common office environments (documents, presentations, spreadsheets).

IT392  Network Services Management
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: CY350
Cadets study network services in terms of design, implementation, maintenance and security of computer servers. The learning process in this course builds on IT382 and assumes a functional network with basic connectivity. This course first covers the design and selection of hardware and software to provide network services based on identified user requirements. Cadets then learn to support the Army Enterprise through the implementation and maintenance of network services, including naming, addressing, resource management, voice over IP, and web services. Security is a pervasive theme throughout the course. While this course focuses on the practical aspect of network services, it also gives cadets a foundational understanding of the theories behind those services.

IT393  Database Systems
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: CY300, CY305/CY355
This course addresses the analysis, design and implementation of relational and non-relational databases. Structured query language (SQL) is covered in depth along with standard problem domain and data modeling techniques. Implementation techniques and considerations are discussed and practiced extensively. Key concepts include analysis and design using a standardized notation such as the unified modeling language (UML), data model to logical schema conversion techniques, normalization, client-server architectures and web-based access to database systems (e.g. XML). Additional advanced topics covered include system security, transaction processing, web data extraction, Big Data, MapReduce framework and key-value stores.

IT394  Distributed Applications Development
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: CS393
Building on the foundations of algorithm implementation, data representation, web development, and basic networking, this course focuses on the principles of constructing a modern distributed application. Cadets study the principles, construction, and interaction of user interface, network, web server, and database components to produce an effective distributed application. Cadets will learn new tools and skills working as a team to analyze, design, and implement a system that solves a given problem.

IT400  IT Professional Considerations
3.0 Credit Hours (BS=0.0, ET=3.0, MA=0.0); Prerequisite: XE401; Corequisite:XE402
This course addresses the professional considerations of Information Technologists, primarily focusing on non-technical considerations and the development of communication skills. Coursework includes a heavy emphasis on iterative written and oral presentation assignments, based on relevant reading assignments, class discussions, case studies, and lectures by distinguished guest speakers. Content will address recent Department of Defense initiatives and new developments in the computing discipline. Students will develop the ability to identify, explain, and interpret local and global (professional, ethical, social, security, legal, economic, political) impacts of computing on individuals, organizations and society. They will also be able to defend the values and responsibilities of a member of the computing profession and to summarize avenues through which they can continue to grow professionally.
IT460  Cyber Policy, Strategy & Operations  
3.0 Credit Hours (BS=0.0, ET=1.5, MA=0.0); Prerequisite: IT105/IT155 or Validation and SS307/SS357 or Validation  
This course addresses the entire spectrum of Information Warfare from the political, legal, and ethical aspects to the technology and techniques of cyber attack. The Political Science and Computer Science faculty jointly teach this course. The course covers how digitization has changed the world and the national security environment of the United States. Students also learn how attack and defense are conducted in cyberspace through classroom discussion and hands-on exercises in the IWAR Laboratory. The course culminates with a group project in which cadets are given a real scenario and possible U.S. objectives and then develop and brief an information operation plan.

IT485  Special Topic in Information Technology  
3.0 Credit Hours (BS=0.0, ET=0.0, MA=0.0); Prerequisite: Permission of the Department Head  
This course provides in-depth study of a special topic in information technology not offered elsewhere in the USMA curriculum. Course content will be based on the special expertise of the visiting professor or a senior information technology faculty member.

IT491/IT492/IT493  IT Independent Study  
1.0 or 2.0 or 3.0 credits (BS=0.0, ET=0.0, MA=0.0); Prerequisite: Permission of the Department Head  
This elective will be tailored to the specific project and to qualifications of the cadet. The research, study program, or special project will be proposed by the cadet or selected from those proposed by the department. The cadet will formalize a proposal, develop a viable research plan, and conduct project design under the guidance and supervision of a faculty advisor. The Head of the Department will approve cadet projects and designate 1, 2, or 3 credits. Lessons and labs established through consultation between cadet and advisor.

XE401  Integrative System Design I  
3.5 Credit Hours (BS=0.0, ET=3.5, MA=0.0); Prerequisite: CS403 or EE362 or IT394  
This course is a team-based capstone design experience in electrical engineering, computer science and information technology. It provides an integrative experience, presenting each cadet team with a professionally relevant, open-ended situation including professional, ethical, social, security, legal, economic, and political dimensions, where an engineering approach has strong potential to produce benefits. Under the guidance of a faculty advisor for each project team, cadets develop client-focused products, applying the principles of design and implementation to effect an optimal outcome for the circumstances presented to the team by creating a product or service that meets requirements and constraints negotiated with the client.

XE402  Integrative System Design II  
3.5 Credit Hours (BS=0.0, ET=3.5, MA=0.0); Prerequisite: First Class standing in an academic major offered by the Department of Electrical Engineering and Computer Science  
This course is a team-based capstone design experience in electrical engineering, computer science and information technology. It provides an integrative experience, presenting each cadet team with a professionally relevant, open-ended situation including professional, ethical, social, security, legal, economic, and political dimensions, where an engineering approach has strong potential to produce benefits. Under the guidance of a faculty advisor for each project team, cadets develop client-focused products, applying the principles of design and implementation to effect an optimal outcome for the circumstances presented to the team by creating a product or service that meets requirements and constraints negotiated with the client.
COL James J. Raftery, Jr.
Signal Corps / Acquisition Corps
Department Head

B.S., Electrical Engineering, Washington University in St. Louis, 1988
M.S., Electrical Engineering, University of Missouri - Columbia, 1996
Master of Strategic Studies, United States Army War College, 2011
Ph.D., Electrical Engineering, University of Illinois at Urbana-Champaign, 2005

COL Jim Raftery is a Professor and Head of the Department. As a Signal Corps officer he commanded the 261st Signal Company in Hanau, Germany. As a 15-year member of the Army Acquisition Corps, he served as Product Manager Information Warfare at Ft. Meade, Maryland. He completed a one year operational experience with the Cyber Nation Mission Force at Ft. Meade in summer 2016. He holds the academic rank of Associate Professor. His research interests include semiconductor lasers, optoelectronics, power and energy, and cyberspace operations.

COL Christa Chewar
Signal Corps
Deputy Department Head
Associate Professor

B.S., Computer Science, USMA, 1995
M.B.A., Webster University, 2001
M.S., Computer Science, Virginia Tech, 2003
Ph.D., Computer Science, Virginia Tech, 2005

COL Christa Chewar is a Professor and Deputy Head of the Department. She was commissioned as a Signal Corps officer. She has served in tactical and strategic signal units, a basic training company, on a DoD-level software acquisition program, and with the Regional Computer Emergency Response Team in Iraq. Her military assignments include platoon leader, logistics officer, plans officer, company commander. She has served overseas in Germany, Hungary, and the Czech Republic during Operation Joint Endeavor, as well as in Iraq during Operation Enduring Freedom. COL Chewar is a graduate of the Senior Service College, the Command and General Staff College, the Combined Arms Services Staff School, Signal Officers Advanced Course, and Signal Officers Basic Course. Her academic interests include human-computer interaction, programming, web frameworks, and software testing.
Dr. Jean R. S. Blair
Professor of Computer Science

B.S., Economics, Allegheny College, 1981
B.S., Computer Science, Allegheny College, 1981
M.S., Computer Science, University of Pittsburgh, 1984
Ph.D., Computer Science, University of Pittsburgh, 1986

Jean R. S. Blair was the Vice Dean at the United States Military Academy (USMA) from 2010-2017. Prior to becoming the Vice Dean, she served as the director of the Computer Science Program for six years and as the director of the Information Systems Engineering program for four years. She spent academic years 2001-2002 and 2009-2010 on sabbatical at the University in Bergen, Norway, where she served as a visiting professor and senior research scientist. She became a Professor of Computer Science at West Point in 2001. Before joining the USMA faculty in 1994, Blair spent eight years on the faculty at the University of Tennessee and also worked at Oak Ridge National Laboratory as a research scientist.

Dr. Katherine Duncan
Visiting Professor, CERDEC

B.E., Computer Engineering/Electrical Engineering Minor, Stevens Institute of Technology
M.E., Electrical Engineering/Optics Certificate Minor, Stevens Institute of Technology
Ph.D., Applied Physics, New Jersey Institute of Technology Dissertation
Ph.D., Computer Science, University of Pittsburgh, 1986

Dr. Kate Duncan received a B.E. in Computer Engineering and M.E. in Electrical Engineering from Stevens Institute of Technology and a Ph.D. in Applied Physics from New Jersey Institute of Technology. She joined CERDEC in 2009, where she has been engaged in the development of novel nanomaterials for the next-generation communication systems. Synthesis, deposition, material, and electrical characterization have been her research focus. This has resulted in her group being among the first to successfully deposit novel nanomaterial via ink-jet printing for RF/power applications. She developed a direct-write laboratory enhancing the Army's in-house prototyping capabilities and plans to introduce the capabilities to the USMA cadets.

COL (Ret) John R. James, Ph.D., P.E.
Associate Professor

B.S., USMA, 1967
M.S., Electrical Engineering, University of California, Berkeley, 1973
Ph.D., Electrical Engineering, Rensselaer Polytechnic Institute, 1986
Registered Professional Engineer, Virginia, 1976

Dr. James’ previous military assignments include Platoon Leader/Battery Commander, 5th Bn, 6th Arty, 32nd AADCOM in Germany, District Senior Advisor, Republic of Vietnam, Battery Commander / Chief Division Airspace Management Element, 2/59 ADA, 1st Armored Division, Inst. / Asst. Prof / Assoc. Prof, Dept of EE, USMA, and Director Artificial Intelligence Center, TRADOC. Dr. James’ technical interests are in network science, artificial intelligence, software tools for real-time control, and information assurance. He is a former Associate Editor for the IEEE Control Systems Magazine, former member of the Board of Governors of the IEEE Control System Society (CSS), and former Chairman of the CSS Technical Committee for Computer-Aided Control System Design (CACSD). Dr. James has held the Adam Chair in Information Technology since 2000 and was the first Director of the USMA Network Science Center, serving in that capacity from April of 2007 until February of 2009. He served as the Computer Science mentor at the National Military Academy of Afghanistan (NMFA) from February to July of 2009.

Dr. Wenli Huang
Professor of Electrical Engineering

B.S., Physics, Beijing University, China, 1990
Ph.D., Electrical Engineering, University of Connecticut, 1995

Dr. Huang previously worked as an Assistant Professor at Bucknell University for three years, where she taught courses in electronics, circuits theory, optoelectronics, optical fiber communications, and digital design labs. She also served as a Visiting Assistant Professor at Trinity College at Hartford, Connecticut from Fall 1995 to Spring 1997. Her research interests include design, modeling, and fabrication of semiconductor optoelectronic devices with a focus on nanostructure wide-gap semiconductor lasers and modulators.
Mr. Kyle King  
**National Security Agency (NSA) Fellow**

M.S., Information Technology, University of Maryland University College, Europe, 2011  
B.S., Computer Science, University of Idaho, 2006  
B.S., Applied Mathematics, University of Idaho, 2006  

Mr. King attended the University of Idaho as a Scholarship for Service Fellow, where he published papers on building computer laboratories suitable for teaching computer exploitation. Mr. King took a job in Maryland as a protocol analyst. Mr. King spent five years working in England where he studied and taught at the University of Maryland University College, Europe. He received a Master's in Information Technology. Before coming to West Point, Mr. King worked at the Aerospace Data Facility in Aurora, Colorado as a Senior Data Science writer analytics and supporting data science initiatives. Mr. King's research interests are in data science, network understanding, and network visualization.

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Dr. Robert Sadowski  
**Adjunct Professor, Army Chief Robotacist**

Ph.D., Electrical Engineering, Stanford University, 1995  
M.S.S., Strategic Studies, US Army War College, 2008  
M.S., Electrical Engineering, Stanford University, 1992  
B.S., Computer Engineering (EE), USMA, 1986  

Dr. Robert W. Sadowski is a member of the Scientific and Professional (ST) cadre of the Senior Executive Service and serves as the Robotics Senior Research Scientist within the Research, Technology and Integration Directorate at the US Army Tank Automotive Research, Development and Engineering Center (TARDEC) in Warren, MI. Selected to this position after a career within the Army culminating as an Academy Professor and Electrical Engineering Program Director in the Department of Electrical Engineering and Computer Science, USMA where he was instrumental in developing the Academy's robotics program, facilities, and outreach. He also has over 40 months of operational experience in Southwest Asia in a variety of leadership, staff, and engineering positions including Iraq and recently Afghanistan.

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Dr. Edward Sobiesk  
**Professor of Computer and Cyber Science**

Ph.D. Computer and Information Sciences, University of Minnesota, 2000  
M.S. Computer and Information Sciences, University of Minnesota, 1996  
B.S. Computer Science, Winona State University, 1987  

Dr. Edward Sobiesk serves as the Senior Civilian Faculty Member in the Army Cyber Institute. He spent 28 years in the U.S. Army, retiring as a colonel. He has over two decades of experience as an educator, leader, and practitioner within the Cyber Domain. He has taught 17 different computer science and information technology courses and has directed three different computing programs at West Point; he has run a 200 person computer support directorate; and he has over 30 invited or refereed academic publications. His research interests include online privacy and usable security, computing and cybersecurity education, artificial intelligence and machine learning, and complex interdependency.

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Mr. Roland Trope  
**Adjunct Professor, Dept. of Law**

J.D., Yale Law School, 1980  
M.A., English Language and Literature, Oxford University, 1976  
B.A., English Language and Literature, Oxford University, 1972  
B.A., University of Southern California, 1969  

Mr. Trope is a partner in the NYC offices of the law firm of Trope and Schramm LLP. He is also a member of the Senior Advisory Board of IEEE Security & Privacy. His specialization includes government procurement, export controls, compliance with anti-corruption laws, cross-border tech transfers, protection and licensing of intellectual property. He advises corporations on technology acquisition and licensing agreements, compliance with cross-border trade regulations issued by the U.S. Treasury, Commerce, and State Dept's., senior officials responsible for oversight of defense procurements of high technology articles and contractors performing development contracts for digital and other software-intensive land and naval systems and medical devices for use by U.S. and allied armed forces. His academic
interests include security of corporate information systems, professional ethics, and linguistics.

COL Tanya T. Estes
Aviation
Associate Professor
B.S. Mechanical Engineering (Aerospace), USMA, 1995
M.S. Computer Science, North Carolina State University, 2004
Ph.D. Human-Centered Computing, Georgia Institute of Technology, 2012
COL Estes is an Aviation Officer, having served as an AH-64A Apache Instructor Pilot and is currently the Director of the Information Technology Program. Her previous assignments include Battalion Intelligence Officer, 3-229th Aviation Regiment, Ft. Bragg, NC; Company Commander, HHC, 1-14th Aviation Regiment; Assistant Professor, USMA; Operations Officer, 164th Theater Airfield Operations Group, and Operations Officer, Air Traffic Services Command, Ft. Rucker, AL. She was deployed during Operation Joint Endeavor to Bosnia-Herzegovina and Operation Iraqi Freedom as the Airfield Operations Officer for Udairi Army Airfield. COL Estes is a graduate of the Army’s Command and General Staff College, AH-64A Instructor Pilot Course, Aviation Captain’s Career Course, Initial Entry Rotary Wing Course, Aviation Officer Basic Course, Master Fitness Trainer Course, Air Assault School and Airborne School. Her research interests include haptics, spinal cord injury rehabilitation, and human-computer interaction.

Maj (USAF, Ret) Peter D. Hanlon
Associate Professor
B.S., Engineering, University of Central Florida, 1985
M.S., Electrical Engineering, Air Force Institute of Technology, 1992
Ph.D., Electrical Engineering, Air Force Institute of Technology, 1996
Dr. Hanlon is a civilian professor in the EE&CS Department, after retiring from the Air Force. He was a Research and Development Engineer specializing in guidance and control systems for aircraft, munitions, and space systems. His previous military assignments include service in Massachusetts, Ohio, and Florida. Just before coming to USMA, he served as Chief of the Weapons Lethality and Vulnerability Branch that was responsible for developing computer models to assess the effectiveness of inventory and conceptual weapons against various high value targets. His academic interests include aircraft and missile failure detection, guidance and tracking algorithms, and software development.

Dr. Christopher Okasaki
Associate Professor
B.S., Mathematics, Harvey Mudd College, 1989
M.S., Computer Science, Carnegie Mellon University, 1993
Ph.D., Computer Science, Carnegie Mellon University, 1996
Dr. Okasaki spent three years at Columbia University as an Assistant Professor of Computer Science, where he taught courses in programming languages and advanced data structures. He has also worked as a visiting researcher at the University of Glasgow, and as a consultant for an Internet startup company, developing a compiler for their agent control language. His primary research interests are programming languages and algorithms. He is especially interested in the combination of these two areas, considering questions of how the details of a programming language affect the implementation and efficiency of algorithms.
Dr. Suzanne J. Matthews  
**Associate Professor**  
B.S., Computer Science, Rensselaer Polytechnic Institute, 2006  
M.S., Computer Science, Rensselaer Polytechnic Institute, 2008  
Ph.D., Computer Science, Texas A&M University, 2012  
Dr. Matthews is an assistant professor in the Department of Electrical Engineering & Computer Science. She was a research assistant for three years in the Department of Computer Science & Engineering at Texas A&M University. During the last year of her Ph.D., she was recognized as a Texas A&M University Dissertation Fellow. Prior to her Ph.D. program, Dr. Matthews held teaching and research assistantships at Rensselaer Polytechnic Institute. For academic year 2007-2008, she was recognized as a Rensselaer Master Teaching Fellow for her performance as a teaching assistant. During the summer of 2006, she received a CRA-W Distributed Mentoring Program (DMP) summer research grant. She is a member of the Association of Computing Machinery (ACM), the Institute of Electrical and Electronics Engineers (IEEE), and the honor societies of Upsilon Pi Epsilon (UPE) and Phi Kappa Phi. Her research interests include high performance phylogenetic algorithms, computational biology, experimental algorithmics, data analysis, parallel computing, domain-level compression and version control systems.

Dr. Paul Maxwell  
**Associate Professor**  
Ph.D., Colorado State University, 2012  
M.S., University of Kentucky, 2001  
B.S., United States Military Academy, 1992  
Dr. Maxwell is an Associate Professor in the department of Electrical Engineering and Computer Science and is the Cyber Fellow of Computer Engineering at the Army Cyber Institute at West Point. He served 24 years in the Army as an Armor officer. His military assignments include Battalion Executive/Operations Officer, Brigade Logistics Officer, Company Commander, Scout Platoon Leader, Company Executive Officer, and Mechanized Infantry Platoon Leader. He is a member of the Institute of Electrical and Electronics Engineers (IEEE) and is a CISSP.

Dr. Aaron St. Leger  
**Associate Professor**  
B.S., Electrical Engineering, Drexel University, 2003  
M.S., Electrical Engineering, Drexel University, 2005  
Ph.D., Electrical Engineering, Drexel University, 2008  
Dr. St. Leger’s expertise is in electric power systems. He is currently Director of the Electrical Engineering Program. His research interests include power system modeling, computation, operation and control. His research has focused on faster than real time computation via analog techniques and power transmission line modeling.
LTC Thomas Babbitt

Infantry

Assistant Professor

Ph.D., Computer Science, Rensselaer Polytechnic Institute, 2016

M.S., Computer Science, Rensselaer Polytechnic Institute, 2009

B.S., Computer Science, United States Military Academy, 1999

LTC Tom Babbitt served in Iraq as a Stryker Rifle Company Commander, in Kuwait as the Future Operations and Plans OIC in the SW Asia Cyber Center, and an operational deployment to Bosnia-Herzegovina as an Infantry Battalion Support Platoon Leader. As infantry officer he was Rifle Platoon Leader, Rifle Co. Executive Officer, Support Platoon Leader, Assist. Battalion S3, and Stryker Rifle Co. Commander. As an FA53 Info. Systems Management Officer, he served on USARAK G6 staff, and in the SWACC. He is a graduate of the Command and General Staff College, Combined Arms and Staff School, Infantry Captains Career Course, Infantry Officer Basic Course, Airborne and Air Assault School. Academic interests include Network Protocols, Network Security, and Cyber Policy.

MAJ Raymond Blaine

Cyber

Assistant Professor

Ph.D., Electrical Engineering, Vanderbilt University, 2014

M.S., Electrical Engineering, Vanderbilt University, 2011

B.S., Electrical Engineering, United States Military Academy, 2002

MAJ Ray Blaine was commissioned as a Signal Officer upon graduation. He is currently CRC Director. His assignments include positions in the 82nd Airborne Division and 18th Airborne Corps at Fort Bragg, NC, to include commanding HHC, 508th Parachute Infantry Regiment. He was selected for the Cyber Branch and joined the Cyber Protection Brigade. He served as Mission Team Leader for Cyber Protection Teams 156 and 201. Has served 2 tours in Operation Iraqi Freedom and 1 tour in Operation Enduring Freedom, as a Contingency Communication Platoon Leader, Aide-de-Camp to the Chief of Staff MNC-I, and as S6 for 2-508 PIR respectively. He is a graduate of the Signal Officers Basic Course, Signal Captains Career Course, BDE/BN S6 Course, Command and General Staff College, Airborne School, Jumpmaster School, and the Combat Diver Qualification Course.

Dr. Erica Borghard

Assistant Professor

Ph.D., Political Science, Columbia University, 2014

M.Phil., Political Science, Columbia University, 2011

M.A., Political Science, Columbia University, 2008

B.A., Political Science, Columbia University, 2007

Dr. Borghard is an Assistant Professor at the Army Cyber Institute and Department of Electrical Engineering and Computer Science at West Point. She received her Ph.D. in Political Science in 2014 from Columbia University. From 2014-2017 she served as an Assistant Professor and Executive Director of the Grand Strategy Program in the Department of Social Sciences at West Point. Subsequently, She was selected to be an International Affairs Fellow with the Council on Foreign Relations, where from 2017-2018 she spent her fellowship year at JPMorgan Chase & Co. working in the Global Cyber Partnerships and Government Strategy Group, and U.S Cyber Command working in the Cyber National Mission Force.

LTC Jason Cody

Signal Corps

Assistant Professor

Ph.D., Computer Science, Vanderbilt University, 2018

M.S., Computer Science, Vanderbilt University, 2010

B.S., Computer Science, United States Military Academy, 2002

LTC Cody was commissioned as a Signal Officer from USMA. His previous assignments include Platoon Leader, Company Executive Officer and Assistant S3, 86th Signal Battalion, Fort Huachuca, AZ; Commander of US Army South's Early Entry Command Post Communications Detachment, 56th Signal Battalion, Fort Sam Houston, TX; Commander of C Company, HHC, and Rear Detachment, 63rd Signal Battalion, Fort Gordon, GA; Assistant Professor, USMA, West Point, NY; Executive Officer, 69th Strategic Signal Battalion, Grafenwoehr, Germany; and Commander of the Bavaria Signal Company, 102nd Signal Battalion, Grafenwoehr, Germany. He is a graduate of the Command and General Staff College, Signal Captain's Career Course, and Air Assault School. He has deployed to Afghanistan in support of Operation Enduring Freedom, Iraq in support of Operation Iraqi Freedom, and Kuwait in support of Operation Iraqi Freedom III.
Dr. Thomas S. Cook COL (R)  
**Armor**  
Assistant Professor  

B.S., History, Brockport State University, 1987  
M.S., Computer Science, Naval Postgraduate School, 1999 M.S., Industrial Engineering, University of Louisville, 2003  
Ph.D., Software Engineering, Naval Postgraduate School, 2008  

Dr. Cook was commissioned Armor and later joined the Army Acquisition Corp. His Armor assignments include Platoon Leader and Executive Officer, 3rd Infantry Division; Platoon Leader, VII Corps Canadian Army Trophy Team, 1st Armored Division; Company Commander, 1st Infantry Division; and Chief, Crew Gunnery Doctrine, United States Army Armor Center. In the Acquisition Corp he has served as Assistant Program Manager in the Office of the Secretary of Defense for Command, Control, Communications, and Intelligence; Executive Assistant to the Deputy Director for Integration and Product Leader, Battle Manager, Missile Defense Agency. He deployed with the 1st Armored Division to Saudi Arabia and Kuwait during Operations Desert Shield and Desert Storm. He retired from active duty on 1 October, 2016 after 28 years and 9 months of active federal service. Academic interests include software engineering, real-time systems, information assurance, and computer science education.

LTC Steven Elgan  
**Signal Corps**  
Assistant Professor  

MS, Mechanical Engineering University of Illinois, 2011  
MA, Information Technology Management Webster University, 2008  
BS, Mechanical Engineering, United States Military Academy, 2001  

LTC Elgan graduated from USMA commissioning as an officer in the Signal Corps. His previous assignments include Platoon Leader, BCO, 57th Signal BN, Ft Hood, TX; Brigade Assist S1/Company XO/Brigade Assist S4, HHC; 3rd Signal BDE, Ft Hood, TX; Battalion S6, HHC, BSB, 4IBCT, 1st ID, Ft Riley, KS; Company Commander, Network Support Co, BSTB, 4IBCT, 1st ID, Ft Riley, KS; Instructor and Assistant Professor, Department of Civil and Mechanical Engineering, USMA; Battalion S3, 304th Expeditionary Signal BN, 1st Signal Brigade, Camp Humphreys Korea; Deputy G6, 3rd Expeditionary Sustainment Command, Ft Bragg, NC; Battalion Commander, 330th Transportation BN (Rear Provisional), Ft Bragg, NC; Deputy G5, 3rd Expeditionary Sustainment Command, Ft Bragg, NC. He deployed to Iraq for two tours in support of Iraqi Freedom. He is a graduate of the Signal Captains Career Course, Air Assault School, and the Command and General Staff College.

LTC David Harvie  
**Field Artillery**  
Assistant Professor  

B.S., Computer Science, United States Military Academy, 1996  
M.S., Computer Science, North Carolina State University, 2006  
Ph.D., Computer Science, University of Kansas, 2015  

LTC Harvie is a Field Artillery Officer. His previous military assignments include Company Fire Support Officer (FSO), Battery Fire Direction Officer (FDO), Battery Executive Officer, and Battalion FDO in 3-319th AFAR, 82nd Airborne Division; Battalion Maintenance Officer, Battalion Assistant S3, and Battery Commander in 1-39th FA (MLRS), 3rd Infantry Division; Assistant Professor in the Department of Electrical Engineering and Computer Science, USMA; Iraqi Army Advisor and Brigade FSO in 1st Brigade, 82nd Airborne Division. LTC Harvie has deployed to Kosovo (1999) and twice to Iraq (2003 and 2009). LTC Harvie's military education and training include: Field Artillery Officer Basic Course, Field Artillery Captains Career Course, Combined Arms Staff Services School, Intermediate Level Education, Air Assault School, Airborne School, Ranger School, Jumpmaster School, and Joint Firepower Course.

LTC Kirk Ingold  
**Military Intelligence**  
Assistant Professor  

B.S., Electrical Engineering, USMA, 1996  
M.S., Electrical Engineering, Stanford University, 2006  
Ph.D., Electrical Engineering, Stanford University, 2015  

LTC Ingold was commissioned as a Military Intelligence Officer from the United States Military Academy. He became a Functional Area 24 - Telecommunications Officer in 2008. His previous military assignments include Assistant Battalion and Battalion Intelligence Officer, 1st Battalion, 501st Parachute Infantry Regiment (PIR) at Fort Richardson, AK; Assistant Brigade and Brigade Intelligence Officer, 18th Aviation Brigade; Brigade Adjutant, 525th Military Intelligence Brigade and Company Commander, HHD, 525th MI Brigade at Fort Bragg, NC; and Deputy Director, Theater Network Operations and Security Center (TNOSC) - Kuwait at Camp Arifjan, Kuwait. His academic interests include non-linear optics and optical parametric oscillators for frequency comb applications in the mid-infrared, high energy laser applications, and optoelectronic semiconductor devices.
LTC Christopher Korpela  
Corps of Engineers  
Assistant Professor  

B.S., Electrical Engineering, USMA, 1996  
M.S., Electrical Engineering, University of Colorado, 2006  
Ph.D., Electrical Engineering, Drexel University, 2014  

LTC Korpela is an Academy Professor serving as the Deputy Director of the Electrical Engineering Program. His previous military assignments include: Tank Platoon Leader, Scout Platoon Leader, Troop Executive Officer, Squadron Adjutant, and Squadron Assistant Operations Officer in 1st Squadron, 3rd Armored Cavalry Regiment. He deployed as the Headquarters Commander for the 439th Engineer Battalion (USAR) while attached to 2nd Brigade, 82nd Airborne Division in Baghdad, Iraq, in support of Operation Iraqi Freedom. In 2010, he served as the 2nd Infantry Division Network Engineer at Camp Red Cloud, South Korea. In 2015, he deployed with the 82nd Airborne Division in support of Operation Inherent Resolve. He is a graduate of the Armor Officer Basic Course, Engineer Captains Career Course, Combined Arms and Services Staff School, Command and General Staff College, Ranger School, Airborne School, and Air Assault School. His research interests include robotics, aerial manipulation, and embedded systems.

Mr. Dominic Larkin (MAJ) R  
Field Artillery  
Assistant Professor  

B.S., Computer Science, Troy State University, 2003  
M.S., Computer Science, Georgia Institute of Technology, 2008  

Mr. Larkin enlisted as an Infantryman and served with 3/75th Ranger Regiment, Ranger Training Brigade, and the 82nd Airborne Division before being selected to attend Officer Candidate School. After receiving his commission as a Field Artillery officer he served in 2-5th Field Artillery, 2-80th Field Artillery which later reflagged to 1-78th Field Artillery and the 101st Airborne Division. He is a graduate of the Army Command and General Staff College, the Field Artillery Advanced Course and Basic Course, Officer Candidate School, Airborne, Jumpmaster, Ranger, and Pathfinder Schools. He deployed in support of Operation Just Cause in Panama, Operation Iraqi Freedom in Iraq and Operation Enduring Freedom in Afghanistan. His academic interests include computer science education, robotics, and cyber privacy, and cyber warfare.

LTC Michael Lanham  
Cyber Warfare  
Assistant Professor  

B.S., Computer Engineering, North Carolina State University, 1992  
B.S., Computer Science, North Carolina State University, 1992  
M.S., Computer Science, University of Florida, 2002  
M.S., Computation, Organizations, and Society, Carnegie Mellon University, 2014  

LTC Mike Lanham is an Academy Professor and Director of the Cyber Research Center. He became a Functional Area 53 - Information Systems Management officer in 2003. He has served in numerous deployments to Macedonia, Bosnia-Herzegovina, Sierra Leone, Liberia, and Kuwait. His military assignments included duty with 2-15IN, 3rd ID(Mech) (Schweinfurt, Germany) and Special Operations Command Europe (Stuttgart, Germany) as well as with the 1st BDE and 1-327IN, 101st Airborne Division (Air Assault) (Fort Campbell, Kentucky). He has also served as faculty at USMA, in various staff positions with USSTRATCOM, Joint Functional Component Command (JFCC)-Integrated Missile Defense (IMD), JFCC-Network Warfare (JFCC-NW), USARCENT, and USASMDC/ARSTRAT/ARFORCYBER. His current research interests revolve around finishing his dissertation in "Rapid Mission Assurance Assessment via Socio-Technical Modeling and Simulation."

Dr. Peggy J. Leonowich-Graham  
Assistant Professor  

B.S., Computer Science, University of New Haven, 1984  
M.S., Systems Management, University of Southern California, 1989  
D.C.S., Computer Science, Colorado Technical University, 2003  

Dr. Leonowich-Graham was CIO of Pikes Peak Integrated Solutions in Colorado Springs. She led the software development of an electronic medical record system for mental health. Dr. Leonowich-Graham has over 14 years experience working for the Department of the Army in Information Technology positions. She was the Chief of the Information Management Department at Keller Army Community Hospital for 8 years. Prior to working for the government, she was a programmer for a pharmaceutical company. Her prior teaching experience was at Connecticut College and Big Bend Community College. She was also a cadet for two years at USMA. Dr. Leonowich-Graham’s research interest is data quality, and she currently serves on the Program Committee for the International Conference on Information Quality at MIT.
LTC Christopher Lowrance  
Military Intelligence  
Assistant Professor  
Ph.D., Computer Engineering, University of Louisville, 2016  
M.S., Electrical Engineering, George Washington University, 2008  
B.S., Electrical Engineering, Virginia Military Institute, 2000  

LTC Lowrance has served in multiple capacities, including operational deployments to Iraq and Kuwait, as a Signal Officer and Network Engineer. His past military duty positions include: Signal Platoon Leader, 32d Signal Battalion, Darmstadt, Germany; Assistant Brigade S-3 Operations for the 22nd Signal Brigade while deployed in support of Operation Iraqi Freedom I; G-6 Signal Officer for V Corps Artillery, Schweinfurt, Germany; Company Commander of Delta Company, 551st Signal Battalion and Delta Company, 369th Signal Battalion, 15th Signal Brigade, Fort Gordon, Georgia; Chief of Enterprise Operations, Southwest Asia Cyber Center, Camp Arifjan, Kuwait. He is a graduate of the Signal Officer Basic Course, Signal Captain’s Career Course, Army Command and General Staff College. His academic interests include ad hoc networks, robotics, machine learning, and fuzzy control.

Mr. James R. Loy (LTC) R  
Associate Professor  
Ph.D, RPI, 2003, Computer and Systems Engineering  
M.E., RPI, 1986, Computer Engineering  
M.S., RPI, 1986, Computer Science  
B.S., USMA, 1974, General Engineering  

Dr. Loy entered the Army as an Armor Officer after USMA graduation. He returned to USMA in 2008 and directed Dean’s Resources Division, 2008-2018. He then returned to the EECS Department in 2018 to return full time to teaching and research pursuits. He initially joined the faculty at West Point in 1987, was selected as an Academy Professor and rose to Computer Science Program Director. Dr. Loy retired as a Lieutenant Colonel (P) in 1996. He also worked for Morgan Stanley and later, was an equity partner in a technology start-up firm. Dr. Loy earned the reputation as Wall Street’s most respected expert on Business Continuity Planning and Disaster Recovery. He served as the Secretary, Vice President and President of the Mid-Hudson Chapter of the IEEE. He is a member of the Phi Kappa Phi, Eta Kappa Nu, and Pi Mu Epsilon national honor societies. His research interests are Fuzzy Logic, VLSI / FPGA chip design, Cyber.

LTC Alexander S. Mentis  
Signal Corps  
Assistant Professor  
B.S., Computer Science, United States Military Academy, 1997  
M.S., Computer Science, University of Colorado Denver, 2007  
Ph.D., Computer Science, Auburn University, 2014  

LTC Mentis is currently Director of the Computer Science Program. He has served as a Signal Officer and Telecommunications Systems Engineer in several overseas assignments and operational deployments including S. Korea, Thailand, Egypt, Afghanistan, Iraq, and Bahrain. His past military duty positions include Signal Company Commander in the 1st Brigade Combat Team, 101st Airborne Division (Air Assault); S-6 at the brigade and battalion levels in the 101st Airborne and 25th Infantry Divisions, Platoon Leader, Executive Officer, and S-4 in a variety of tactical signal units. He is a Distinguished Graduate of the Command and General Staff College and a graduate of the Air Assault School. His academic interests include agent-based modeling and simulation, metaheuristic optimization, artificial intelligence, network science, and computer science education.

MAJ W. Clay Moody  
Cyber  
Assistant Professor  
Ph.D., Computer Science, Clemson University, 2015  
M.S., Computer Networking, North Carolina State University, 2009  
B.S., Computer Engineering, Clemson University, 1998  

MAJ W. Clay Moody is an FA24 Information System Engineer Officer. He has served two tours in Iraq as a Cyber Defense Planner in the Expeditionary Cyber Support Element and as a Stryker Infantry Battalion Signal Officer. MAJ Moody also served as a Cyber Battle Captain and Cyber Capabilitier Engineering with US Cyber Command. Originally branched as a Signal Officer, MAJ Moody served as a Platoon Leader, Company Executive Officer, and Assistant Battalion S3 in the 57th Signal Battalion. He is a graduate of the Signal Officers Basic Course, Signal Captains Career Course, and CGSC ILE. His academic interest include cyber maneuver, parallel and distributed systems, networking, and security.
MAJ Timothy McGee
Signal Corps
Assistant Professor
D. CS, Computer Science, Colorado Technical University, 2016
M. S. Telecommunications Engineering, University of Maryland University College, 2011
B. S. Computer/Information Technology, Business Administration and Management, Northern Arizona University, 2004 • Certificate in Web Development
After graduation, he was reassigned to Signal Brigade in Camp Humphries, Korea. Where, he served as the Area Node Platoon Leader and Company Executive Officer. He was reassigned to Special Troops Battalion, at Fort Stewart, Georgia. There, he served as the Company Executive Officer, Company Commander, Battalion S6, and Battalion S3. He deployed to Combat Operating Base Qayyarah West during Operation Iraqi Freedom. 2009, he departed for the Signal Captain's Career Course. He joined 3d Battalion, 158th Aviation Regiment where he served as the Battalion S6, in support of the Battalion's deployment to OIF 09-10. Upon completion, as the Assistant S6. 2012, he deployed to Afghanistan in support of Operation Enduring Freedom. He was then reassigned to Cyber Protection Brigade.

LTC Christopher Morrell
Signal Corps
Assistant Professor
B.S., Computer Science, United States Military Academy, 2000
M.S., Computer Science, Rensselaer Polytechnic Institute, 2008.
LTC Christopher Morrell is an FA26 Information Systems Engineer Officer. He has served a tour in Afghanistan as the Signal Detachment Commander for 2nd Battalion, 1st Special Forces Group (Airborne) and a tour in Kuwait as the Chief of Enterprise Engineering for 335th Signal Command (Theater) (Provisional). Originally branched as a Signal Officer, LTC Morrell has served as a Battalion S6 for 1-501st Parachute Infantry Regiment and a platoon leader in the 21st Signal Company. He is a graduate of the Signal Officer's Basic Course, Signal Captain's Career Course, Combined Arms Service Staff School, CGSC ILE, and the Jumprmaster School. His academic interests include cyber operations, networking, and computer security.

LTC Glenn Robertson
Signal Corps
Assistant Professor
Ph.D., Computer Science and Engineering, University of South Carolina, 2012
M.S., Computer Engineering, Colorado Technical University, 2000
B.S., Electrical Engineering, United States Military Academy, 1996
LTC Robertson graduated from USMA in 1996 with a Bachelor’s degree in Electrical Engineering. In 2000, he received a Master’s degree from Colorado Technical University in Computer Engineering. In 2007 he deployed to Iraq and was the Chief Network Engineer for the Army’s tactical network in Iraq. In 2012, he received a PhD in Computer Science and Engineering from the University of South Carolina. From 2015-2018 he was the Chief of Innovation and Partnership Research at the Army Cyber Institute. His research interests include network security, routing convergence, and wired networks availability and reliability.

LTC Malcolm Haynes
Armor
Assistant Professor
B.S., Computer Science, United States Military Academy, 1998
M.S., Computer Science, University of Texas at Austin, 2000
M.S., Business Supply Chain Management and Logistics, University of Kansas, 2011
M.A., Military Arts and Sciences, Command and General Staff College, 2012
LTC Haynes was assigned as a Tank Platoon Leader in 2d Battalion, 12th Cavalry Reg, 1st Cavalry Division, Fort Hood, TX. Other assignments include TAC Officer, Officer Candidate School, 3rd Battalion, 11th Infantry Reg, Fort Benning TX; Assistant Operations Officer and Company Commander, 2d Battalion, 23d Infantry Reg, 4th Stryker Brigade Combat Team, 2d Infantry Division, Ft Lewis, Washington; Military Transition Team Chief, 1st Battalion, 19th Reg, Iraqi Army, Khalis, Iraq; Financial Management Officer, 43d Sustainment Brigade, Fort Carson, Colorado; Future Operations Maneuver Planner, 3d Corps, Fort Hood, TX; Operations Officer and Executive Officer, 2d Squadron, 3d Stryker Calvary Reg, Fort Hood, TX. He deployed to Iraq in...
LTC Robert Ross  
**Cyber**  
**Assistant Professor**  
B.S., Computer Science, Rowan University, 1998  
M.S., Computer Science, Monmouth University, 2005  
Ph.D. Candidate, Information Science, Naval Postgraduate School, pending  
LTC Bob Ross is a newly transitioned Cyberwarfare officer. He was commissioned and served as a Field Artillery Officer for 18 years. He has two combat deployments to Iraq and an operational deployment to Kosovo. His military assignments include Brigade Fires and Effects Coordinator, Battalion S3, Stability Transition Team Operations Advisor, Battery Commander, Paladin Platoon Leader, and Company Fire Support Officer. LTC Ross is a graduate of resident CGSC. His academic interests include robotics, Linux systems administration, and computer networks.

MAJ Danny Zhu  
**Military Intelligence**  
**Assistant Professor**  
Ph.D., Electrical Engineering, The Pennsylvania State University, 2018  
M.S., Electrical Engineering, Rochester Institute of Technology, 2007  
B.S., Electrical Engineering, Rochester Institute of Technology, 2007  
MAJ Danny Zhu commissioned as a Military Intelligence Officer in 2007 through ROTC at the Rochester Institute of Technology. His previous assignments include Executive Officer to the Commander, 501st MI Brigade and Headquarters Company Commander, 524th MI Battalion, Seoul, Korea; Assistant S2, HHC, 3d Ranger Battalion, and Regimental Collection Manager, MI Company, 75th Regimental Special Troops Battalion, Fort Benning, GA; Intelligence and Electronic Warfare Maintenance Platoon Leader, Bravo Company, 224th MI Battalion (Aerial Exploitation), Hunter Army Airfield, GA. He is a graduate of the Military Intelligence Captain's Career Course, Ranger School and Airborne School. His current research interests include offensive and defensive cyber warfare, network systems, and Computer Science education.

LTC Joshua Bundt  
**Signal Corps**  
**Instructor**  
M.S., Computer Science, Naval Postgraduate School, 2013  
B.S., Electrical Engineering, United States Military Academy, 2000  
LTC Josh Bundt commissioned as a Signal Officer upon graduating from the United States Military Academy in 2000. His previous assignments include S6 at the brigade and battalion levels, company command, and Division G6 NetOps officer. He has served three tours in support of Operation Iraqi Freedom and one tour in Operation Enduring Freedom with the 4th Infantry Division, the 16th Combat Aviation Brigade, and the 69th Air Defense Artillery. He is a graduate of the Signal Officers Basic Course, the Marine Expeditionary Warfare School, Command and General Staff College, and Air Assault School.

CPT John H. Chamberlin  
**Cyber**  
**Instructor**  
B.S. Computer Science, United States Military Academy, 2008  
M.S. Computer Science, University of Colorado at Boulder, 2006  
CPT John Chamberlin received his commission from the United States Military Academy as an Aviation Officer on May 31st, 2008, and was assigned to Fort Hood, Texas. He has served two combat tours in Afghanistan as both an Assistant Operations Officer for the 1st Armored Division Combat Aviation Brigade and as a Company Commander with the Special Operations Aviation Regiment. Prior to commissioning, CPT Chamberlin served as an infantry soldier with the 82nd Airborne Division, where he participated in the 2003 invasion of Iraq. His military education includes the Basic Officer Leadership Course, the Aviation Officer's Basic Course, Initial Entry Rotary Wing Aviator's Course, the AH-64D Apache Longbow Qualification Course, Survival Evasion Resistance Escape (SERE) Course Level C, Aviation Captain's Career Course, the Unmanned Aviation Systems Commander's Course, Airborne School, and Air Assault School.
CPT Jack Cooperman
Signal Corps Instructor
B.S., Electrical Engineering, United States Military Academy, 2008
M.S.E., Electrical and Computer Engineering, University of Texas – Austin, 2017

CPT Cooperman served as the Assistant Operations Officer and as a Stryker Infantry Platoon Leader prior to deployment to Kandahar province, Afghanistan in June 2010. There, he served as a Stryker Infantry Platoon Leader and Squadron Maintenance Officer in support of Operation Enduring Freedom. CPT Cooperman graduated as the distinguished honor graduate from the Signal Captain's Career Course. After, CPT Cooperman commanded E Company, 53rd Signal Battalion (SATCON) in Fort Buckner, Okinawa, Japan from June 2013 to May 2015. E Company's Wideband SATCOM Operations Center provided payload, transmission, defensive space control for two constellations of military communications satellites in order to enable the operations of US Army, Navy, Air Force, Marine Corps, US Government, and allied partner nations throughout the PACOM AOR.

MAJ Corey Crosser
Signal Corps Instructor
B.S., Computer Science, University of Houston, 2001
M.S., Computer Science, University of Texas at San Antonio, 2017

In 2007, MAJ Corey Crosser was assigned to the 304th Signal Battalion at Camp Stanley, South Korea. After a one year tour in South Korea, MAJ Crosser was assigned to the 335th Signal Command (Theater) in East Point, GA. During this assignment, he served as an S3 Operations Officer, Command Automations OIC, and Aide de Camp. In 2013, he transferred to Functional Area 26B (Information Systems Engineer), and was assigned to the 214th Fires Brigade at Fort Sill, OK. During this assignment, MAJ Crosser served as the Brigade Information Management Officer.

CPT Daniel Hawthorne
Instructor Cyber
B.S., Computer Science, Central State University (Ohio), 2009
M.S., Computer Information Systems, Texas A&M University (Central Texas), 2012
D.C.S., Digital Systems Security, Colorado Technical University, Candidate/ABD

CPT Daniel Hawthorne was assigned to Third Brigade, First Cavalry Division at Fort Hood. He served as an assistant intelligence officer at both the battalion and brigade levels and as the SIGINT platoon leader in the military intelligence company. He spent a year deployed in addition to completing his M.S. while at Fort Hood. After 3.5 years at Fort Hood, he departed for the career and signals intelligence courses at Fort Huachuca. During his career training, he was accepted to the Doctor of Computer Science program at Colorado Technical University. His follow on assignment was to the 743rd Military Intelligence Battalion at Buckley AFB where he supported agency information technology operations and commanded the Headquarters and Operations Company. He proceeded to the Cyber Operations Officer Course at Fort Gordon before reporting to West Point.
MAJ John Hutton  
_Instructor_  
Corps of Engineers  
M.S., Computer Science and Engineering, Pennsylvania State University, 2018  
B.S., Computer Science, Iowa State University, 1992  
B.S., Chemical Engineering, Iowa State University, 1992  
MAJ Hutton completed OCS and was commissioned as an Engineer. He became a Space Operations Officer (FA40). His first assignment was platoon leader for the Earth Moving Platoon, C/864 Engineer Company. He deployed to the Philippines as the Tactical Engineer for Task Force Mindanao, JSOTF-P. Upon returning, he took command of the rear detachment for 109th Transportation Company. He deployed to Afghanistan and served as assistant J3 for USACE, AED-South and then as the Engineer Planner, CJS for RC-East. He completed Army schooling. Was assigned to 1st Space Battalion, and served as detachment operations officer, during which time he deployed to CENTCOM. His military schooling includes the Engineer Officer Captain's Career Course, Airborne School, Mountain Warfare School (Winter), and the Space Operations Officer Qualifier Course. He has deployed to the Philippines, Afghanistan, and CENTCOM.

MAJ Alexander Kedrowitsch  
_Instructor_  
Signal Corps  
B.S., Pennsylvania State University, 2004  
Certificate of Graduate Studies, Space Studies, American Military University, 2013  
M.S., Computer Science, Virginia Polytechnic Institute and State University, 2017  
MAJ Alexander Kedrowitsch has served in the US Army since 2005 and has completed two combat tours in Iraq and one in Afghanistan. He is a Signal Corps officer and an instructor in the Electrical Engineering and Computer Science department at the US Military Academy at West Point. Recently, he attended the Virginia Polytechnic Institute and State University (Virginia Tech) and graduated with a Master of Science in Computer Science. Previous duties served include two Company Commands, BN S-6, and Division Network Operations Current Operations Officer. His academic interests include deception-based computer security and privacy leakage from wireless signals.

MAJ Brian Lebiednik  
_Instructor_  
Cyber  
M.S., Computer Science Information Security, Georgia Tech, 2017  
M.S., Interdisciplinary Telecommunications, University of Colorado, Boulder, 2015  
B.S., United States Military Academy, 2005  
MAJ Brian Lebiednik commissioned as an Infantry Officer from the United States Military Academy in 2005. He served a platoon leader and executive officer in 1st battalion 325th A.I.R including a deployment in support of Operation Iraqi Freedom. Other assignments include S-3 Oklahoma City Recruiting Battalion and Sensor Manager at Army Cyber Command. MAJ is a graduate of Ranger School, Airborne School, Air Assault School, Infantry Officer Basic Course, Telecommunications Systems Engineering Course, Signal Company Commander Course, and Command and General Staff College.

CPT Daniel Konopa  
_Instructor_  
Infantry  
B.S., Electrical Engineering, United States Military Academy, 2008  
M.S., Electrical & Computer Engineering, Purdue University, 2016  
CPT Dan Konopa graduated from the United States Military Academy in 2008 and was commissioned as an infantry officer. His first assignment was to 1st Brigade, 2-327 Infantry at Ft. Campbell, KY. In 2010 he deployed in support of Operation Enduring Freedom where he served as an antiarmor platoon leader and rifle company executive officer. In 2012 CPT Konopa was assigned to 1-25 SBCT at Ft. Wainwright, AK where he served for 16 months as a stryker infantry company commander of Alpha Company, 3-21 Infantry. CPT Konopa is a graduate of the US Army Infantry Officer Basic Course, Maneuver Captains Career Course, Air Assault School, Airborne School, and Ranger School.
| SSG William Magno  
Army Band  
Instructor | Mr. Pratheek Manjunath  
Robotics Engineer  
Instructor |
|---|---|
| M.S., Software Engineering, Regis University, 2017  
B.M., Music Industry, James Madison University, 2006  
Warrior Leadership Course  
SSG Vince Magno is an Army Musician and currently serves as an audio engineer for the West Point Band. Vince has toured around the country and the world as a musician and an audio engineer. Highlights include performing for the Queen of England at the London Military Tattoo and for President Barack Obama at the 70th anniversary of D-Day in Normandy France. He has spoken at the Audio Engineering Society's annual conference and as a guest lecturer at NYU. | B.E., Electronics Engineering, R. V. College of Engineering, Bangalore (May 2014)  
M.S., Robotics & Controls, Columbia University, New York (Feb 2016)  
Mr. Manjunath is a strong engineering professional skilled in Embedded Systems, Robot Design and Control Systems. Possess expertise in interdisciplinary areas ranging from Mechatronics to Aircraft Systems. |
| CPT Keith Major  
Instructor  
Cyber | CPT Austin Minter  
Cyber  
Instructor |
| B.S., Information Technology, United States Military Academy, 2008  
M.S., Engineering Management, Missouri Science and Technology, 2013  
M.S., Computer Science, Stanford University, 2017  
CPT Major commissioned as an Engineer Officer from USMA in 2008. CPT Major has experience as a Platoon Leader, XO, Assistant S3 and a Company Commander in the Engineer Regiment. He has one deployment to Afghanistan where he was a Construction Program Manager for Regional Support Command South. CPT Major transferred to the Cyber Branch in 2015. His military Education includes Engineer Officer Basic Course, Engineer Captain's Career Course, Sapper Leader School and Airborne School. | B.S., United States Military Academy, 2008  
M.S., Information Security Policy and Management, Carnegie Mellon University, 2017  
Captain Austin R. Minter is a Cyber Warfare officer. He graduated from the United States Military Academy and served his next seven years in the signal corps in numerous positions and locations including Fort Gordon, Fort Lewis, Seoul, South Korea; and Basra, Iraq. While in Seoul, South Korea he took command of the signal company responsible for the Army’s telecommunications infrastructure in Seoul. Prior to his assignment to West Point he attended and graduated from Carnegie Mellon University's Heinz College with a M.S. in Information Security Policy and Management. |
MAJ Sean  O’Neil
Armor
Instructor
B.S., Electrical Engineering, Tulane University, 2001
M.S., Electrical Engineering, University of Southern California, 2017

MAJ Sean Patrick O’Neil enlisted as an Infantryman in 2001 and served with 2/75 Ranger Reg and 3-21 Infantry before commissioning as an Armor Officer in 2007 through Officer Candidates School. His first post-commissioning assignment was with 6-9 Cavalry, 3rd Brigade Combat Team, 1st Cavalry Division at Fort Hood, TX. There, he served as a Platoon Leader, Troop Executive Officer, and Assistant Squadron Operations Officer. After attending the Maneuver Captains Career Course in 2011, he was assigned to the 3rd Brigade Combat Team, 82nd Airborne Division at Fort Bragg, NC. There, he served as the Brigade’s Air Operations Officer and commanded B Troop, 5-73 Cavalry. He has deployed in support of Operation Enduring Freedom, three times in support of Operation Iraqi Freedom, and once in support of Operation Inherent Resolve. His academic interests include robust, multivariable control and nonlinear control.

CPT Roy Ragsdale
Cyber
Instructor
B.S., Computer Science, United States Military Academy, 2009
M.S., Electrical & Computer Engineering, Carnegie Mellon University, 2017

CPT Roy Ragsdale received his commission from the United States Military Academy as a Military Intelligence Officer in 2009. He first served as an Assistant Intelligence Officer for 3d Squadron, 2d Stryker Cavalry Regiment in Vilseck Germany. With the 2d SCR he deployed to Kandahar Afghanistan in support of Operation Enduring Freedom where his Squadron fought under 2nd BDE, 101st Airborne Division. CPT Ragsdale then joined the newly established 782d MI Battalion where he served in support of Operation Iraqi Freedom, three times in support of Operation Inherent Resolve. His academic interests include: Basic Officer Leaders Course, Signal Officer Basic Course, Signal Officer Captain Career Course, Command and General Staff College, U.S. Army Airborne School, and Sabalauski Air Assault School.

MAJ Joseph Sagisi
Instructor
Signal Corps
B.S., Electrical Engineering, United States Military Academy, 2004
M.S., Computer Engineering, Virginia Tech, 2017

MAJ Sagisi is a Network Systems Engineer (FA26A). He has served in multiple capacities, including operational deployments to Iraq and Egypt, as a Signal Officer and Network Engineer. His previous assignments include Signal Platoon Leader and Executive Officer, 324th Network Support Company, 41st Fires Brigade; Battalion Signal Officer, 2-20th Field Artillery Battalion, 41st Fires Brigade, Fort Hood, TX; Network Engineer, 2nd Infantry Division, Camp Red Cloud Korea; Telecommunications Systems Engineer, 1st Theater Sustainment Command, Fort Bragg, NC; Network Engineer, Brigade S6, and Multinational Force Communications Officer for Task Force Sinai, Multinational Force and Observers, El Gora, Egypt. He has also earned certification as a Certified Information Security Professional (CISP). His military education includes: Basic Officer Leaders Course, Signal Officer Basic Course, Signal Captain’s Career Course, Telecommunications Systems Engineer Course, and Sabalauski Air Assault School.
Mr. Charles Schooler  
**Instructor**  
B.S. Business, University of New Hampshire, 1980  
M.S. Human Computer Interaction, Georgia Institute of Technology, 2010  
Mr. Schooler is a 30-year veteran of the technology industry and remains an avid student of technologies that can be used to solve business-related problems. He has spent his career working with customers in the roles of software engineer, product manager, and technical support engineer. During this time, Mr. Schooler has been involved with projects as diverse as overhauling Canada’s national air traffic control system, accelerating the transaction speed of the foreign exchange trading system for a global bank, upgrading a Fortune 100 company’s system management infrastructure, and launching Internet-defining security and firewall products.

MAJ Jacob Shaha  
**Signal Corps Instructor**  
B.S., Computer Engineering, University of Utah, 2006  
M.S., Applied Statistics, Pennsylvania State University, 2014  
M.S., Electrical Engineering, University of Michigan, 2016  
MAJ Jacob Shaha is a Signal Officer. He has served two combat tours as a Battalion S6 in the 101st Airborne Division, one in Iraq and the other in Afghanistan. MAJ Shaha also deployed as a Signal Company Commander with 4th ID. He is a graduate of the Signal Officers Basic Course and Signal Captains Career Course. His academic interests include self-forming radio networks, adaptive antenna architectures, and user interface design.

CPT Nathaniel Stickney  
**Aviation Instructor**  
M.S., Computer Science, Baylor University, 2018  
B.S., Computer Science with Honors, United States Military Academy, 2008  
A 2008 graduate of the Computer Science department, CPT Stickney is a UH-60A/L aviator. As a cadet and lieutenant, he participated with several champion Cyber Defense Exercise teams, and as a graduate student he led Baylor University's cyber team to the National Finals of the Collegiate Cyber Defense Competition in 2018.

MAJ Eric Sturzinger  
**Infantry Instructor**  
B.S., Oregon State University, 2006  
M.S., University of California, Davis, 2017  
MAJ Eric Sturzinger is a Network Systems Engineer (FA26A) who has served in various positions across multiple combatant commands. He initially served as a Platoon Leader in B Co., 52nd Infantry Reg (Anti-Tank), 2nd Stryker Brigade Combat Team, 25th Infantry Division from 2009-2010 at Schofield Barracks, HI. He then deployed to Iraq in support of Operation Iraqi Freedom and Operation New Dawn from 2010-2011, serving as Executive Officer of HHC, 2nd SBCT, 25th ID. Upon graduating the Telecommunication System Engineer Course in 2012, he served as Systems Engineer of 7th Theater Tactical Signal Brigade in Schweinfurt, Germany from 2012-2013 and later as Systems Engineer of 44th Expeditionary Signal Battalion from 2013-2015 in Grafenwoehr, Germany where he regularly supported EUCOM, CENTCOM, and NATO operations, exercises, and training.
MAJ Sang Yim
Systems Automations
Instructor
B.S., Computer Science, Hawaii Pacific University, 2005
M.S., Information Systems Management, Syracuse University, 2015
MAJ Yim has served in the US Army since 2006 and has successfully completed two tours
to Afghanistan. He is a Signal Corps officer and
is an instructor in the Electrical Engineering and
Computer Science department at the US
Military Academy at West Point. Recently, he
attended Carnegie Mellon University and
obtained a Masters of Science degree in
Information Technology Security. He has also
served as Division Automations Officer and a
Battalion S-6. His academic interests include
software defined radios, software reverse
engineering, and wireless security. MAJ Yim’s
military education includes the Signal Officer
Basic Course, the Signal Captain’s Career
Course, Information Systems Management
Course, Ranger school, and Airborne schools.