
CAPITOL TECHNOLOGY UNIVERSITY
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CAPITOL TECHNOLOGY UNIVERSITY

2018-2019 Catalog

General Information

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General Information

Directory

Capitol Technology University

11301 Springfield Road
Laurel, MD 20708-9758

Main Telephone Numbers

301-369-2800
888-522-7486

Admissions

Washington, DC	301-953-3200
Toll Free	800-950-1992
Fax	301-369-2326
Online Learning	866-960-9620

Undergraduate Admissions Email
admissions@CapTechU.edu
Graduate Admissions Email
gradadmit@CapTechU.edu

Website

www.CapTechU.edu

Office Hours

The following offices are open Monday through Friday, 8:30 a.m.- 5 p.m. (EST).

Executive Suite
- President
- Vice President for Student Engagement and University Development
- Senior Vice President for Enrollment Management and Marketing/Chief Enrollment Officer
- Senior Vice President for Finance and Administration/Chief Operating Officer
- Vice President for Academic Affairs/Chief Academic Officer

Office of the Dean
- Academic Dean
- Critical Infrastructures and Cyber Protection Center

Career Services*
Communications and Publications
*Evening appointments are available.
The following offices are open as indicated (EST).

Admissions

M, F	9 a.m.- 5 p.m.
T-Th	9 a.m.- 5:30 p.m.

Saturday appointments are available.

Business Office

M, F	9 a.m.- 5 p.m.
T-Th	9 a.m.- 5:30 p.m.

Financial Aid

M,F	9 a.m.-5 p.m.
T-Th	9 a.m.- 5:30 p.m.

Registration and Records

M, F	9 a.m.- 5 p.m.
T-Th	9 a.m.- 5:30 p.m.

Student Life

M-F	9 a.m.-5 p.m.

Evenings by appointment.

Emergency Closing

In the event of severe weather or other emergencies, any possible cancellations or late openings will be announced to area radio and television broadcasts and posted on the university website.

The university maintains a recorded message at 301-369-2800, 888-522-7486, 800-950-1992 and 301-953-3200 and posts a weather advisory on the website when possible. Due to power outages and other circumstances that occur during adverse weather, it is not always possible to update this information. It is the responsibility of students to tune in to the radio or television for announcements.

The television channels and radio stations notified by the university are listed in the student handbook and on the university website.

Accreditation

Capitol Technology University is authorized by the State of Maryland (through the Maryland Higher Education Commission, 6 N Liberty St, Baltimore, MD 21201) to confer Bachelor of Science (B.S.) degrees in Astronautical Engineering, Business Analytics and Data Science, Computer Engineering, Computer Engineering Technology, Computer Science, Construction Management and Critical Infrastructure, Cyber Analytics, Cyber and Information Security, Electrical Engineering, Electrical Engineering Technology, Engineering Technology, Management of Cyber and Information Technology, Mechatronics Engineering, Mechatronics and Robotics Engineering Technology, Mobile Computing, Software Engineering, Technology and Business Management, and Unmanned and Autonomous Systems. The University is authorized to confer Associate in Applied Science (A.A.S.) degrees in Computer and Cyber Operations Engineering and Electronics Engineering Technology, and Engineering Fundamentals.

The University is authorized by the State of Maryland to confer Master of Science (M.S.) degrees in Computer Science, Cyber Analytics, Cyber and Information Security, Electrical Engineering, Information Systems Management, and Unmanned Systems Policy and Risk Management. The University is authorized by the State of Maryland to confer a Master of Business Administration (M.B.A.) degree. The University is authorized by the State of Maryland to confer Technical Master of Business Administration (T.M.B.A.) degrees in Business Analytics and Data Science, and Cybersecurity.

The University is also authorized by the State of Maryland to confer a Doctor of Science (D.Sc.) in Cybersecurity, and Doctor of Philosophy (Ph.D.) degrees in Business Analytics and Decision Sciences, Technology, and Unmanned Systems Applications. The University is authorized by the State of Maryland to confer a combined Master of Science (M.S.) in Research Methods and Doctor of Philosophy (Ph.D.) in Technology.

Capitol Technology University is accredited by the Middle States Commission on Higher Education, 3624 Market Street, Philadelphia, PA 19104. (267-284-5000) www.msche.org The Middle States Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

The B.S. degree in Astronautical Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

The B.S. degree in Computer Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

The B.S. degree in Electrical Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

The B.S. degree in Computer Engineering Technology is accredited by the Engineering Technology Accreditation Commission of ABET, http://www.abet.org.

The B.S. degree in Electronics Engineering Technology is accredited by the Engineering Technology Accreditation Commission of ABET, http://www.abet.org.

Capitol Technology University has received specialized accreditation for its business programs through the International Accreditation Council for Business Education (IACBE) located at 11374 Strang Line Road in Lenexa, Kansas, USA. The business programs in the following degrees are accredited by the IACBE:

--Master of Business Administration
--Master of Information and Systems Management
--Bachelor of Science in Technology and Business Management
--Bachelor of Science in Management of Cyber and Information Technology

Equal Opportunities

Capitol Technology University actively subscribes to a policy of equal educational and employment opportunity and, in accordance with Title IX of the education amendments of 1972, does not discriminate on the basis of race, color, religion, gender, gender identity or expression, gender orientation, sexual orientation, national or ethnic origin, genetics, disability, age, or veteran status in admission, treatment of students or employment.

The following members of the Capitol Technology University community are designated to receive inquiries concerning the university's application of the equal opportunities statement. Inquiries related to the application of Title IX may be referred to the campus Title IX Coordinator, Melinda Bunnell-

Rhyne; the Director of Human Resouces and Administration, Katy DeHart; or any Vice President of the university or to the Department of Education's Office of Civil Rights.

Melinda Bunnell-Rhyne
Vice President for Student Engagement and University Development
Title IX Coordinator and Section 504 Coordinator
11301 Springfield Rd. Laurel, MD 20708
301-369-2491
deanofstudents@CapTechU.edu

Katy DeHart
Director of Human Resources and Administration
Title IX Deputy
11301 Springfield Rd. Laurel, MD 20708
240–965-2465
hr@CapTechU.edu

Changes in Catalog Information

Capitol Technology University reserves the right to make changes in policies, procedures, degree requirements, schedules, course offerings and other university standards or announcements to meet circumstances that may arise after publication.

The provisions of this publication are not to be regarded as an irrevocable contract between the student and Capitol Technology University. The university reserves the right to change any provision or requirement in any university publication without notice at any time during the student's term of attendance.

Capitol Technology University reserves the right to require a student to withdraw, or to refuse to grant a degree or certificate if, in the judgment of the administration of the university, the student fails to meet the university's requirements satisfactorily. The university reserves the right to change tuition and fees at any time at the discretion of the Board of Trustees.

Student Records

The procedures and guidelines adopted by Capitol Technology University (hereinafter occasionally referred to as the "university") regarding student records comply fully with the Family Educational Rights and Privacy Act of 1974 (FERPA). This federal law establishes the rights of students to inspect and review their records, and provides students with a mechanism for correcting inaccurate or misleading data found within a student's education record. Moreover, FERPA guarantees the privacy of students' education records. Specifically, FERPA limits the disclosure of personally identifiable, non-directory, information from education records, without the consent of the student. Consistent with its obligations, Capitol Technology University will not release personally identifiable information from a student's education records without the student's consent, except in circumstances permitted by FERPA (e.g., in connection with a health or safety emergency).

Education records are records, files, documents and other materials containing information directly related to a student that are maintained by Capitol Technology University. For example, records maintained by faculty advisors, the Office of Admissions, Office of Financial Aid, the Business Office, the Office of Career Services, Office of Student Life, and Office of Registration and Records, are generally education records.

Student Review of Education Records

Students are entitled to inspect and review education records maintained by Capitol Technology University. Students who wish to access a particular record should contact the office responsible for maintaining that record. The university will produce the record within a reasonable period of time, although in most instances the university will allow the student to review the record immediately upon request. Certain documents, including financial records of parents, are not available to students.

A student who, after reviewing their records, believes they contain information that is inaccurate, misleading, or in violation of the student's rights of privacy, may request that Capitol Technology University amend the record. Students should submit such requests, in writing, to the official from whom the record was obtained. Alternatively, students may submit written requests to Melinda Bunnell-Rhyne, Vice President for Student Engagement and University Development. Capitol Technology University will decide whether to amend the record, as requested by the student, within a reasonable time after receiving the request. If Capitol Technology University declines to amend the

record as requested, it will inform the student of its decision. In this instance, the student is entitled to request a hearing to determine the merits of his or her request.

Students may request copies of their Capitol Technology University education records. Reproduction of academic transcripts costs $10 per copy. However, Capitol Technology University will not copy records for students with unpaid financial obligations.

Disclosure of Information Contained in Education Records

Capitol Technology University will generally not disclose personally identifiable information contained in a student's education records without the student's prior consent. However, FERPA does allow Capitol Technology University to disclose such information in certain, limited circumstances. For example, Capitol Technology University may disclose information in a student's education records to school officials within Capitol Technology University whom the university has determined to have a legitimate educational interest in the information. A school official generally has a legitimate educational interest if the official needs to review an education record in order to fulfill his or her professional responsibility. School officials include: professors; instructors; administrators; health staff; counselors; attorneys; clerical staff; trustees; members of committees and disciplinary boards; and a contractor, volunteer or other party to whom the university has outsourced institutional services or functions.

Capitol Technology University may also disclose a student's directory information without consent. Directory information includes, but is not limited to, the student's name, address, telephone number, electronic mail address, photograph, date and place of birth, major field of study, grade level/class, enrollment status (e.g., undergraduate or graduate, full-time or part-time), dates of attendance, participation in officially recognized activities and sports, degrees, honors, and awards received, and previous educational agencies or institutions attended.

Students may restrict the release of directory information, except to school officials with legitimate educational interests. To do so, a student must make a written request directed to the Office of Registration and Records. Once filed, this request will become a permanent part of the student's record until the student instructs the university, in writing, to remove the request.

.Allegations that Capitol Technology University is not in compliance with FERPA may be directed, in writing, to the Family Policy Compliance Office at the Department of Education.

The Capitol Technology University Commitment

Capitol Technology University guarantees its qualified bachelor's degree graduates placement in the fields of engineering, engineering technology, computer sciences, information technology or business with a competitive salary within 90 days of graduation, or Capitol Technology University will provide up to 36 additional undergraduate credits tuition free while students continue their job search.

The Capitol Technology University Commitment is a written job guarantee between the student and Capitol Technology University. The commitment is open to all full-time undergraduate students (U.S. citizens or permanent residents). Application for redemption of this waiver must be made within 210 days of degree conferral or completion.

Contact the Office of Career Services for more information.

Locations

Laurel Campus

Capitol Technology University occupies the grounds of the former Beltsville Speedway. Located just off the Baltimore-Washington Parkway, the campus is minutes away from NASA Goddard Space Flight Center, the Beltsville Agricultural Research Center, the laboratory headquarters of the U.S. Food and Drug Administration, and the Patuxent Wildlife Research Center.

The tree-ringed suburban campus features gentle slopes and a small pond. The sleek white forms of M/A-COM Hall, MCI Hall and Telecommunications Hall are connected by glass-enclosed pedestrian walkways. The William G. McGowan Academic Center houses state-of-the-art classrooms, the Critical Infrastructures and Cyber Protection Center, the

Space Operations Institute, the Cyber Lab, the Fusion Lab, and the Identity Credentialing and Access Management (ICAM) Lab. The buildings have high ceilings, skylights and exterior reflective glass walls overlooking the woods. Apartment-style student housing is available for 220 students.

Mission, Vision and Learning Goals

Motto from the University Seal

Aut viam inveniam aut faciam (Latin). Either find a way or make one.

Mission

The mission of Capitol Technology University is to educate individuals for professional opportunities in engineering, computer and information sciences, and business. We provide relevant learning experiences that lead to success in the evolving global community.

Vision

In 2025, in accordance with the Mission Statement, Capitol Technology University will be seen by its constituents and by the public as:

A STEM focused institution of higher education, providing undergraduate and graduate degrees in engineering, information sciences, and technology leadership, that has flexibility and opportunities to grow, and that adapts offerings to emerging workforce needs.

A provider of hands-on, career-relevant learning that is conducted in an interdisciplinary and interactive environment, where faculty and staff support student achievement and success.

A university that delivers programs of similarly outstanding quality through face-to-face and virtual classrooms, and other forms and mixtures of teaching methods that align with the learning needs of our students.

An organization with faculty and leadership who stimulate and implement new curricula, research and entrepreneurial activities for the professions we serve, and that benefit a diverse community of learners.

An organization that is closely linked to its constituency of local, regional and national partners in business, government, non-profits, and professions that provide influence for future technology development and policies.

An organization that engages the global community, through educating international students, coordinating with educators, and supporting multinational professional associations.

A university that develops graduates with communications, analysis and critical thinking skills that allow them to be successful in a global environment and pursue lifelong learning as technical professionals, leaders and innovators.

A university that prepares graduates for jobs and careers, and that serves the broader purpose of education to address national needs-based policies through scientific consideration.

An organization appropriately sized for quality education and financial viability, with sustainable assets for faculty and staff to provide a best-value STEM education.

Values

The core values are the characteristics we embrace in working together to fulfill the mission and achieve the vision of the institution.

- Quality – always striving for continuous improvement
- Growth – expanding and changing to meet new needs of society
- Leadership – offering creative, supportive and shared leadership
- Balance – maintaining a balance between competing needs
- Integrity – being honest, ethical and open
- Teamwork – exercising collective effort to support students and staff
- Communications –providing timely and useful information
- Flexibility – discovering and seizing opportunities
- Safety – maintaining awareness and prevention of accidents and threats

Students

Capitol Technology University's student body mirrors the 21st century diversity of American higher education. Academically prepared and motivated high school graduates come to Capitol Technology University to complete educational experiences that will open career opportunities for them. Working adults, veterans and transfer students come to Capitol Technology University to complete undergraduate programs of study that will open or enhance career opportunities for them. Established professionals come to Capitol Technology University to expand their skills by earning graduate degrees or completing short-term learning experiences. The diversity of students enriches the learning environment of the university.

Learning Goals

Capitol Technology University seeks to prepare graduates who demonstrate four characteristics:

Employability: The ability to enter and advance in technical and managerial careers, appropriate to their level and area of study, immediately upon graduation.

Communications: Mastery of traditional and technological techniques of communicating ideas effectively & persuasively.

Preparation of the Mind: The broad intellectual grounding in technical and general subjects required to embrace future technical and managerial opportunities with success.

Professionalism: Commitment to life long learning, ethical practice and participation in professions and communities.

The Educational Philosophy of the Academic Programs

Four principles define the educational philosophy of Capitol Technology University. Academic programs must be:

- Grounded in both theory and practice in order to prepare graduates for immediate employment and long-term professional careers,
- Fundamentally hands-on and practice oriented to provide the technical skills for students to be immediately employable upon graduation,
- Tied to the contemporary needs of industry so that curriculum reform and development are pragmatic, and
- Enriched by courses in the liberal arts to provide every graduate with an enhanced sense of self, society, history and aesthetics.

Strategic Goals

Capitol Technology University has identified four strategic goals that will move us to the next level of excellence and support the vision.

Expand Educational Offerings, Increase Program Completion

Capitol Technology University is an institution that offers career-relevant curricula with quality learning outcomes. The strategy includes continuing to expand educational offerings, increasing program completion, and raising learner qualifications and outcomes.

Increase Enrollment and Institutional Awareness

Capitol will accelerate its goal pursuit to become more globally renowned and locally active through student, faculty and staff activities. Enrollment will grow to 650 undergraduates, 350 masters' students, and 250 doctoral candidates.

Improve the Utilization of University Resources and Institutional Effectiveness while Expanding Revenue

Capitol will likely continue to be 80% financially dependent on student tuition and fees. We plan to enhance our resources by expanding the range and amount of funding from other streams and aligning costs with strategic initiatives.

Increase the Number and Scope of Partnerships

Capitol's service to our constituents and sources of financial viability both depend upon participation with continuing and new partner corporations, agencies, and schools.

History

Since its start more than 80 years ago, Capitol Technology University has remained true to its mission – preparing students for careers in a quickly changing world. With a tradition of academic excellence and practical

learning, Capitol Technology University has equipped its alumni with the knowledge and skills to evolve with the advanced sophistication of technology.

Capitol Technology University was founded in Washington, DC, as the Capitol Radio Engineering Institute in 1927 by Eugene H. Rietzke. A Navy veteran and radio operator, Rietzke foresaw the need for an advanced school that could produce talented radio and electronics technicians. CREI began as a correspondence school, but its popularity led to the 1932 opening of a residence division allowing students to work hands on in laboratories. As radio technology improved, new training programs and courses were quickly added. Following World War II, CREI became one of the first three technical institutes accredited by the Engineers' Council for Professional Development.

The institute entered a new era in the mid-1950s when it began awarding three-year AAS degrees. The school expanded its reach to new programs in applied engineering and electronics. To reflect this evolution, the institute changed its name to Capitol Institute of Technology in 1964. It awarded its first bachelor of science degrees in 1966 to four graduates of its electronics engineering technology program. Anticipating the need for more room, Capitol relocated in 1969 to a leased space in Kensington, Maryland.

During the following decade, enrollment increased and so did the program offerings. In 1976 the Middle States Association of Colleges and Secondary Schools granted accreditation to Capitol, and the National Science Foundation provided funding for new instructional scientific equipment. Quickly outgrowing its space, Capitol's leaders recognized a need for a permanent home and began searching for a new campus.

The result of that search was a relocation to Laurel, Maryland. Capitol purchased the 52-acre former site of the Beltsville Speedway, built new academic facilities and opened the doors to students in 1983. Enrollment swelled and two more engineering technology degrees were added. The campus expanded with Telecommunications Hall and the 340-seat Avrum Gudelsky Memorial Auditorium. In 1987, the school became Capitol College, a name it would retain until September 2014.

In the late 1980s, Capitol's leadership again recognized the transformation in the institution. The technical-based curriculum had become broader, with an increasing incorporation of humanities and social science courses. With a spacious campus and four-year degrees, the school had shed its skin as a technical institute. Preferring a title and an environment that would better suit its presence, the Board of Trustees changed the school's name to Capitol College. Master's degrees were introduced in the 1990s. Capitol began several outreach efforts and business partnerships, such as the NASA PREP summer program for minority students and the Maryland Distance Learning Network. Meanwhile, Capitol expanded the John G. and Beverly A. Puente Library, creating a spacious state-of-the-art facility with a multimedia teaching center. The opening of the William G. McGowan Academic Center in 2005 marked the next era for Capitol. The academic center hosts an expanded computer science department, the Space Operations Institute, and the BRAC-funded Cyber Battle Lab.

With a new century and millennium now under way, the time came again to take stock of Capitol's achievements and set a course for its future growth. The radio institute founded in 1927 had burgeoned over the decades in ways that few could have predicted. It had become a full-fledged higher education institution, offering a wide palette of academic disciplines and degrees. Reflecting these changes, the school was renamed Capitol Technology University in 2014.

Today, Capitol is the only independent institution of higher education in Maryland that specializes in providing a relevant education in engineering, business and related fields. It takes pride in its proven record of placing graduates in competitive careers with salaries that are higher than the industry average. As a respected regional leader, Capitol continues attracting the attention of government agencies and corporate partners. Through a partnership with NASA, Capitol offers academic programs in astronautical engineering and practical training at its Space Operations Institute. The National Security Agency and Department of Homeland Security have designated Capitol a National Center of Academic Excellence in Information Assurance Education, and the Institute of Electrical and Electronics Engineers has named the university one of its twelve educational partners. In 2010, Capitol introduced a

doctor of science in information assurance to its academic repertoire, allowing students to pursue their education to the highest level in the discipline. Starting in 2015, the university launched additional doctorates in fields ranging from business analytics to unmanned and autonomous systems. It has embarked on a long-term strategic plan to guide its continued expansion, including new facilities on campus and an expansion of academic programs.

In 2017, Dr. Bradford L. Sims became Capitol's eighth president, inheriting the proud legacy that began with Eugene H. Rietzke. Under Dr. Sims's leadership, the university has added new degrees and strengthened its focus on future technology development, as well as related management and policy fields. Degree programs in areas such as construction management and critical infrastructure, and in unmanned and autonomous systems, have been developed to meet the demands of industry.

While new innovations spur new developments and industries, the foundations that are taught at Capitol Technology University – thinking critically, actively and creatively – will remain. As it looks to the future, Capitol Technology University remains committed to providing students with a quality education and the relevant experience to excel in a changing world.

The Centers of Excellence

Capitol Technology University has a vision, mandated by industry leaders, government officials, and education policy makers, to answer the call to provide a new generation of engineers and technology professionals who have higher levels of innovation and leadership in order to ensure the national workforce is competitive in science, technology, engineering, mathematics, and business.

Critical Infrastructures and Cyber Protection Center

Capitol established the Critical Infrastructures and Cyber Protection Center (CICPC) to address the technical and managerial needs of the nation's professional workforce in the areas of critical infrastructure protection and homeland security. The CICPC delivers professional training to the homeland security workforce, as well as facilitating employment connections between our talented students and the federal agencies and industry contractors that hire them. CICPC programs and services specifically target the needs of individuals employed in fields responsible for securing what many take for granted – the American way of life.

From technical training in areas such as Computer Forensics and SCADA protection to managerial areas such as project management and supply chain management, Capitol provides customized programs featuring dedicated faculty who bring years of experience with theory and concepts. Our programs can be delivered at the customer site, on campus, and/or via our synchronous distance-learning platform.

Space Operations Institute (SOI)

The Space Operations Institute (SOI) was established at Capitol in 2003 with a grant from the National Aeronautics and Space Administration (NASA).

The SOI provides support for educational programs that prepare students for careers in the aerospace industry. Through the SOI and its resources, students gain hands-on experience in satellite mission operations and planning, and in developing and operating a picosatellite ground system.

In 2017, the Space Flight Operations Training Center (SFOTC) was established as part of the SOI, with sponsorship from The Hammers Company. This unique resource utilizes state-of-the-art flight simulation and telemetry software, enabling students to gain hands-on training in real time.

Students enrolled at Capitol may apply for an industry sponsored or internal university SOI internships. Industry sponsored student interns work at NASA, the employers facility, or on campus. The SOI currently has interns working on the James Webb Telescope at the Space Telescope Science institute in Baltimore, among other missions.

STEM Outreach Center

The STEM Outreach Center provides hands-on education and workforce development experiences for students in K-12, community colleges, colleges or universities and those who support them in achieving leader-

ship careers in the science, technology, engineering and math (STEM) fields.

The Center's vision is to assist in educating and developing the future leaders of the STEM career fields through utilizing space science, astronomy and other related areas of study at Capitol Technology University to engage students of all ages.

Working at the local, regional, and national levels, the Center will:

- assist the Capitol Technology University Space Operations Institute in fulfilling their mission;
- provide hands-on educational experiences for middle school, high school, community college, and college students to both introduce them to STEM fields and continue to expand their interest in these fields as possible career choices;
- provide leadership development opportunities, in conjunction with the Innovation and Leadership Institute, to enable students to be future leaders within the STEM fields.
- support the dissemination of information regarding STEM workforce and leadership opportunities.

Affiliations, Memberships and Partnerships

The university's academic offerings are strengthened by relationships with government agencies, professional societies and private industry.

Institute of Electrical and Electronics Engineers

Capitol Technology University is a participating university partner with the Institute of Electrical and Electronics Engineers. Master's students who hold full or graduate student membership in IEEE at the time of registration will receive a 10 percent discount on tuition charges upon verification.

National CyberWatch Center

Capitol Technology University is a member of the National CyberWatch Center, an Advanced Technological Education Center funded by a grant from the National Science Foundation. The center, founded in 2005 as a consortium for ten institutions in the DC metro area, has grown to 95 member institutions across 29 states and the District of Columbia. The National CyberWatch Center's mission is to increase the quantity and quality of the cybersecurity (information assurance) workforce through increased education, curriculum development, faculty development, student development, career pathway exploration and development and public awareness.

National Defense University

Capitol Technology University is a partner with the National Defense University iCollege (formerly Information Resource Management College) to advance the professional skills and knowledge of active-duty military, veterans and select Department of Defense employees. This arrangement provides an opportunity for military and DoD students who have completed selected NDU programs to transfer up to 15 credits in lieu of Capitol Technology University graduate coursework.

National Security Agency and Department of Homeland Security

Capitol is designated by the National Security Agency and the Department of Homeland Security as a Center of Academic Excellence (Cyber-Defense). The Center of Academic Excellence progran is intended to reduce vulnerabilities in the national information infrastructure by promoting higher education in IA, and producing a growing number of professionals with cybersecurity expertise in various disciplines. University applicants are assessed against published criteria intended to measure depth and maturity of programs in IA. The criteria are specified in courseware training standards issued by the Committee on National Security Systems (CNSS). Capitol received its initial CAE designation in 2003 and has been redesignated twice.

Partner Institutions

Capitol Technology University has collaborated with numerous state and regional colleges to provide transfer/articulation agreements in certain degree fields. These colleges include Anne Arundel Community College, Baltimore City Community College,

College of Southern Maryland, Community College of Baltimore County, Delaware Technical Community College, Delta College, Forsyth Community College, Hagerstown Community College, Harford Community College, Howard Community College, Montgomery Community College, Northern Virginia Community College, the National Security Agency (on behalf of the National Cryptologic School), Prince George's Community College and WorWic Community College. These agreements allow students from these participating institutions to easily transfer credits to Capitol Technology University.

Online Learning

Capitol Technology University offers all graduate degrees and certificates online. In addition, many undergraduate third and fourth year courses are available online for degree completion. Students enrolled in Capitol's online programs meet in online classrooms using the latest technologies to create an enriching, interactive learning environment. In addition, Learn@Capitol, our learning management system, provides state-of-the-art features that allows you to access all of your course materials, homework, and grades. Student-faculty and student-student interactions are highly engaging and typically occur via email or online discussions, with faculty often providing one-on-one feedback. Online students participate in in synchronous and asynchronous modalities. During the live lectures, students view slides or live programming and diagnostics while listening to professors and other students speaking in real-time. Student interactivity is encouraged and made possible through chat and audio discussions. In a way similar to a traditional classroom, students can raise their hands using interface icons and ask questions using their microphones or by chatting. Outside of the live classroom, the knowledge exchange continues as students download and view course material, transmit homework assignments, post to discussion boards, and collaborate with other classmates. A typical online course consists of 8 or 16 class sessions.

Capitol Technology University posts the latest computer system requirements for online learning on our support site at ask.CapTechU.edu. Even though it is possible and convenient to attend online classes with mobile devices, they limit capacities required in some classes. For example, a student might be required to upload and present a PowerPoint presentation or use another application.

Students can receive technical assistance by phone or e-mail (ask@CapTechU.edu) and around-the-clock support via our website at ask.CapTechU.edu. Phone support is available 8:30 a.m. until 10 p.m. Monday-Thursday; 8:30 a.m. until 5 p.m. Friday; and 8:30 a.m. until 2 p.m. Saturday (only during terms with Saturday classes) at 888-960-9620.

Academic Policies and Procedures

Program Advisors

Degree-seeking students are assigned academic advisors before registration. Students are encouraged to work closely with advisors in developing their programs of study. Academic advisors are available for guidance, but each student must assume final responsibility for conforming to university regulations and curriculum requirements.

Registration Procedures

Detailed registration information is provided before the beginning of each semester. Registration dates are listed in the university calendar beginning on page 150 and online. Students must be in good financial standing with the university to be eligible for registration services.

Registration forms can be obtained and submitted at the Laurel campus or online.

Late registration occurs during the first two weeks of the semester for all semester-length courses, or between the first and second class meeting for all term-length courses (both undergraduate and graduate). No term-length course registrations will be accepted after the second class meeting. The last day to add or drop a class is listed in the university calendar beginning on page 150 and online.

Cross Divisional Registration

Students pursuing an undergraduate degree who wish to enroll in graduate courses must meet with the dean of academics and receive approval from the dean prior to registration. This includes concurrent undergraduate students taking graduate level coursework to meet graduate degree requirements and students substituting graduate courses for undergraduate degree requirements. Courses taken at the graduate level to satisfy undergraduate degree requirements will not be counted toward the graduate level should the student choose to pursue a graduate degree. Course substitutions will be necessary for completing graduate credit requirements. Students interested in cross divisional registration should submit the appropriate paperwork to the Office of Registration and Records.

Audited Courses

Students who register to audit a course are charged the same tuition as those who register for credit. The grade of X is awarded at the end of the semester and is not used in computing the cumulative grade point average. Half-time, financial aid students that change to audit will have part or all of their aid returned to the federal government. Students receiving VA benefits will not receive payment for audited courses. Any student receiving financial aid contemplating an audit should contact the Office of Financial Aid. Once registered for audit, students are not permitted to change to credit after the first two weeks of the semester. The last day to change from credit to audit is listed in the university calendar beginning on page 150 and online.

Independent Study

Independent study in a course will be granted only in the most extraordinary circumstances. Eligibility for an independent study course will be determined by a committee comprised of academic department chairs, academic advisors and academic support staff. If the committee or advisor determines that a student is eligible for an independent study course, the appropriate department chair will assign a professor and the student will be registered for the course by the Office of Registration and Records. The assigned professor will organize all course requirements including exams, homework, lab assignments and research papers to compensate for the absence of classroom participation. Students interested in an independent study course should submit and independent study request form to the Office of Registration and Records.

Change of Degree Program

Students who want to change degree programs must fill out a change of degree program form, which may be obtained in the Office of Registration and Records or online. The dean of academics must approve all changes of degree programs. Students who change their degree program are required to meet all requirements of the new programs that are in effect at the time of the change. Transfer credits and courses that have already been completed will be applied toward the new degree program where appro-

priate. Any student receiving financial aid contemplating a change of degree should see the Office of Financial Aid. Completed documentation must be submitted to the Office of Registration and Records after academic dean approval.

Double Degree Requirements

Undergraduate students who are currently enrolled and want to pursue two degrees (AAS or BS) must have a cumulative GPA (grade point average) of 2.5 or higher. For a second BS degree, the student must complete a minimum of 150 credits, with a minimum of 18 credits distinction between majors, of which at least 12 must be upper-level credits completed at Capitol Technology University. For a second AAS degree, the student must complete a minimum of 75 credits, with a minimum of nine credits distinction between majors, of which at least six must be 200-level or above. Undergraduate students who are currently enrolled in an AAS program and a different BS program must complete nine credits of distinction between the two degrees.

Graduate students who want to obtain two degrees must complete all the requirements for both degrees plus a minimum of twelve distinct semester hours of credit. Should more courses overlap than is approved, the student must take additional courses to make up the credit requirement. Double-degree-seeking graduate students are encouraged to consult the Dean of Academics or their department chair for advisement.

All students declaring a second degree must have academic dean approval and complete the change of degree program form. This may be obtained in the Office of Registration and Records or online.

Course Drop

There are two course drop periods. The first course drop period occurs during the registration period and ends on the last day for a 25% refund. The second course drop period occurs following the period for 25% refund and continues until the date indicated on the academic calendar.

For a course drop that takes place during the first period students are entitled to a percentage refund as outlined in the refund schedule. The course is removed from the student's transcript and no grade is assigned.

A course drop that takes place during the second period results in a mark of W on the student's transcript. A grade of W does not affect students' cumulative GPA. Failure to attend class does not constitute withdrawal from the course and does not eliminate a student's academic or financial responsibilities.

If a student drops all classes for the semester (zero credits), he/she is considered withdrawing from the university and should follow the procedure for withdrawal (as listed in the next section). Deadline dates for dropping a course with or without a W from a course are listed in the university calendar on page 150 and online.

Withdrawal from the University

Students who want to withdraw from the university or are dropping from all classes in a term or semester must complete a withdrawal form from the Office of Student Life or online. Students who interrupt their attendance for less than one academic year and are in good standing with Capitol Technology University at the time of the withdrawal do not need to reapply to the university. Also see "Readmission."

Failure to attend classes does not constitute withdrawal and does not eliminate students' academic or financial responsibilities. Students cannot withdraw during the week of final exams.

Withdrawal from the university may affect financial aid awards. Anyone receiving financial aid or VA benefits must see a financial aid administrator before withdrawing. Consult the university calendar on page 150 for specific withdrawal dates.

Active Duty Withdrawal Policy

Members of the active duty military, reserves or National Guard who are called into active service may withdraw from classes and receive a full refund of tuition and fees for the semester. The student must present a copy of their military orders to the Dean of Students along with a withdrawal form to process the withdrawal.

Students who wish to receive incomplete (I) grades for courses interrupted by a call to active service must make arrangements with their individual professors. Faculty will determine whether an incomplete grade is appropriate by taking into account factors such as amount of work remaining, a student's

performance in class, mode of instruction, etc. Students who receive incomplete grades will not receive refunds for those courses. The student must then complete coursework by the end of the fourth week of the next term, or the I grade will be converted to an F (unless the professor has specified that the I be converted to a C or D). After six months, the Academic Dean must approve changes in grades.

Students are responsible for keeping their professors informed of any military-related absences.

Readmission

S Students who withdraw from the university are eligible for readmission at any time, unless they have been in violation of the university's academic regulations, or have been dismissed for disciplinary reasons. Students who have been admitted to the university and have not maintained continuous enrollment must resubmit an application for admission. A readmitted student must meet the degree requirements in place at the time of readmission in order to qualify for graduation. Applications are available online. Arrangements for payment of outstanding tuition balances must be made with the Business Office before readmission is approved.

Continuous Enrollment

To be considered continuously enrolled a student must not have more than one academic year (three consecutive semesters) of non-enrollment with the university.

Leave of Absence

Doctoral students may request a Leave of Absence (LOA) by completing the "Request for Leave of Absence" form on the myCapitol portal (Doctoral Student tab). When requesting an LOA, keep in mind all coursework must be completed within a five-year time period. Please note this does not include the additional two years allowed for dissertation completion.

All LOA requests must be submitted in writing, include the reason for the request and be signed and dated. In order to adhere to federal regulations of the Department of Education, the LOA, together with any additional leaves of absence, must not exceed a total of 180 days in any 12-month period. The 12-month period begins on the initial date of your LOA. At leave expiration, students must re-enroll or (if qualified) request an LOA extension. If you have not returned at the end of the 180-day period, the school is required to notify the Department of Education of your last date of attendance. This will affect your federal financial aid and your loan repayment status. Students with circumstances requiring LOA beyond 180 days should consider withdrawing from the program, retaining the right to reapply at a later date. LOA forms are provided on the MyCapitol portal.

Course Cancellation

The university can cancel a course for which an insufficient number of students are enrolled. Students will be notified of a cancellation by the first class session, and any payments made will be refunded in full or credited to your next term.

Course Prerequisites

When planning schedules for upcoming semesters, students should pay special attention to the course prerequisites. Students must obtain a grade of C or better in prerequisites for degree required courses. Those students not meeting the course criteria will not be allowed to register without approval from the dean of academics.

Completion of English Courses

Students seeking bachelor's degrees at Capitol Technology University must complete EN-101 and EN-102 before being permitted to register for junior-level classes. Transfer students must have equivalent transfer credits for EN-101 and EN-102 before being permitted to register for junior-level classes. Transfer students of junior status who do not have equivalent transfer credits for EN-101 and EN-102 must meet with the academic before registering.

Class Attendance

Each professor establishes regulations regarding class attendance at Capitol Technology University. Regular class and laboratory attendance is necessary to achieve maximum success in university work. Students receiving financial aid who do not attend classes will lose their aid.

Transcripts

Student academic records are maintained exclusively by the Office of Registration and Records. These records are considered privileged documents between the student and the university and will be released only upon a signed, written request from the student, except as may be required by law.

Transcripts will be issued when the student submits a signed request form and the student's financial account is current. A $10 transcript fee is assessed for each issuance. Transcript request forms are available in the Office of Registration and Records and on the myCapitol portal.

Capitol Technology University will neither issue a transcript that reflects only part of a student's record nor make copies of transcripts on file from other colleges or universities. Federal guidelines prohibit the faxing or emailing of grades and transcripts.

Unofficial transcripts are available at any time with proper photo identification if the student's financial account is current.

Identification Cards

All enrolled undergraduate students will receive a Capitol Technology University identification card. ID cards are required to check out laboratory equipment or library materials.

The student activity fee covers the cost of the original ID card. At the beginning of each semester, information about obtaining an ID card is posted on campus and online.

Graduate students may request an ID card from the Office of Student Life.

Scholastic Standing

Grading System

The quality of a student's academic performance is evaluated by letter grades that are assigned quality points as follows:

Grade	Standard	Quality Points
A	Excellent	4
B	Good	3
C	Average*	2
D	Below average**	1
F	Failing	0
I	Incomplete	0
NG	No grade	0
P	Pass	0
R	Repeat	0
S	Satisfactory	0
U	Unsatisfactory	0
V	Validation credit	0
W	Withdrawn (officially)	0
X	Audit	0
T	Transfer credit	0

*A grade of C shows minimum expectations have been met at the graduate level.

**Grades of D will not apply toward graduate program requirements.

Grade Point Average

At the end of each semester, averages are computed for each student's record to indicate the general level of his or her academic standing. The first is the scholarship level for the semester. The second is the cumulative grade point average, indicating the scholarship level for all work taken at the university to date.

In cases where a student retakes a course, only the highest grade is used in computing the CGPA. The previous grade remains on record as information only. To graduate, undergraduate students must have a minimum 2.0 CGPA and a 2.0 GPA in their degree program. Graduate students must have a minimum 3.0 CGPA and a 3.0 GPA in their current degree program.

Incomplete Grades

An incomplete (I) grade will not be given except in the case of a true emergency that can be documented by medical records, death certificates, etc. Even if a true emergency exists, a student will not be allowed an extension (an I grade) unless that student has been attending classes and has kept up with the work before the emergency.

When an I grade is submitted, the professor will complete an incomplete grade form in the Office of Registration and Records explaining the reasons for the I grade and listing the student's grades in the course. The student must then complete the work by the end of the fourth week of the next term, or the I will be converted to an F (unless the professor has specified that the I be converted to a C or D). After six months, the Academic Affairs Council must approve changes in grades.

No Grade Mark

When it is not appropriate to award a grade, a mark of NG will be given. NG grades are not calculated in the student's term or CGPA.

Grade Reports

Grade reports are available at https://mycapitol.CapTechU.edu within three weeks after the last day of final exams. Students who want to have grades sent to sponsors must complete the proper request form available in the Office of Registration and Records or online. Federal regulations prohibit the use of phone, email or fax for official grade distribution.

Grade Appeal

Students who believe their posted grade is incorrect should speak directly to the professor. If the student and professor cannot resolve the issue in a satisfactory manner, the student may write a letter clearly explaining the situation to the dean of academics. If the dean of academics and student are unable to resolve the issue in a satisfactory manner, the student may appeal in writing to the vice president for academic affairs. The vice president will review the situation and may seek the advice of the Academic Affairs Council. The decision of the vice president is final and no further review will be granted. All appeals must be filed by the fourth week of the next term.

Grade Changes

Occasionally, a grade must be changed as errors do occur. However, grade changes will not be accepted later than six months after a term has ended; therefore, if a student truly feels that a mistake has been made, he or she must investigate as soon as possible after the grade is issued. (see Grade Appeal above)

Dean's List for Full-time Students

Full-time undergraduate students who have GPAs of 3.5 or higher, and no failing grades for the semester, qualify for the dean's list. Dean's list designation is included on the student's permanent record.

Dean's List for Part-time Students

Part-time undergraduate students taking at least six semester credits, who have GPAs of 3.5 or higher and no failing grades for the semester, qualify for the dean's list for part-time students. Dean's list designation is included on the student's permanent record.

Academic Performance

Academic Standing

Students seeking a bachelor's or associate degree are in good academic standing if they have a cumulative grade point average of at least 2.0 in their degree program and are not on academic suspension. Students seeking a master's or doctoral degree are in good academic standing if they have a CGPA of at least 3.0 and are not on academic suspension.

Repeating a Class

A specific course may be repeated twice in order to improve a grade or replace a W or X. Therefore, a student may take a specific course only three times. Three-time enrollment is limited to a maximum of five different courses during a student's academic career. The higher grade is used and the lower grade is omitted in computing the CGPA. All grades are recorded on the student's transcript.

Any student who has taken a course required for their degree three times and has not achieved a satisfactory grade will be dismissed from that academic program. The dismissed student is permitted to apply for any other program that does not require that specific course. An academically dismissed student with extenuating circumstances can appeal in writing to the dean of academics for recommendation to the vice president of academic affairs.

Satisfactory Academic Progress for Students Receiving Financial Aid

Undergraduate and graduate students receiving federal aid must meet satisfactory academic progress (SAP) standards or risk the cancellation of financial awards and repayment of funds already received. See page 27 for the policy.

Academic Probation

Academic probation alerts students that they are in academic trouble and will be suspended from the university if their GPA and

CGPA are not brought up to good academic standing (see above).

Undergraduate students are placed on academic probation under the following conditions:

- If a student registers for MA-005 or EN-001 and does not complete the course with a P.
- If the CGPA of an undergraduate student with fewer than 30 attempted credits falls below 1.7.
- If the CGPA of an undergraduate student with more than 30 attempted credits falls below 2.0.

Undergraduate students on academic probation must have a mandatory meeting with their advisor before registration and may not register for more than 12 semester credits, or no more than four courses.

Master's degree students whose cumulative GPA falls below 3.0 are placed on last warning. Students on academic probation will be given three semesters (registered for coursework) to raise their CGPA to 3.0 and must consult with their advisor on the best course options.

Doctoral students must maintain a 3.0 GPA. A grade of C or below is not acceptable. A student who receives a C or lower in any course must repeat that course, achieving a B or higher before moving on in the program. Students failing to successfully achieve a grade of B or higher in a single course after three attempts will be dismissed from the program. A student whose cumulative grade point average falls below 3.0 will be placed on academic probation. Probation will be lifted when the student achieves a cumulative GPA of 3.0. Students failing to meet any of these criteria will be dismissed from the doctoral program.

Academic Suspension

Undergraduate students who have not completed the prerequisites for MA-110, MA-112 or MA-114 and EN-101 through placement testing, or successful completion of MA-005 and EN-001 after two attempts, will be suspended from the university until it is demonstrated to the faculty that they can achieve and maintain good academic standing at the university level by successfully completing MA-110, MA-112 or MA-114 and EN-101 (depending on their degree program) at another accredited college or university with a grade of C or better.

Undergraduate students whose cumulative GPA has been below 2.0 for three consecutive semesters will be suspended from the university for one academic semester after which they may return to the university. Students suspended from the university are not relieved of their financial obligations.

Upon return, students will remain on probation and must achieve and maintain good academic standing or be suspended from the university until it is demonstrated to the faculty that they can achieve and maintain good academic standing at the university level. To demonstrate to the faculty that a student can achieve and maintain good academic standing at the university level, he or she must complete at least six academic courses (a minimum of 18 credits) with grades of a C or better at another accredited college or university. Before a student is readmitted to Capitol Technology University, the director of admissions will review his or her file.

Academic Dismissal

After a second suspension, undergraduate students who have been readmitted to Capitol Technology University after completing 18 credits at another institution must earn a 2.0 GPA each semester. If their GPA falls below 2.0 at any time, they will be dismissed and not permitted to return to Capitol Technology University. Graduate students who fail to reach the 3.0 requirement in the allowed period will be automatically dismissed and may not be readmitted to the university for at least one year after the effective date of dismissal.

Students dismissed from the university are not relieved of their financial obligations.

The U.S. Department of Veterans Affairs regional office will be notified if students receiving VA educational benefits are suspended or terminated. The dean of academics will consider re-entry requests on an individual basis from students who have been dismissed for unsatisfactory progress.

The Office of Registration and Records will maintain a record of each VA student's grades in accordance with VA regulations. A student can request official transcripts from the Office of Registration and Records as long as his or her financial accounts are current.

Any doctoral student who has been dismissed for failure to meet academic standards becomes eligible to reapply no sooner than one year after the dismissal date. Students will be required to submit a letter with the application, outlining how the reasons for the conditions that led to dismissal have been remediated and why the student is now confident that he or she will succeed in the program. The student must meet all the requirements of the degree existing at the time of readmission. Students are still subject to the time limit for completion (see pg. 19).

Disciplinary Dismissal

The continued enrollment of any student is dependent upon proper conduct. Failure to comply with the university's regulations, or conduct deemed by the faculty as inconsistent with general good order, is regarded as sufficient cause for irreversible dismissal. The university reserves the right to terminate a student's enrollment at any time for cause. Students dismissed from the university are not relieved of their financial obligations. Students who are dismissed for academic dishonesty or other breaches of student conduct will not be considered for readmission.

Matriculation

Classification of Undergraduate Students

Freshman	29 semester credits or fewer
Sophomore	30-59 semester credits
Junior	60-89 semester credits
Senior	90 semester credits or more

Residency Requirements

A minimum of 15 semester credits, including 12 semester credits in the student's degree program, must be completed at Capitol Technology University in order to receive an associate degree. At least 30 semester hours of academic credit must be earned by direct instruction. Direct instruction does not include instruction through correspondence, credit for prior learning, cooperative education activities, practica, internships, externships, apprenticeships, portfolio review, departmental examinations or challenge examinations.

A minimum of 30 semester credits, including 18 semester credits in the student's degree program, must be completed at Capitol Technology University in order to receive a bachelor's degree. At least 60 semester hours of academic credit must be earned by direct instruction. Direct instruction means synchronous or asynchronous instruction for academic credit that allows regular interaction between student and instructor, such as lectures, laboratory instruction, interactive instructional television, delayed video online instruction and (if regular interaction is available from an instructor) independent study. The residency requirement is 25% of the degree requirements for campus based programs and 30% for online programs.

For all BS degrees, at least 27 credits must be 300 level or above to qualify for graduation.

Students who want to take courses at another institution for possible transfer after enrolling at Capitol Technology University must receive prior written permission from the dean of academics. Transfer credit approval forms are available at the Office of Registration and Records and online.

Graduate degrees must be completed in their entirety at Capitol Technology University, with the exception of students transferring courses in accordance with the transfer credit policy on page 20 of this catalog.

Students pursuing a Capitol Technology University certificate must complete all required coursework through Capitol Technology University.

Enrollment Status

Undergraduate

1-11 credits is considered part time
12-18 credits is considered full time

Master's

1-8 credits is considered part time
9 or more credits is considered full time

Doctoral

1-5 credits is considered part time
6 or more credits is considered full time

For federal and Veterans' benefits enrollment requirements, see page 31.

Graduation Requirements

Capitol Technology University conducts the annual commencement ceremony at the Laurel campus in May. Transcripts always reflect the exact semester the degree program is completed. The "date degree

conferred" information on transcripts and diplomas coincides with the date of the May commencement ceremony for spring semester graduates and with the last day of classes in the semester for summer and fall semester graduates.

Undergraduate Requirements

Undergraduate students must have satisfactorily completed the curriculum requirements for their degree program with a CGPA and degree program GPA of at least 2.0, including a grade of C or better on their Senior Project capstone course, and must have satisfied the Capitol Technology University residency requirements as listed.

Undergraduate students who complete all degree requirements by the end of the summer session are permitted to take part in the commencement ceremonies as degree candidates. If a student is not enrolled for the summer by April 15, permission to participate as a degree candidate will not be granted.

Undergraduate students must file an application for graduation with the Office of Registration and Records no later than six months before the semester of completion. The student's file is reviewed and forwarded to the dean of academics for final approval. Students are subsequently notified of approval and status. Applications for graduation are available in the Office of Registration and Records and online. The graduation fee, due by April 15, cannot be waived.

Undergraduate students are considered degree candidates only when the above procedures have been completed. Students who change their plans for graduation must notify the Office of Registration and Records in writing.

Graduate Requirements

Graduate students must have a minimum 3.0 CGPA. Grades of D will not apply towards graduate program requirements. Graduate students must submit an application for graduation no later than the end of January to be considered and included in the May commencement ceremony. The graduation fee, due by April 15, cannot be waived. The form, available online and in the Office of Registration and Records, is required so that orders for diplomas and commencement regalia can be placed before commencement. Diplomas will be released only after graduation fees are paid.

Graduate students who complete all degree requirements by the end of the summer (Term I, Term II or in summer semester classes) are permitted to take part in commencement ceremonies as degree candidates. If a student is not enrolled for the summer by April 15, permission to participate as a degree candidate will not be granted.

Time Limit for Degree Completion

Graduate students are required to maintain satisfactory progress toward the completion of degree requirements, which must be accomplished within seven years. The seven-year period begins when the oldest course applied to the degree was completed. This includes any transfer credits from other institutions.

Doctoral students are required to maintain satisfactory progress toward the completion of course requirements, which must be accomplished within five years. MS/PhD students must complete course requirements within seven years. DSc in Cybersecurity students and PhD in Business Analytics and Decision Sciences students then have an additional two years after completing all required coursework to submit and defend their dissertation.

Graduation Clearance

In the final weeks of their last semester of study, students should check with the Business Office, the Office of Financial Aid, the Office of Residence Life and the Puente Library to be certain that they have no outstanding obligations. Diplomas and transcripts will not be issued for students who have outstanding library books or fines, outstanding balances in the Business Office, or for financial aid recipients who have not had exit interviews with the Office of Financial Aid.

Academic Honors

Honors are awarded and noted on the transcript of students who graduate with the following cumulative GPAs:

Undergraduate

3.9 - 4.0	summa cum laude
3.75 - 3.8999	magna cum laude

3.5 - 3.7499 cum laude

Master's

4.0 with honors

If an undergraduate student is completing more than one degree, the overall CGPA is used to calculate honors for the multiple degree programs.

If a master's student is completing more than one degree, the CGPA within their degree program is used to determine honors.

Honor Societies

Alpha Chi National Honor Society

The Maryland Beta Chapter represents the Alpha Chi National Honor Society at Capitol Technology University. Membership is based on demonstrated service to the university community, good reputation and character, as well as high academic standing. Juniors and seniors enrolled in one of the bachelor's degree programs at Capitol Technology University for at least one year and who rank among the top 10 percent of their class are eligible for election to the chapter by the faculty.

Alpha Chi offers opportunities for public performance at conventions; publication in the Alpha Chi Recorder; leadership through National Council membership; financial assistance through National Benedict Fellowships, Nolle Scholarships and several regional scholarships; and participation in local chapter projects and activities.

Tau Alpha Pi National Honor Society

The Kappa Alpha Chapter represents the Tau Alpha Pi National Honor Society at Capitol Technology University. Membership requirements include successful completion of at least 55 semester credit hours and at least 24 semester credit hours at Capitol Technology University, enrollment in one of the degree programs, a CGPA of at least 3.5 for two consecutive semesters and a willingness to lead and serve in capacities beneficial to the university community. Members are elected for life. The chapter holds dinner meetings to recognize new members and encourages alumni participation.

Eta Kappa Nu National Honor Society

The Kappa Mu Chapter of Eta Kappa Nu at Capitol Technology University is a national honor society for electrical engineers. HKN was founded in 1904 and enjoys a membership of over 175,000, representing 198 chapters. This prestigious organization is the only honor society solely devoted to electrical engineering. A successful candidate possesses proven character, perseverance and the ability to excel. This organization extends membership to the top juniors and seniors in the fall and spring semesters. Officers are elected in the fall.

Sigma Beta Delta

The purposes of Sigma Beta Delta are to encourage and recognize scholarship and achievement among students of business, management and administration, and to encourage and promote personal and professional improvement and a life distinguished by honorable service to humankind. Membership in Sigma Beta Delta is the highest national recognition a business student can receive at a college or university with a Sigma Beta Delta chapter. To be eligible for membership, a business student must rank in the upper 20 percent of the junior, senior or master's class and be invited to membership by the faculty officers.

Upsilon Pi Epsilon

It is the express purpose of Upsilon Pi Epsilon (UPE) to promote the computing and information disciplines and to encourage their contribution to the enhancement of knowledge. The mission of UPE is to recognize academic excellence at both the undergraduate and graduate levels in the Computing and Information Disciplines. UPE is a member of the Association of College Honor Societies (ACHS). UPE has received endorsements from the two largest computer organizations in the world, the Association for Computing Machinery (ACM) and the IEEE Computer Society (IEEE-CS). UPE is also a charter member of The International Federation of Engineering Education Societies (IFEES). UPE both installed the Capitol chapter and inducted the charter members in April 2018.

Transfer Credits

Undergraduate Transfer Policies

Unofficial transfer credit evaluations are completed during the admissions process in consultation with the academic departments. Once the transfer student is enrolled at Capitol Technology University, an official evaluation is conducted by the assistant director of registration and records in consultation with the academic departments and approved by the director of registration and records. The approved transfer credits are then added to the student's permanent academic record and the student will receive written notification of the official transfer evaluation from the Office of Registration and Records. Once students matriculate at Capitol Technology University, they must meet the academic standards for their degree program.

Capitol Technology University will consider credit for transfer from coursework completed at a regionally accredited institution, ABET-accredited program, or, in special cases, other qualified institutions acceptable to the standards of Capitol Technology University. Capitol Technology University will consider transfer credit for courses taken at an unaccredited institution on a probationary status, in which the student must complete a minimum of 24 credits at Capitol Technology University with a CGPA of 2.0 before the credits will transfer.

Coursework must also meet the following requirements:

- Courses must be relevant to the Capitol Technology University curriculum.
- Only a passing grade of C or higher will be considered for transfer (courses are evaluated and transferred individually).
- Grades do not transfer, therefore transfer credits are not used in computing the CGPA.
- Capitol Technology University credit requirements are based on the semester-credit system. Transfer credits from other institutions operating on other academic calendar systems will be converted to semester credits.
- The grade of D will not be accepted for credit even when it is part of a degree.
- Comply with Residency Requirements as stated on page 17.
- Courses completed more than five years prior to enrollment at Capitol Technology University will be reviewed on a case-by-case basis.

Capitol Technology University may transfer a maximum of 70 semester-credit hours from any combination of the following:

- community or junior colleges*
- proprietary or technical schools
- the military
- College Level Examination Program (CLEP)
- DANTES Subject Standardized Test Program (DSST)
- StraighterLine courses
- Advanced Placement (AP)
- International Baccalaureate (IB)
- Massive Open Online Course (MOOC)**

* Credits transferred are limited to the first two years and approximately 50% of the baccalaureate degree program.

** MOOC coursework will be considered for transfer credit if the courses are approved by the American Council of Education (ACE).

There is no maximum amount of credits that can be transferred from a four-year accredited institution as long as residency requirements are met.

Military Credits

Capitol Technology University will award credit for military courses based on the American Council on Education's Guide to the Evaluation for Educational Experiences in the Armed Forces and program relevancy. Applicants must present an official Joint Services Transcript (JST) to the Capitol Technology University Admissions Office or Office of Registration and Records.

Industrial Courses

Capitol Technology University will not accept credits for courses taken at an industrial site unless the American Council on Education has approved the course. Students who have taken industrial courses may elect to take validation exams (see below).

Continuing Education Units

Capitol Technology University will not accept continuing education units (CEU) for transfer.

CLEP Tests

The official results of all CLEP exams must be submitted to the Office of Registration and Records no later than two semesters before completion.

Validation Exams

Undergraduate students who can demonstrate competence in a subject without having completed the specific coursework, due to relevant work or life experience, may take a specially arranged validation examination. Not every course, however, lends itself to the validation process, and the Dean of Academics or the student's department chair must grant permission for the examination to be given. Validation examinations are thorough and cannot be taken a second time. In addition, a student may not request a validation exam for a course in which a grade of D or lower has been earned.

Students interested in taking a validation exam should visit the Office of Registration and Records, where forms and procedures (including fees) are available. Students who pass the validation examination receive a V on their transcript and the appropriate number of semester credits. No partial credit or quality points are awarded.

Professional Certifications

Capitol Technology University will consider transfer credit for industry recognized certifications that are relevant to the program curriculum (A+,N+,S+,CISSP, OWSP)

Waived/Substituted Courses

In some circumstances, transfer credits may count toward a waived or substituted course. If a Capitol Technology University course is waived, the student must complete the equivalent number of credits in a related subject area to fulfill the requirements of the degree. If a course is substituted, the credit is transferred and the requirement is therefore considered complete. Waivers and substitutions are conducted by the assistant director of registration and records and approved in writing by the dean of academics.

Engineering Programs

Students transferring credits into the engineering programs must follow additional guidelines.

taken within five years of admission will be considered for transfer. Once accepted, Credits for military, vocational or technical training may be used to satisfy some electronics- and technology-based freshman and sophomore level EL courses.

Such courses do not fulfill the objectives of engineering, engineering science, or social science courses; they may be used as engineering electives in the engineering programs.

Graduate Transfer Policies

Unofficial transfer credit evaluations are completed during the admissions process in consultation with the academic departments. Once the student is enrolled at Capitol Technology University, an official evaluation is conducted by the assistant director of registration and records in consultation with the academic departments and approved by the director of registration and records. The approved transfer credits are then added to the student's permanent academic record and the student will receive written notification of the official transfer evaluation from the Office of Registration and Records.

Depending on the program, a maximum of nine to twelve semester credits of comparable accredited coursework taken elsewhere may be applied toward a graduate degree. Only courses with a B or better will be accepted for transfer. Capitol Technology University will not accept continuing education units (CEUs) for transfer. Results from a certification exam may not be used for transfer. Validation exams for credit are not available at the graduate level. In some cases, military train that is part of a completed graduate degree may be used as transfer credit. Transfer credits are limited to six credits in 30-credit programs and nine credits in programs containing more than 30 credits except in the case of students who participated in selected NDU programs (see page 9 for details). Once the student enrolls a Capitol Technology University, all remaining credits must be completed at Capitol Technology University.

The time limit for degree completion applies to transfer credits. Therefore, any course that was taken more than seven years before the date of graduation will not fulfill graduation requirements at the master's level and will be removed from the student's transcript. At the doctoral level, courses

doctoral transfer credits do not expire. Transfer credits cannot be applied to any capstone or research-related course. Grades do not transfer, therefore transfer credits are not used in computing the CGPA.

Tuition and Fees

The following rates are in effect for the 2018-2019 academic year beginning fall 2018 and continuing through summer 2019. Tuition rates are subject to change without notice.

Undergraduate Tuition

Full-time/Part-time tuition

Full-time tuition, per semester (12-18 credits)	12,354
Full-time credits above 18 (per credit)	1,030
Part-time 1-11 credits (per credit)	813
Audited courses (per credit)	813

Military Tuition Rates (Active Duty)

Undergraduate Military Tuition Rate: 250 per credit hour, plus fees.

Graduate Tuition

Master's Programs

Online or satellite site (per credit), plus fees	603
Independent study (per credit), plus fees	839
Online 3-credit course, including fees	1,866
Active duty service members (per credit)	350

Doctoral Program

Per credit	893
3-credit course	2,679

Fees

Admissions

Undergraduate (paper) application	25
Undergraduate online application	free
Master's program online application	free
Processing fee for international students	150
Doctorate application	100

Registration

Late registration for continuing students	40
Drop/add (each form)	10
Deferred payment plan	30
Late payment	25
Returned check	40
Check stop payment request	40

Undergraduate On-campus Student Services, per semester

Resident students	120
Full-time commuter students (12+ credits)	56
Part-time commuter students (1-11 credits)	13

Information Technology, per semester

Undergraduate Full-time (flat fee, 12+ credits)	380
Undergraduate Part-time (per credit, 1-11 credits)	19
Master's (per credit)	19

Exam Fee for RSC/DSM 802 (doctoral students) 50

Write and Cite Exam Fee for RSC/DSM 802 and TEC 800 50

Academic Services

Transcripts (each)	10
Certificates (each)	25
Replacement of Diploma	75

Graduation (non-refundable)

AAS degree programs	75
BS, MS, MBA, DSc degree programs	150
Additional degrees	75

Validation exam 250

Doctorate entrance exam 100

Lab Fees

Level 1 Lab Fee	25
Level 2 Lab Fee	50
Level 3 Lab Fee	75
Level 4 Lab Fee	100

International Student Fee (per semester) 750

Campus Residence Halls

Single occupancy bedroom (per semester)	3,896
Double occupancy bedroom (per semester)	3,375
Triple occupancy bedroom (per semester)	2,854
Room reservation fee	150
Security deposit (refundable)*	50
Student services (per semester	$120
Communication fee (per semester)	$120

On-campus summer 2019 housing
Single occupancy bedroom $2,226

Full-time Student Tuition Lock

Capitol Technology University offers a tuition-lock program for undergraduate students registered full time. Tuition is locked in from the students' first full-time semester and remains unchanged for up to five years. To remain eligible for the tuition-lock rate, students must adhere to the following terms and conditions:

- Maintain continuous full-time enrollment during the academic year (minimum 12 credits per semester).
- Keep all financial accounts up to date. (Consult the academic calendar on page 150 for due dates.)
- Remain in good academic standing. (See page 15 for academic performance.)

If these terms are not met, the student will no longer be eligible for the tuition lock and will be subject to the prevailing tuition rate.

Payment Options

Undergraduate Payment Options

- Full payment at time of registration
- Deferred payment plan
- Financial aid (see page 26)
- VA Benefits (see page 30)
- Employer sponsorship

Undergraduate Deferred Payment Plan

The undergraduate deferred payment plan allows semester students to pay their tuition in three installments: one-third at registration, one-third on or before the end of the fourth week of classes and one-third on or before the end of the eighth week. Students taking 8-week classes may also pay their tuition using a deferred payment plan; 50 percent of tuition is due upon registration and the remaining balance is due four weeks after classes begin. The cost of the deferred payment plan is $30, which is due with the first installment.

Nonpayment of tuition deposits may result in registration cancellation. Failure to adhere to the arrangements of the deferred payment plan may result in immediate dismissal from the university. Students who abuse the deferred payment plan will not be allowed to defer their tuition in the future.

Students on academic last warning are not eligible to use the deferred payment plan and must pay their tuition in full at registration.

Undergraduate Employer Sponsorship

Undergraduate students who are sponsored by an employer or other appropriate third party must submit authorization forms to the Business Office at the time of registration. Sponsors will be billed directly. Tuition not covered will be the responsibility of the student.

Undergraduate Employer Tuition Reimbursement

Undergraduate Students who are reimbursed by their employers must pay in full or use the undergraduate deferred payment plan.

Master's Program Payment Options

- Full payment at time of registration
- Deferred payment plan
- Financial aid (see page 26)
- VA Benefits (see page 30)
- Employer sponsorship
- Employer reimbursement

Doctorate Program Payment Options

- Full payment prior to start of classes
- Financial aid (see page 26)
- VA Benefits (see page 30)
- Employer sponsorship
- Employer reimbursement

Master's Programs Deferred Payment Plan

Masters students are required to pay 50 percent of tuition upon registration. If tuition is not paid in full at the start of classes, students will be automatically enrolled in the deferred payment plan and assessed a $30 deferment fee. The remaining balance is due

four weeks after classes begin. Nonpayment of tuition could result in cancellation of student registration.

Graduate Employer Sponsorship

Graduate students (masters and doctorate) who are sponsored by an employer or other appropriate third party must submit authorization forms to the Business Office at the time of registration. Sponsors will be billed directly. Tuition not covered will be the responsibility of the student.

Graduate Employer Tuition Reimbursement

Graduate students (masters and doctorate) who are reimbursed by an employer must submit authorization forms to the Business Office at the time of registration along with one third (1/3) of the tuition cost. Balance is due ten (10) days after classes end. Students who do not pay within the ten days will be subject to deferment fees and required to follow the standard payment options in the future.

Financial Aid

All students who receive financial aid are required to pay the remaining balance in full or follow the appropriate deferred payment plan. If funds have not been received by the university from a particular financial aid source, that amount will not be credited to the student's account and cannot be provided to the student, even if notification of the award has been received.

Book Vouchers

All students receiving financial aid in excess of tuition, fees and on-campus housing charges may be considered for a book voucher. The Business Office must receive all financial aid proceeds, including federal and private loans, for students to receive a book voucher.

Obligation for Payment

Tuition and fees for all students become an obligation in accordance with the provisions of the refund schedule in this section. Failure to pay any debt when due to the university is considered sufficient cause to bar the student from classes or examinations or to withhold diploma, scholastic certificate or transcript of record. Students with outstanding accounts will be sent to collections. Collection or litigation expenses associated with this account are the responsibility of the student. Students whose accounts are past due one semester will be notified that their accounts are in jeopardy of being referred to a collection agency.

Refund Policy

Dropping or Withdrawing from Classes

It is the students' responsibility to officially drop any class in which they are enrolled. This includes situations in which the student never attended the first class meeting. Never attending or ceasing to attend classes does not constitute an official withdrawal or relieve students of their financial obligation to Capitol Technology University.

Full tuition refunds are available only to students who officially drop a class before the first day of classes. After the first day of classes, any student who drops or withdraws from class will be subject to the tuition refund schedule, outlined below. Refunds are effective on the date the drop or withdrawal is submitted to the Office of Registration and Records.

Refunds are computed according to the following schedule and are a percentage based on the full tuition amount for each course. The percentage listed equates to the student refund in the event the balance was paid in full before the start of class. Students on company contract may be personally responsible for the balance of their tuition, in the event their company only pays for completed courses.

Please refer to the published semester and term calendars beginning on page 150 of this catalog or online for specific dates of refunds.

Tuition Refund Schedules

8-week Term Courses

100%	Student drops before the first day of classes
75%	Student drops during the first week of classes
50%	Student drops during the second week of classes
25%	Student drops during the third week of classes
0%	Student drops after the third week of

classes

16-week Term Courses

100% Student drops before the first day of classes

75% Student drops during the first or second week of classes

50% Student drops during the third week of classes

25% Student drops during the fourth week of classes

0% Student drops after the fourth week of classes

Military Tuition Assistance Refund Policy

Military Tuition Assistance (TA) is awarded to a student under the assumption that the student will attend school for the entire period for which the assistance is awarded. When a student withdraws, the student may no longer be eligible for the full amount of TA funds originally awarded. To comply with the Department of Defense policy, Capitol Technology University will return any unearned TA funds on a proportional basis through at least the 60% portion of the period for which the funds were provided. TA funds are earned proportionally during an enrollment period, with unearned funds returned based upon when a student stops attending. If a service member stops attending due to a military service obligation, Capitol Technology University will work with the affected service member to identify solutions that will not result in a student debt for the returned portion.

When a student "officially" withdraws from a course, the date of withdrawal will be used as the last date of attendance. If a student receives a grade of "F" (failure for nonattendance) for a course, that is considered an "unofficial" withdrawal. For unofficial withdrawals, Capitol Technology University will determine the last date of attendance by reviewing the last date of activity within a course. For online courses, Capitol Technology University will determine last date of attendance based on the last date a student made a contribution to the class or submitted an assignment. For on campus courses, Capitol Technology University will reach out to the professor to determine the last date of attendance. Once last date of attendance has been determined, Capitol Technology University will recalculate student's TA eligibility based on the following formula:

Percentage earned equals number of days completed divided by total number of days on the course

Determining eligibility for TA is class specific. The start and end date will be used for each class to determine eligibility. Using the formula above, Capitol Technology University will be required to return to the Department of Defense some or all of the TA awarded to service members that did not complete at least 60% of each course; possibly creating a balance on the Capitol Technology University student account.

Federal Return of Funds Policy

The Financial Aid Office is required by federal statute to recalculate federal financial aid eligibility for students who withdraw, drop out, are dismissed or take a leave of absence before completing 60% of a semester or term. The federal Title IV financial aid programs must be recalculated in these situations.

If a student leaves Capitol Technology University before completing 60% of a semester or term, the financial aid office recalculates eligibility for Title IV funds. Recalculation is based on the percentage of earned aid using the following Federal Return of Title IV funds formula:

Percentage of semester or term completed = the number of days completed up to the withdrawal date divided by the total days in the semester or term. (Any break of five days or more is not counted as part of the days in the term.) This percentage is also the percentage of earned aid.

Funds are returned to the appropriate federal program based on the percentage of unearned aid using the following formula:

Aid to be returned = (100% of the aid that could be disbursed minus the percentage of earned aid) multiplied by the total amount of aid that could have been disbursed during the semester or term.

If a student earned less aid than was disbursed, the institution would be required to return a portion of the funds and the student would be required to return a portion of the funds. Keep in mind that when Title IV funds are returned, the student borrower may owe a debit balance to the institution.

If a student earned more aid than was disbursed to him/her, the institution would owe the student a post-withdrawal disbursement that must be paid within 120 days of the student's withdrawal.

Refunds are allocated in the following order:

Unsubsidized Direct Loans
(other than PLUS loans)

Subsidized Direct Loans
Federal Perkins Loans
Direct PLUS Loans
Federal Pell Grants for which a return of funds is required
Academic Competitiveness Grant
National SMART Grant
Federal Supplemental Opportunity Grants for which a return of funds is required

According to federal regulation, a financial aid student who receives all Fs during a period of enrollment is considered not to have attended any of his or her classes; therefore, all financial aid received for that period of enrollment must be returned to the Department of Education. Financial aid will not have to be returned to the federal government if at least one of the student's professors verifies that the student has been in class and really earns the failing grade. The return of financial aid does not relieve the student of financial obligations.

Financial Aid

Capitol Technology University understands that paying for college is a major hurdle for parents and students. To help families meet tuition and living expenses, the university offers a variety of financial assistance programs including loans, work-study, scholarships and grants to help cover tuition and living expenses. Regardless of income level, all degree-seeking students are encouraged to apply for assistance.

Financial aid is available to both full- and part-time undergraduate students who are U.S. citizens or eligible non-citizens. Audited courses, some repeated courses, and credit by examination are not counted as meeting enrollment requirements. A student receiving financial aid must demonstrate satisfactory progress toward degree completion.

The Capitol Technology University student handbook contains additional information about financial aid at Capitol Technology University.

Application Procedures

One of the most important aspects of the financial aid process is to apply for assistance as early as possible. The application due dates are priority deadlines. Students who meet the priority deadlines enjoy the security of having their award authorization ready in time for class registration.

1. You must complete and submit the Free Application for Federal Student Aid (FAFSA) to apply for federal and state financial aid. Complete the application as early as October 1, 2018, or by priority date of March 1, 2019, or as far in advance of the starting term as possible. Apply online with FAFSA on the web at www.fafsa.ed.gov. Be sure to list Capitol Technology University on the FAFSA, School Code 001436 so the FAFSA information will be electronically forwarded to the university. A paper FAFSA can be obtained by requesting one from the Department of Education at 1-800-433-3243.

2. After reviewing your processed FAFSA data, the Office of Financial Aid will send an award letter listing the awards for which you are eligible.

3. Sign and return one copy of the award letter to the Office of Financial Aid. Students may also review, accept or decline their financial aid on the myFA portal. This portal is located within myCapitol and is available 24 hours a day from any location.

Renewal of Financial Aid

Financial aid is not automatically renewed, except as may be noted. The entire financial aid application process must be completed every year in order for your request for federal, state and institutional aid to be considered.

Enrollment Status for Financial Aid

Undergraduate and Graduate – Federal
- 6-8 credits is considered half time
- 9-11 credits is considered three-quarter time
- 12+ credits is considered full time

Undergraduate – Veterans
- 3 to 5 credits is considered part time
- 6 to 8 credits is considered half time
- 9 to 11 credits is considered three-quarter time
- 12+ credits is considered full time

Graduate – Veterans
- 3 or more credits taken during an 8-week term session is considered full time

- 3 to 5 credits taken during a 16-week semester is considered greater than one-quarter but less than half time
- 6 or more credits taken during a 16-week semester is considered full time

Continuing Eligibility

The Office of Financial Aid reserves the right to review or modify financial aid commitments at any time based on information affecting eligibility. This includes the availability of funds, changes in financial status, satisfactory academic progress, and changes in enrollment status.

Return of Federal Funds

Students who have received financial aid awards and withdraw from classes (officially or unofficially) may be required to return a portion of the federal funds. See the federal return of funds policy on page 25-26.

Federal Satisfactory Academic Progress (SAP) Standards

The Department of Education passed a new federal satisfactory academic progress policy effective July 1, 2011.

This policy applies to both undergraduate and graduate students receiving federal financial student aid funds. This financial aid SAP policy is separate from the university's general satisfactory academic progress policy.

Under the Federal SAP policy there are two components: a qualitative SAP component (Grade Point Average) and a quantitative SAP standard (earned credit hours versus attempted credit hours). Students receiving federal student aid must be in compliance with both standards in order to be considered making financial aid satisfactory academic progress.

Repeated Coursework

A student may repeat any coursework previously taken in the student's program as long as the repeated course is not a result of more than one repetition of a previously passed course.

Undergraduate Student Requirements

Qualitative Standard (Grade Point Average Component)

A minimum cumulative Grade Point Average of 1.7 for undergraduate students who have attempted fewer than 30 semester credit hours; a minimum Grade Point Average of 2.0 for undergraduate students who have attempted 30 semester credit hours or more or have completed their second academic year, whichever comes first. Transfer credits are also counted in the earned credit hours.

Quantitative Standard (number of credit hours attempted versus number of credit hours earned)

Under the quantitative component of the financial aid satisfactory academic progress standard, an undergraduate student must successfully complete coursework within a certain time frame. Charts showing the minimum number of credits you must earn each enrollment period and year of study are in the table on page 27 and on the university website. Additionally, for an undergraduate the time frame cannot exceed 150% of the published length of the program measured in academic years or credit hours attempted, as determined by the university. For instance, if the published

Undergraduate Credit Hours

Half-time Students												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Credits (5.5 credits per semester)	11	12	33	44	55	66	77	88	99	110	121	132
Three-quarter-time Students												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**X**	**X**	**X**
Credits (7.5 credits per semester)	15	28	44	59	73	88	103	117	132	X	X	X
Full-time Students												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**X**	**X**	**X**	**X**	**X**	**X**
Credits (11 credits per semester)	22	44	66	88	110	132	X	X	X	X	X	X

length of your academic program is 120 credit hours, the maximum period must not exceed 180 (120 x 1.5) attempted hours.

To be in compliance, you must complete your credit hours as listed in the table above.

Not meeting these standards will place you on financial aid warning for one semester.

A student on financial aid warning will receive financial aid for one more semester. However, before registering for classes the student must meet with the university advisor to develop a success plan and to receive approval for courses the student wishes to register for during the warning period.

A student under financial aid warning will have his/her financial aid terminated if the standards (GPA and credit hour) are not met following the warning period.

Graduate Student (Master's and Doctoral) Financial Aid Progress Requirements

Master's and Doctoral degree students receiving federal student aid

Graduate students must maintain a 3.0 Cumulative Grade Point Average. Not meeting this standard will place you on financial aid warning for one semester. A student on financial aid warning will receive financial aid for one more semester. However, before registering for classes the student must consult with their advisor on the best course options.

A student under financial aid warning will have his/her financial aid terminated if the GPA standard is not met during the warning period.

Graduate students must adhere to the time limit for degree completion. See page 18.

Financial Aid Termination– Undergraduate and Graduate (Master's and Doctoral) students

An undergraduate or graduate student whose financial aid is terminated following the warning period will not receive financial aid again unless the student has submitted an appeal requesting financial aid reinstatement. In your letter of appeal, you must explain the reason for your poor academic performance and provide medical documentation or other documents which help to explain your exceptional circumstances.

Your letter of appeal and accompanying documentation will be sent to the university's Financial Aid Appeals Committee for review. You will be notified in writing of the Committee's decision.

If your appeal is granted you will be placed in a probationary status for one semester.

Types of Financial Aid

The financial aid program at Capitol Technology University consists of grants, scholarships, loans and work-study employment. Detailed information about each aid program is available from the Office of Financial Aid.

Scholarships

The scholarship program at Capitol Technology University is designed to reward students for their academic accomplishments, leadership qualities or other special talents. The scholarships come from a variety of sources and donors, and each scholarship has its own set of criteria and annual value, ranging from $2,000 to full tuition. Scholarships are available to full-time undergraduate students enrolled for 12 credits or more per semester. Scholarships do not have to be repaid.

Institutional Scholarships

Each full-time undergraduate degree applicant is automatically considered for an institutional scholarship when applying for admission to the university. Initial institutional scholarship notification is sent by the Office of Admissions and is based on prior academic performance and SAT scores. For eligibility requirements, contact the Office of Admissions. All of the scholarships are annually renewable to recipients who maintain at least a 3.0 GPA and complete 24 credits each year.

Richard J. Heiman Scholarship

Awards range from $10,000 to $12,000. Named in memory of a dedicated member of the Capitol Technology University Board of Trustees, this scholarship is the highest offered by the university to new students.

Presidential Scholarship

Awards range from $7,000 to $9,000.

Board of Trustee Scholarship

Awards range from $4,000 to $6,000. The scholarship is named to recognize the service and support of the university Board of Trustees members.

Capitol Technology University Scholarship

This scholarship is offered to qualifying community college students who are transferring to Capitol Technology University, with awards ranging from $4,000 to $10,000.

Corporate and Foundation Scholarships

A number of corporations and foundations have invested funds with the university to be awarded annually to students meeting criteria specified by the donors, such as academic merit or financial need. Students continuing to meet the awarding criteria will be considered for subsequent scholarship awards. However, corporate and foundation scholarships are not automatically renewed.

Interested students must submit a completed scholarship application with a typed essay on an assigned topic between March 1 and March 30, before the academic year they want to be considered for a corporate and foundation scholarship. Applications are available between March 1 and March 30 on the university website under Financial Aid Office. For a complete listing of corporate and foundation scholarships and eligibility criteria, please consult the student handbook or visit the financial aid section online.

Maryland State Scholarships

Maryland students seeking Maryland state scholarships should complete the FAFSA by the March 1 filing deadline.

Students who are residents of other states should check with their state scholarship agencies for available scholarships, proper application procedures and deadline dates.

Grants

Grants are available to undergraduate students. Grants do not have to be repaid.

Richard A. Wainwright Grant

This grant provides support for students who have academic ability and demonstrate financial need. The Richard A. Wainwright Grant is the highest level of institutional grant offered to the most qualified students.

Pell Grant and Federal Supplemental Educational Opportunity Grant (SEOG)

These grants are funded by the federal government and are awarded by the Office of Financial Aid to eligible students based on financial need as determined by the U.S. Department of Education.

Maryland Part-time Grant

These grants are funded by the state of Maryland and are awarded to Maryland residents enrolled on a half-time basis. Interested students enrolled on a half-time basis must complete the FAFSA. Funds are limited.

The Howard P. Rawlings Educational Excellence Awards

These grant program funds (Guaranteed Access Grant and Educational Assistance Grant) are awarded to full-time eligible students who filed their FAFSA before the state's March 1 deadline.

Guaranteed Access Partnership Program

The Guaranteed Access Partnership Program (GAPP) provides a matching grant award to eligible Maryland students who receive a Guaranteed Access (GA) grant and who enroll at Capitol Technology University as a new undergraduate student. Students who complete the FAFSA by March 1 will automatically be considered for the GA grant by the Maryland Higher Education Commission. Additional documentation may be required before the award can be made. Award amounts for the GA grant and matching GAPP grant are determined by your financial need and cost of attendance. An eligible student may receive a GAPP grant equal to the GA grant up to the full cost of tuition and fees.

Loans

Loans are a serious financial obligation that must be repaid. Both undergraduate and graduate students can apply for loans. Students must be enrolled at least half time (six credits each semester) and cannot borrow more than their cost of attendance minus other financial aid received. The Federal Family Education Loan Program (FFELP) includes the Federal Direct and graduate PLUS loans for students and the Federal Direct PLUS loan for parents. Students can

apply for loans online through Department of Education website: www.studentloans.gov

Alternative Loan Programs

These loans are available if additional funds are needed over and above what you receive under the federal, state, and institutional financial aid programs.

Work-Study Employment

On-campus jobs are available to both undergraduate and graduate students under the Federal College Work-Study and Capitol Technology University Work-Study programs. These work programs offer students the opportunity to earn money to meet educational and personal expenses during the year and to get on-the-job work experience.

Federal Work-Study

Federal Work-Study is funded by the federal government and awarded by the Office of Financial Aid to eligible students who have filed the FAFSA. It is the policy of Capitol Technology University that while class is in session during fall and spring, students cannot work more than 20 hours each week.

Capitol Technology University Work-Study

Students not awarded Federal Work-Study can consider employment under the Capitol Technology University Work-Study Program. Funding for this program is provided by various campus departments. Admitted students can contact the Office of Human Resources for more information. The employer decides the maximum hours students may work each week.

Other Aid Programs

Private Organizations

In addition to federal, state and institutional financial aid programs, there are private organizations that offer financial aid funds for a college education.

Many local clubs, religious organizations and other groups provide scholarships for deserving students. Students should visit their public library to research these possible sources or contact organizations such as the American Legion, 4-H clubs, Kiwanis, Jaycees, Chamber of Commerce, Girl Scouts and Boy Scouts. Do not overlook organizations connected with family, friends, and field of interest, such as the American Society of Professional Engineers or the Society of Women Engineers.

A scholarship packet has been developed by the Financial Aid Office to assist students. It is available for download at the university's website under Financial Aid Office and on myFA.

Veterans' Benefits

To qualify for financial aid, veterans' benefits or both students must be enrolled in a degree program and submit all necessary transcripts. Non-degree students are not eligible for veterans' benefits or federal financial aid. Certification and certificate courses are not eligible for veterans' benefits or federal financial aid, unless they are taken as part of an approved degree program. A veteran will not receive educational benefits for an audited course. Private loan programs can be used for these programs.

A counselor is available to assist veterans, active duty personnel and spouses, and children of deceased veterans who may be eligible for educational assistance through the VA. The counselor is located in the Office of Registration and Records.

Vocational Rehabilitation

Assistance is available to individuals with physical and/or mental disabilities. For further information, contact the Vocational Rehabilitation Service nearest you.

Additional Information

Course withdrawals (W) after the drop/add period are considered a non-completion of attempted credit hours.

An audit grade is not considered attempted coursework.

Incomplete grades are not included in the GPA calculation nor are they counted as attempted coursework. When the course is completed and a permanent grade is assigned the Office of Financial Aid will reevaluate the student's academic progress.

Students will not receive financial aid for audited courses.

The Capitol Technology University student handbook contains additional information about financial aid at Capitol Technology University.

Student Complaints

A student who wishes to file a complaint against the university should contact the

Maryland Higher Education Commission, 6 N. Liberty St., Baltimore, MD 21201, 410-767-3301 and/or the university's accrediting agency: Commission on Higher Education, Middle States Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104 (215-662-5606).

Undergraduate Program Offerings

Bachelor of Science (BS) Degrees

- Astronautical Engineering
- Business Analytics and Data Science
- Computer Engineering
- Computer Engineering Technology
- Computer Science
- Construction Management and Critical Infrastructure
- Cyber Analytics
- Cyber and Information Security
- Electrical Engineering
- Electronics Engineering Technology
- Engineering Technology
- Management of Cyber and Information Technology
- Mechatronics Engineering
- Mechatronics and Robotics Engineering Technology
- Mobile Computing
- Software Engineering
- Technology and Business Management
- Unmanned and Autonomous Systems

Associate in Applied Science (AAS) Degrees

- Computer and Cyber Operations Engineering
- Electronics Engineering Technology
- Engineering Fundamentals

Programs of Study

Capitol Technology University's programs of study for associate in applied science and bachelor of science degrees are outlined beginning on page 36.

Undergraduate Certificates

Lower Division

- Object-Oriented Programming
- Programming and Data Management
- Web Programming

Upper Division

- Acquisitions Management
- Computer and Network Security
- Project Management
- Software Engineering
- Space Missions and Operations Specialist
- Website Development

Requirements for undergraduate certificates are outlined beginning on page 56.

Undergraduate Admissions

Degree-seeking Students

First-Time, Full-Time Freshman

A first-time, full-time freshman is defined as any applicant who has graduated from high school within one year of the proposed entrance term and is entering Capitol Technology University on a full-time basis. A full-time student must carry 12 or more credits per semester.

Application Requirements

1. File a formal application for admission as far in advance of the proposed entrance date as possible. An application for admission can be obtained from the Office of Admissions or online.

2. Enclose a $25 nonrefundable admissions processing fee with the application. (Applications remain on file for one academic year.) The application fee is waived for those students submitting electronic applications through the university website.

3. Forward the official high school transcripts to the Office of Admissions.

4. Submit SAT or American College Test (ACT) scores to the Office of Admissions.

Admissions Requirements

All applicants receive a comprehensive evaluation of their previous school records. Admissions decisions are based on the applicant's course preparation, high school grade point average (GPA), class rank and standardized test scores. Scholarship consideration is given based on GPA test scores, along with the admissions essay, letters of recommendation and a personal interview.

High school course preparation should include a minimum of four units of English, three units of mathematics (including plane geometry and Algebra II), two units of lab science and two units of social sciences.

Students whose GPA, course preparation and/or test scores do not meet the general admissions requirements may be further considered if they submit an admissions essay, letters of recommendation, placement tests and visit the campus for a personal interview.

The minimum GPA required for admission to Capitol Technology University is 2.2 on a 4.0 scale. The minimum SAT score is 800 composite. The minimum ACT score is 17 composite.

Undeclared Applicants

Students admitted to an AAS or BS degree who are undecided on their program study may complete up to 15 credits before they are required to declare a major. During this period, their account will reflect the 15-credit hold.

Computer Science and Engineering Applicants

Applicants to the computer science and engineering programs must have an additional unit of mathematics or entry into college calculus, an additional unit of laboratory science (physics or chemistry), an overall high school GPA of at least 2.8, and a minimum SAT score of 900 with at least a 500 on the Math section (or an ACT score of at least 19).

Computer science and engineering applicants who do not meet these additional criteria, but meet the general admissions criteria, will be accepted into the engineering technology, mobile computing and game programming, or web development programs for their freshman year. After successful completion of the freshman year, students may transfer into the engineering program with academic dean approval.

Tuition Deposit

Upon acceptance, all full-time applicants are required to pay a nonrefundable $200 tuition deposit or $200 housing deposit to the university. The tuition deposit is credited to the applicant's first-semester tuition. The housing deposit is held until graduation, or permanent move to off-campus housing.

Full-Time Transfer Students

A full-time transfer student is defined as any applicant who is eligible to transfer 15 or more semester credits from an accredited higher education institution to Capitol Technology University and will attend on a full-time basis. A full-time student must carry 12 or more credits per semester.

Application Requirements

1. File a formal application for admission as far in advance of the proposed entrance date as possible. An application for admission can be obtained from the Office of Admissions or online.

2. Enclose a $25 nonrefundable admissions processing fee with the application. (Applications remain on file for one academic year.) The application fee is waived for those students submitting electronic applications through the university website.

3. Forward all official transcripts to the Office of Admissions. Applicants who are completing, or who have already earned, an associate or bachelor's degree from a regionally accredited university need only forward university transcripts. Applicants who have less than 30 college credits must forward an official high school transcript denoting graduation date or General Equivalency Diploma (GED) record and college transcripts, if applicable.

4. For transfer credit policies, see page 20 of this catalog.

Admissions Requirements

Full-time transfer applicants who have successfully completed an associate or bachelor's degree are generally accepted into Capitol Technology University once their application file is complete. Admissions requirements for all other students are based on previous academic coursework (including high school, college, proprietary institutions, the military or appropriate work experience), with an emphasis on postsecondary achievement. Students must be in good standing at all previous institutions. Students not in good standing are subject to further review.

If applicants are not eligible to transfer credits for MA-114 or EN-101, completion of a skills assessment test may be required.

Part-time Degree-seeking Students

A part-time degree-seeking student is defined as any student pursuing an undergraduate degree at Capitol Technology University on a part-time basis. A part-time student may carry 1-11 credits per semester.

Application Requirements

1. File a formal application for admission as far in advance of the proposed entrance date as possible. An application for admission may be obtained from the Office of Admissions or online.

2. Enclose a $25 nonrefundable admissions processing fee with the application. (Applications remain on file for one academic year.) The application fee is waived for those students submitting electronic applications through the university website.

3. Forward all official transcripts to the Office of Admissions. Applicants who are completing, or who have already earned, an associate or bachelor's degree from a regionally accredited college need only forward college transcripts. Applicants who have less than a degree or no college credits must forward an official high school transcript denoting graduation date or General Equivalency Diploma (GED) record and college transcripts, if applicable.

4. For transfer credit policies, see page 20 of this catalog.

Admissions Requirements

Part-time applicants who have successfully completed an associate or bachelor's degree are generally accepted into Capitol Technology University once their application file is complete. Admissions requirements for all other students are based on previous academic course work (including high school, college, proprietary institutions, the military or appropriate work experience). Students must be in good standing at all previous institutions. Students not in good standing are subject to further review.

If applicants are not eligible to transfer credits for MA-114 or EN-101, completion of a skills assessment test may be required.

Concurrent, Readmit and Other Types of Students

Concurrent Enrollment

Concurrent students are any qualified high school juniors or seniors who want to enroll in a limited number of courses at Capitol Technology University while completing their high school graduation requirements. Concurrently enrolled students are not eligible for financial aid.

Application Requirements

1. File a formal application for admission as far in advance of the proposed entrance date as possible. An application for admission may be obtained from the Office of Admissions or online.

2. Enclose a $25 nonrefundable admissions processing fee with the application. (Applications remain on file for one academic year.) The application fee is waived for those students submitting electronic applications through the university website.

3. Forward an up-to-date official high school transcript to the Office of Admissions.

4. Forward a letter of recommendation from the high school principal or guidance counselor.

5. Meet with an admissions counselor at Capitol Technology University for a personal interview. Students may also be required to meet with the Academic Dean and/or Dean of Student Life.

Admissions Requirements

Once the application requirements have been completed, the applicant will be eligible for concurrent enrollment. Concurrent students are required to complete all prerequisites for courses in which they intend to enroll. Concurrent enrollment is considered a non-degree-seeking status, so the student will not be accepted into a specific degree program. If the student wants to apply for degree-seeking status after high school graduation, the student must complete the application requirements for a first-time, full-time freshman, outlined on page 31 of this catalog, and should do so as far in advance of the proposed start term as possible.

Concurrent students who want to enroll in MA-114 or EN-101 may be required to complete a skills assessment test.

Readmission

A readmit applicant is defined as any applicant who has previously completed any amount of coursework at Capitol Technology University, has not attended Capitol Technology University in at least one full academic year and wants to resume study. Students who were at any time in violation of the university's academic, financial or disciplinary regulations may be denied readmission. Readmitted students may be required to submit or resubmit required documents, such as official transcripts. Readmitted students will enter Capitol Technology University's degree program under the current graduation requirements and will be subject to current policies and procedures. A course audit will be completed to determine what coursework must be fulfilled for graduation. Readmission is contingent upon an application for admission, which may be obtained from the Office of Admissions or online, and review by the admissions staff.

Other Types of Students

Applicants who do not match any of the undergraduate types discussed herein should contact the Office of Admissions to determine the application and admissions requirements that apply. To reach the Office of Admissions, call 800-950-1992 or send email to admissions@CapTechU.edu.

Certificate Students

An undergraduate certificate student is any student pursuing one or more of Capitol Technology University's state-approved undergraduate certificates, maintaining less than 12 credits per semester and not pursuing a degree. Undergraduate certificate students are not eligible for financial aid.

Application Requirements

1. File a formal application for admission as far in advance of the proposed entrance date as possible. An application for admission can be obtained from the Office of Admissions or online.

2. Enclose a $25 nonrefundable admissions processing fee with the application. (Applications remain on file for one academic year.) The application fee is waived for those students submitting electronic applications through the university website.

3. Forward all official transcripts to the Office of Admissions. Applicants who are completing, or who have already earned, an associate or bachelor's degree from a regionally accredited college need forward only college transcripts. Applicants who have less than a degree or no college credits must forward an official high school transcript denoting graduation date or General Equivalency Diploma (GED) record and college transcripts, if applicable.

Admissions Requirements

Undergraduate certificate applicants who have successfully completed an associate or bachelor's degree are generally eligible to register for classes once their application file is complete. Admissions requirements for all other students are based on previous academic coursework (including high school, college, proprietary institutions, the military or appropriate work experience). Students must be in good standing at all previous institutions. Students not in good standing are subject to further review.

All certificates require that students have completed MA-110, MA-114 or have equivalent experience. All coursework must be completed through Capitol Technology University. Students must complete the specific courses listed for the certificate; no substitutions are permitted. Once the course requirements are completed, students must apply for the certificate in the Office of Registration and Records. A $25 processing fee is due with the certificate request. A student must have a minimum cumulative GPA of 2.0 in all certificate coursework to be awarded the certificate.

Non-degree-seeking Students

A non-degree-seeking student is any student pursuing a non-degree certification program or taking individual courses not applying to a degree. Non-degree study is not eligible for financial aid.

Application Requirements

1. File a formal application for admission as far in advance of the proposed entrance date as possible. An application for admission can be obtained from the Office of Admissions or online.

2. Enclose a $25 nonrefundable admissions processing fee with the application. (Applications remain on file for one academic

year.) The application fee is waived for those students submitting electronic applications through the university website.

Admissions Requirements

Once the application and processing fee are received, applicants are notified of their acceptance and may register for classes during the appropriate registration period. Information about registration is continually updated online.

After successful completion of 15 semester credits at Capitol Technology University, non-degree students must complete the admissions procedure for degree-seeking status, or receive approval for continued non-degree status from the dean of academics.

International Students

An international student is defined as any applicant from a country other than the United States who will be pursuing an undergraduate degree program on a student visa. Eligibility requirements, listed below, must be met for acceptance. International students are not eligible for institutional scholarships or federal financial aid.

Application Requirements

1. File a formal application for admission as far in advance of the proposed entrance date as possible. An application for admission can be obtained from the Office of Admissions or online.

2. Enclose a $200 nonrefundable admissions processing fee with the application. (Applications remain on file for one academic year.)

3. Verify that you meet the academic and financial requirements stated below.

Academic Requirements

Submit certified transcripts (with English translations) of secondary school and/or college records, or examination results when periodic grades are not used for measurement purposes. The university may require that you have your transcripts evaluated by a recognized credential evaluation service.

Applicants should have two years of college preparatory mathematics, such as algebra, geometry and trigonometry.

English proficiency for direct admission into a degree program:

1) TOEFL paper-based test score of 550 or an internet-based test score of 79, or 2) proof of completing a specified level of proficiency at an English language school, or 3) satisfactory completion of English courses at an accredited university or college within the United States.

Financial Requirements

International students must submit evidence of sufficient financial resources for living and educational expenses. Support documents must be dated within the last six months. Proof of financial support can be in one of the following forms:

A letter of sponsorship or scholarship from a government agency or corporation. This letter of sponsorship must be an original and outline specific billing procedures.

Complete the declaration and certification of finances form. This form must be accompanied by supporting bank statements or employment verification. Include signatures or original letters of support from each sponsor.

Students who have not provided valid evidence of sponsorship from a government agency or corporation must make a tuition deposit of $500 prior to formal acceptance and issuance of I-20.

Applicants can expect an answer from the university three to five weeks after receipt of all necessary documents. All international students must join the university health insurance program, unless adequate coverage is proven.

Astronautical Engineering (BS)

The Astronautical Engineering program is structured to provide students with a balance between theory and practice. Students receive hands on design experience via the university's high altitude balloon payload program, course assignments, laboratory exercises and the Space Flight Operations Training Center. The focus is on spacecraft and ground systems design rather than research.

The main objectives of the program is to produce skilled systems oriented astronautical engineers to support the needs of NASA and the aerospace industry.

In order to achieve this objective, students study space systems engineering, orbital mechanics, spacecraft subsystems, spacecraft attitude and control, autonomous ground systems as well as other areas of satellite mission planning, design and operations. Graduates have the ability to work on multidisciplinary teams, meet the expectations of employers of astronautical engineers, and pursue an advanced degree if desired.

All engineering majors must take courses in humanities and social science to broaden their understanding of professional and ethical responsibilities and impact of their engineering solutions in a global context.

All bachelor of science students must complete a capstone where they propose, design, develop and deliver a satellite mission plan or other space related project. The BS degree in Astronautical Engineering Technology is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org

Course Requirements

Bachelor of Science **120 Credits**

Course		Credits
Astronautical Engineering		42 Credits
AE-100	Intro to Astronomy	3
AE-150	Introduction to Space	3
AE-250	Ground Systems Engineering	3
AE-311	Spacecraft Systems	3
AE-350	Autonomous Ground Systems	3
AE-351	Orbital Mechanics	3
AE-361	Remote Sensing	3
AE-411	Space Systems Engineering	4
AE-451	Propulsion	3
AE-454	Spacecraft Attitude Control	4
AE-455	Satellite Communications	4
AE-458	Senior Project in Space Science	3
Astronautical Engineering electives (2)*		3
Computer Sciences		3 Credits
CS-150	Intro to Programming Using C	3
Electrical Engineering		6 Credits
EE-309	Circuit Design and Simulation	3
EE-453	Control I	3
English Communications		9 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
EN-408	Writing Seminar in Technical Research	3
Humanities and Social Sciences		15 Credits
HU-331 or HU-332 Arts and Ideas		3
SS-351	Ethics	3
Humanities electives (1)*		3
Social Sciences electives (2)*		6
Mathematics and Sciences		18 Credits
MA-261	Calculus I	4
MA-262	Calculus II	4
MA-263	Calculus III	4
MA-330	Linear Algebra	3
MA-340	Ordinary Differential Equations	3
Physics		12 Credits
PH-261	Engineering Physics I	4
PH-262	Engineering Physics II	4
PH-263	Engineering Physics III	4
Engineering Technology		15 Credits
EL-100	Intro to DC/AC Circuits	3
EL-150	AC/DC Circuits and Analysis	3
EL-200	Electronic Devices and Circuits	3
EL-204	Digital Electronics	3
EL-250	Advanced Analog Circuits	3

*See appropriate department for approved list.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Business Analytics and Data Science (BS)

The Bachelor of Science (BS) degree in Business Analytics and Data Science provides the student with the ability to integrate business and analytical and decision-making skills in a diverse world. After graduation, the student will be able to apply skills and knowledge of the business world to the everyday work situations. While studying core business courses, the student will learn how for-profit and non-profit organizations function effectively and efficiently and get a clear picture of how business areas meld to create a successful organization. The Business Analytics and Data Science core courses will prepare students to structure, transform, and analyze data to gain insights that will provide opportunities to improve business intelligence and managerial decision making.

Course Requirements

Bachelor of Science **122 Credits**

Course		Credits
Business Management		39 Credits
BUS-174	Intro to Business Management	3
BUS-270	Financial Accounting	3
BUS-275	Human Resource Management	3
BUS-279	Introduction to Leadership	3
BUS-280	Macroeconomics	3
BUS-289	Entrepreneurship and Small Business Management	3
BUS-301	Project Management	3
BUS-358	Internship	3
BUS-376	Marketing Principles	3
BUS-378	Legal Environment of Business	3
BUS-386	Organizational Theory/Behavior	3
BUS-410	Strategic Management	3
BUS-458	Senior Design Project II	3
Analytics		33 Credits
BUS-101	Introduction to Data Science	3
BUS-240	Statistical Methods in Data Science	3
BUS-245	Writing and Communication in Data Science	3
BUS-284	Data Identification and Collection Strategies	3
BUS-310	Data Mining for Effective Decision Making	3
BUS-367	Data-Driven Digital Marketing	3
BUS-393	Consumer Analysis	3
BUS-396	Data Governance and Stewardship	3
BUS-443	Marketing Analytics: Decision-Making in the Information Age	3
CS-150	Introduction to Programming Using C	3
CS-220	Database Management	3
Mathematics and Sciences		20 Credits
BUS-247	Quantitative Research Methods in Business Analytics	3
MA-112	Intermediate Algebra	3
MA-114	Algebra and Trigonometry	4
MA-128	Statistics	3
MA-261	Calculus	4
Science Elective		3
Humanities and Social Science		21 Credits
BUS-200	Business Communication	3
EN-101	English Communications I	3
EN-102	English Communications II	3
HU-331 or HU-332 Arts and Ideas		3
SS-351	Ethics	3
Humanities eiective		3
Social Sciences elective *		3
General Electives (3) **		9

*See appropriate department for approved list.
**Any course may be taken to satisfy the general elective requirement.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Computer and Cyber Operations Engineering (AAS)

The Associate of Applied Science in Computer and Cyber Operations Engineering offers the student with the opportunity to acquire the cybersecurity skills required to protect computer systems and networks. The degree provides a firm foundation in network security, digital electronics and microprocessors, security fundamentals, cryptography, and programming.

Course Requirements

Associate in Applied Science 62 Credits

Course		Credits
Technical Courses		42 Credits
CS-150	Introduction to Programming Using C	3
CS-200	Programming Using C++	3
CT-152	Introduction to UNIX	3
EL-100	Introductory DC/AC Circults	3
EL-140	DC/AC Circuits and Analysis	3
EL-204	Digital Electronics	3
EL-262	Microprocessors and Microassembly	3
IAE-201	Introduction to Information Assurance Concepts	3
NT-100	Computer Architecture and Construction	3
IAE-201	Introduction to Information Assurance Concepts	3
IAE-250	Comprehensive Computer and Network Security (Formerly IAE-301)	3
IAE-260	Secure System Administration and Oper ation (Formerly IAE-315)	3
IAE-325	Secure Data Communication & Crypto graphy	3
IAE-351	Intro to Cyber Network Operations	3
Mathematics and Sciences		11 Credits
MA-112	Intermediate Algebra	3
MA-114	Algebra and Trigonometry	4
MA-261	Calculus I	4
English Communications		9 Credits
EN-101	English Communications I	3
History/Humanities/Philosophy Elective*		3
Social Science Elective*		3

*See appropriate department for approved list

Computer Engineering (BS)

The computer engineering (CE) program is structured to teach students to design and program computers and computer-based systems, including the latest embedded technology. The main objective of the computer engineering program is to produce practical design engineers who will be capable of analyzing the technical needs of society, and to create the next generation of integrated hardware and software solutions to meet systems requirements. CE majors study digital systems, computer organization and architecture, software design and testing, operating systems and programming languages, microcontroller systems, and the latest programmable chip technology. All engineering majors must take courses in humanities and social science to broaden their understanding of professional and ethical responsibilities and the impact of their engineering solutions in a global context. All students complete a capstone course in which they propose, design, build, test and deliver a computer-based system. The BS degree in Computer Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org

Course Requirements

Bachelor of Science **122 Credits**

Course		Credits
Technical Courses		15 Credits
EL-100	Intro DC/AC Circuits	3
EL-150	DC/AC Circuits and Analysis	3
EL-200	Electronic Devices/Circuits	3
EL-204	Digital Electronics	3
EL-262	Microprocessors and Microassembly	3
Computers and Programming		21 Credits
CS-150	Introduction to Programming Using C	3
CS-200	Programming Using C++	3
CS-220	Database Management	3
CS-230	Computer Science Fundamentals	3
CS-418	Operating Systems	3
CT-152	Introduction to Unix	3
IAE-201	Intro to Info Assurance Concepts	3
Engineering		24 Credits
EE-304	Digital Design I	3
EE-354	Digital Design II	3
EE-362	Microcontroller System Design	3
EE-364	Computer Architecture	3
EE-404	Large-Scale Digital Design	3
EE-458	Senior Project	3
Computer or Engineering electives (2)*		6
English Communications		9 Credits
EN-101	English Communications I	3
EN-102	English Communications II	
Humanities and Social Sciences		21 Credits
BUS-301	Project Management	3
HU-331 or HU-332	Arts and Ideas	3
SS-351	Ethics	3
Humanities electives (2)*		6
Social Science elective (2)*		6
Mathematics and Sciences		32 Credits
CH-120	Chemistry	3
MA-124	Discrete Mathematics	3
MA-261	Calculus I	4
MA-262	Calculus II	4
MA-340	Ordinary Differential Equations	3
MA-345	Probability and Statistics for Engineers	3
MA-355	Numerical Analysis	4
PH-261	Engineering Physics I	4
PH-262	Engineering Physics II	4

* See appropriate department for approved list.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Computer Engineering Technology (BS)

The Computer Engineering Technology (CET) program is structured to teach students to work at the interface between hardware and software linking digital technology to computer applications. The main objective of the program is to produce technologists who support industry in areas ranging from computers and computer manufacturing to networking and network programming. CET majors study software design and testing, operating systems programming languages, digital systems, computer organization and architecture, micro-controller systems, and the latest programmable chip technology. Students are trained to work in a wide range of technical jobs in the information technology industry. All bachelor of science students complete a capstone course in which they propose, design, build, test and deliver a computer-based system. The BS degree in Computer Engineering Technology is accredited by the Engineering Technology Accreditation Commission of ABET, http://www.abet.org

The BS degree program is designed to educate students for computer technology fields by providing a comprehensive understanding of computers. Academic instruction is augmented by requiring students to design and write programs, and through carefully planned laboratory exercises during which students build, interconnect, test, service and operate computer devices and systems.

Course Requirements

Bachelor of Science **120 Credits**

Course		Credits
Technical Courses		66 Credits
CS-150	Introduction to Programming Using C	3
CS-200	Object-Oriented Prog. in C++	3
CT-152	Introduction to Unix	3
EL-100	Introductory DC/AC Circuits	3
EL-150	Intro DC/AC Circuits	3
EL-200	Electronic Devices and Circuits	3
EL-204	Digital Electronics	3
EL-262	Microprocessors/Microassembly	3
NT-100	Computer Architecture and Construction	3
NT-150	Computer Networking	3
CS-220	Database Management	3
CS-230	Data Structures	3
CS-418	Operating Systems	3
CT-240	Network Routers and Switches	3
EE-304	Digital Design I	3
EE-354	Digital Design II	3
EE-362	Microcontroller System Design	3
IAE-201	Intro to Information Assurance	3
SE-458	Senior Project	3
TC-319	Network Sim & Modeling	3
Technical elective (1) (2xx or above)		3
Technical elective (1) (3xx or above)		3
Mathematics and Sciences		30 Credits
MA-112	Intermediate Algebra	3
MA-114	Algebra and Trigonometry	4
MA-124	Discrete Mathematics	3
MA-128	Introduction to Statistics	3
MA-261	Calculus I	4
MA-262	Calculus II	4
PH-201	General Physics I	3
PH-202	General Physics II	3
CH-120	Chemistry	3
English Communications		9 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
EN-408	Writing Seminar in Technical Research	3
Humanities and Social Sciences		15 Credits
HU-331 or HU-332 Arts and Ideas		3
SS-351	Ethics	3
History/Humanities/Philosophy elective (1)*		3
Social Science elective (2)*		6

* See appropriate department for approved list.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Computer Science (BS)

The computer science (CS) program is structured to teach students to design and program computers and computer-based systems to meet the needs of all areas of society. The main objective of the computer science program is to produce practical computer system specialists who can apply computer theory and algorithmic principles to the design of computer-based systems that meet requirements. In order to meet this objective, CS majors study programming languages, computational science, algorithms and complexity, the architecture and organization of computers, software engineering, human-computer interaction, intelligent systems, information management, and the social and professional issues associated with the practice of computer science. All CS students must take courses in the humanities and social sciences to broaden their understanding of professional and ethical responsibilities and the impact of their CS solutions in a global context. All students complete a capstone course in which they propose, design, build, test and deliver a computer-based system.

Course Requirements

Bachelor of Science **120 Credits**

Course		Credits
Computers and Engineering Science		36 Credits
CS-130	Intro to Programming Using Java	3
CS-220	Database Management	3
CS-225	Intermediate Java Programming	3
CS-230	Data Structures	3
CS-310	Computer Algorithms	3
CS-316	Intelligent Systems	3
CS-405	Introduction to Software Design with UML	3
CS-418	Operating Systems	3
CT-152	Introduction to Unix	3
CT-376	Javascript	3
SE-458	Senior Project	3
Computer Science Electives		12 Credits
Computer Science electives (3)*		9
Advanced Programming Course (Choose One)		3 Credits
CS-250	Intro Net Programming Using C	
CS-356	Dynamic Web Page Development	3
CT-406	Web Programming Languages	3
Mathematics and Sciences		30 Credits
Math or Science elective		3
MA-124	Discrete Mathematics	3
MA-128	Introduction to Statistics	3
MA-261	Calculus I	4
MA-262	Calculus II	4
MA-330	Linear Algebra	3
MA-355	Numerical Analysis	4
PH-201	General Physics I	3
PH-202	General Physics II	3
Technical Courses		9 Credits
EL-204	Digital Electronics	3
EL-262	Microprocessors/Microassembly	3
EE-364	Computer Architecture	3
Mobile Computing (Choose One)		3 Credits
CS 305	Android App Development	3
CS-330	iPhone Application Development	3
English Communications		9 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
EN-408	Writing Seminar in Technical Research	3
Humanities and Social Sciences		21 Credits
HU-331 or HU-332 Arts and Ideas		3
SS-272	Group Dynamics	3
SS-351	Ethics	3
Humanities elective (2)*		6
Social Science elective (1)*		3
Social Science/Management elective (1)*		3

*See appropriate department for approved list.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Construction Management and Critical Infrastructure (BS)

The Bachelor of Science (B.S.) in Construction Management and Critical Infrastructure curriculum is designed to meet the needs of industry and government. The program combines education and experience in both technical and managerial skills to prepare students for leadership roles in the Construction Management and Critical Infrastructure protection professions. Laboratory work supplements classroom lectures to provide practical and useful skills. Students gain additional real-world experience through participation in a required internship. With its comprehensive, management-oriented focus and critical infrastructure training, the program helps students understand the impact of construction on the environment and society and prepares students to be leaders in this exciting field.

Course Requirements

Bachelor of Science **121 Credits**

Course		Credits
Construction Management		39 Credits
CM-120	Intro to Construction Management	3
CM-125	Construction Graphics and Plan Reading	3
CM-220	Construction Methods and Materials	3
CM-230	Estimating I	3
CM-250	Legal Issues in Construction	3
CM-260	Statics and Strength of Materials	3
CM-270	Safety Management	3
CM-301	Construction Project Management	3
CM-330	Estimating II	3
CM-350	Construction Planning and Scheduling	3
CM-375	Mechanical and Electrical Systems	3
CM-380	Environmental System	3
CM-450	Management of Field Operations	3
Capstone		6 Credits
CM-457	Internship in Construction Management	3
CM-458	Senior Design Project	3
Critical Infrastructure		9 Credits
CRI-210	Critical Infrastructure I	3
CRI-310	Critical Infrastructure II	3
CS-410	Critical Infrastructure II	3
Business		9 Credits
BUS-270	Financial Accounting I	3
BUS-283	Managerial Accounting	3
BUS-454	International Business	3
Cybersecurity		12 Credits
CT-152	Intro to Unix	3
IAE-201	Intro to Information Assurance Concepts	3
IAE-250	Comprehensive Computer/Network Security	3
IAE-321	Applied Wireless Network Security	3
Mathematics and Sciences		19 Credits
MA-112	Intermediate Algebra	3
MA-114	Algebra and Trigonometry	3
MA-128	Statistics	3
CH-120	Chemistry	3
PH-201	General Physics	3
UAS-101	Introduction to Unmanned and Autonomous Systems	3
Humanities and Social Sciences		27 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
BUS-200	Business Communications	3
BUS-279	Intro to Leadership	3
BUS-282	Economics fir Management	3
HU-331	Arts and Ideas	3
SS-351	Ethics	3
Social Science Elective		3
Humahities Electives*		3

*See appropriate department for approved list.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Cyber Analytics (BS)

The Cyber Analytics curriculum is designed to meet the needs of government, industry and non-profits to evaluate the statistical data generated by their computing infrastructure to determine the state of the organization's security posture on an on-going basis. These statistics are often referred to generically as Big Data, but the reality is this information must be combined with relevant facts specific to the entity such as competitors, market position and sociopolitical factors to determine the threat landscape. This program combines a strong foundation in cybersecurity with hands-on project-based coursework providing analytic experience that can be applied to a wide range of growing concerns.

Course Requirements

Bachelor of Science **121 Credits**

Course		Credits
Programming and Compiters		36 Credits
CS-150	Intro to Programming Using C	3
CS-200	Intro to Object-Oriented Programming	3
CS-220	Database Management	3
CS-230	Computer Science Fundamentals II	3
CS-250	Intro to Network Programming using C	3
CS-300	Secure Coding	3
CS-418	Operating Systems	3
CT-152	Introduction to Unix	3
CT-206	Scripting Languages	3
CT-240	Internetworking with Routers and Switches	3
IAE-457	Senior Design Project I	3
IAE-458	Senior Design Project I	3
Information Assurance		27 Credits
IAE-201	Intro to Information Assurance Concepts	3
IAE-250	Comprehensive Computer and Network Security	3
IAE-260	Secure System Administration and Operation	3
IAE-321	Applied Wireless Network Security	3
IAE-325	Secure Data Communications and Cryptography	3
IAE-390`	Penetration Testing	3
IAE-402	Introduction to Incident Handling and Respose	3
IAE-405	Malware Analysis/Reverse Engineering	3
IAE-406	Digital Forensics and the Investigative Process	3
Analytics		18 Credits
BUS-101	Introduction to Data Science	3
BUS-240	Statistical Methods	3
BUS-247	Research Methods	3
BUS-284	Data Identification and Collection Strategies	3
BUS-310	Data Mining for Effective Decision Making	3
BUS-396	Data Governance and Stewardship	3
Mathematics and Sciences		12 Credits
MA-112	Intermediate Algebra	3
MA-114	Algebra and Trigonometry	3
MA-124	Discrete Methematics	3
MA-128	Intro to Statistics	3
Humanities and Social Sciences		27 Credits
BUS-245	Writing and Communication in Data Science	3
EN-101	English Communications I	3
EN-102	English Communications II	3
EN-408	Writing Seminar in Technical Research	3
HU-331	Arts and Ideas	3
SS-351	Ethics	3
Humahities Electives*		3
Social Science Elective (2)*		6

*See appropriate department for approved list.

All bachelor of science degrees require a mi mum of 27 credits at the 300-level or above. Fo descriptions of required courses, see courses beginning on page 77.

Cyber and Information Security (BS)

The cyber and information security (CIS) program is designed to meet current and anticipated needs for highly-skilled cybersecurity professionals, particularly as it relates to securing information and defending the information systems that store it. As society becomes increasingly reliant on information in electronic form, identifying and addressing vulnerabilities where information resides is vital to any public, private or government organization. The BSCIS degree develops and builds upon students' mastery in computer networking and programming, so that they become effective technologists for managing information security risk. In addition, BSCIS students complete courses by the end of their sophomore year that prepare them to pass industry certification exams to include A+, Network+, CEH, CISSP and Security+. By attaining a combination of the BSCIS degree and one or more of the industry certifications, graduates will not only possess the professional knowledge required for a successful career in information assurance, but also have the credentials to prove it.

Course Requirements

Bachelor of Science **120 Credits**

Course		**Credits**
Programming and Computer		33 Credits
CS-150	Intro to Programming Using C	3
CS-200	Programming in C++	3
CS-220	Database Management	3
CS-230	Data Structures	3
CS-250	Introduction to Network Programming Using C	3
CS-300	Secure Coding	3
CS-418	Operating Systems	3
CT-152	Introduction to Unix	3
CT-206	Scripting Languages	3
CT-240	Internetworking with Routers and Switches	3
IAE-458	Senior Project	3
Information Assurance Courses		27 Credits
IAE-201	Introduction to Information Assurance Concepts	3
IAE-250	Comprehensive Computer and Network Security	3
IAE-260	Secure System Administration and Operation*	3
IAE-321	Applied Wireless Network Security	3
IAE-325	Secure Data Communications and Cryptography	3
IAE-390	Penetration Testing*	3
IAE-402	Introduction to Incident Handling and Malicious Code*	3
IAE-405	Malware Analysis / Reverse Engineering*	3
IAE-406	Digital Forensics and the Investigative Process*	3
Management		6 Credits
BUS-101	Introduction to Data Science	3
BUS-301	Project Management	3
Mathematics and Sciences		12 Credits
MA-114	Algebra and Trigonometry	4
MA-124	Discrete Mathematics	3
MA-128	Introduction to Statistics	3
Science elective (1)**		3
English Communications		9 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
EN-408	Writing Seminar in Technical Research	3
Humanities and Social Sciences		15 Credits
HU-331 or HU-332 Arts and Ideas		3
SS-351	Ethics	3
Humanities (2)**		6
Social Sciences elective (1)**		3
General Electives		18 Credits

* Online only.
** See appropriate department for approved list.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Electrical Engineering (BS)

The electrical engineering (EE) program is structured to teach students a blend of theory and practice directed at engineering design, rather than research. The main objective of the program is to produce practical design engineers who are capable of analyzing the technical needs of society, and to create the next generation of electrical and electronic circuits to meet systems requirements. To meet this objective, students start in the program with basic circuit theory and laboratory projects that provide them a practical background. The students are then taught to use increasingly sophisticated design and testing techniques to conduct experiments, and interpret data. As students progress through the program they are taught more theoretical methods of circuit modeling and computer-aided circuit simulation tools that enable them to design, build, test and analyze sophisticated circuits and systems. There are elective courses that allow for specialization in communications systems, micro-controller system design, signals and systems, digital signal processing, microwave engineering, VHDL and telecommunications. All engineering majors must take courses in humanities and social science to broaden their understanding of professional and ethical responsibilities and the impact of their engineering solutions in a global context. All students complete a capstone course in which they propose, design, build, test, analyze and deliver a working prototype circuit to meet engineering standards and realistic constraints. The BS degree in Electrical Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org

Course Requirements

Bachelor of Science **120 Credits**

Course		Credits
Electrical Engineering		63 Credits
EE-304	Digital Design I	3
EE-309	Circuit Design and Simulation	3
EE-359	High Frequency Circuit Design	3
EE-362	Microcontroller System Design	3
EE-406	Signals and Systems	3
EE-409	Network Analysis and Synthesis	3
EE-453	Control I	3
EE-456	Digital Signal Processing	3
EE-458	Senior Project	3
EE-460	Electromagnetic Fields	3
EE-461	Communications Theory	3
EL-100	Intro to DC/AC Circuits	3
EL-150	DC/AC Circuits and Analysis	3
EL-200	Electronic Devices/Circuits	3
EL-204	Digital Electronics	3
EL-250	Advanced Analog Circuits	3
EL-261	Intro Comm Circuits Systems	3
EL-262	Microprocessors/Microassembly	3
CS-150	Intro to Programming Using C	3
Engineering elective (1)*		3
English Communications		9 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
EN-408	Writing Seminar in Technical Research	3
Humanities and Social Sciences		18 Credits
BUS 301	Project Management	3
HU-331 or HU-332	Arts and Ideas	3
SS-351	Ethics	3
Humanities electives (2)*		6
Social Science electives (1)*		3
Mathematics and Sciences		33 Credits
CH-120	Chemistr	3
MA-261	Calculus I	4
MA-262	Calculus II	4
MA-263	Calculus III	4
MA-340	Ordinary Differential Equations	3
MA-345	Probability and Statistics for Engineers	3
PH-261	Engineering Physics I	4
PH-262	Engineering Physics II	4
PH-263	Engineering Physics III	4

*See appropriate department for approved list.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Electronics Engineering Technology (BS)

The electronics engineering technology (EET) program is structured to teach students a foundation in electronics technology with a strong emphasis on laboratory work and further the students' knowledge with more advanced studies in theoretical analysis and design. The main objective of the program is to produce technologists who support industry in areas ranging from circuit analysis to digital design to control and robotics. To meet this objective, EET majors study circuit design and simulation, network analysis and synthesis, transmission lines, micro-system design and fiber-optic communications with options for specialization in areas such as communications, computer design, control theory, micro-controllers and telecommunications. Students are trained to work in a wide range of practical electronics jobs and conduct design and theory work in the electronics field. All EET students must take courses in humanities and social science to broaden their understanding of professional and ethical responsibilities and the impact of their engineering solutions in a global context. All bachelor of science students complete a capstone course in which they propose, design, build, test and deliver a working electronic project. The BS degree in Electronics Engineering Technology is accredited by the Engineering Technology Accreditation Commission of ABET, http://www.abet.org

Course Requirements

Bachelor of Science		**121 Credits**
Course		Credits
Computer Science		3 Credits
CS-150	Intro to Programming using C	3
Electronics		51 Credits
EE-309	Circuit Design/Simulation	3
EE-354	Digital Design	3
EE-362	Microcontroller System Design	3
EE-409	Network Analysis and Synthesis	3
EE-453	Control I	3
EE-458	Senior Design Project	3
EL-100	Introductory DC/AC Circuits	3
EL-150	DC/AC Circuit Analysis	3
EL-200	Electronic Devices and Circuits	4
EL-204	Digital Electronics	3
EL-212	Transmission Lines	3
EL-250	Advanced Analog Circuits	4
EL-261	Introduction to Communications Circuits and Systems	3
EL-262	Microprocessors/Microassembly	3
EL-301	Advanced Communications Circuits and Systems	3
EL-307	Noise and Shielding	3
Mathematics and Sciences		34 Credits
MA-112	Intermediate Algebra	3
MA-114	Algebra/Trigonometry	
MA-261	Calculs I	
MA-262	Calculus II	4
MA-263	Calculus III	4
MA-340	Ordinary Differential Equations	3
MA-345	Probability and Statistics for Engineers	3
PH-201	General Physics I	3
PH-202	General Physics II	
CH-120	Chemistry	3
English Communications		9 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
EN-408	Writing Seminar in Technical Research	3
Humanities/Social Sciences		18 Credits
HU-331 or HU-332	Arts and Ideas	3
SS-351	Ethics	3
BUS-301	Project Management	3
Humanities elective (2)*		6
Social Science elective		3
Additional Electives		6 Credits
Technical elective*		3
General elective*		3

* See appropriate department for approved list.

Electronics Engineering Technology (AAS)

The AAS degree program is designed to provide students a foundation in electronics technology with a strong emphasis on laboratory work and to prepare graduates to work in technical positions of the electronics technology industry. Some theoretical courses are included to prepare students who are continuing with the bachelor's degree.

Associate in Applied Science 62 Credits

Course		Credits
Technical Courses		30 Credits
CS-150	Introduction to Programming Using C	3
EL-100	Introductory DC/AC Circuits	3
EL-150	DC/AC Circuits`	3
EL-200	Electronic Devices and Circuits	3
EL-204	Digital Electronics	3
EE-212	Transmission Lines	3
EL-250	Advanced Analog Circuits	3
EL-261	Introduction to Communications Circuits and Systems	3
EL-262	Microprocessors and Microassembly	3
EE-304	Digital Design I	3
Technical Elective*		3
Mathematics and Sciences		17 Credits
MA-112	Intermediate Algebra	3
MA-114	Algebra and Trigonometry	4
MA-261	Calculus I	4
PH-201	General Physics I	3
PH-202	General Physics II	3
English Communications		6 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
Humanities/Social Sciences		9 Credits
History/Humanities/Philosophy Elective*		3
Social Science Elective*		3

*See appropriate department for approved list

Engineering Fundamentals (AAS)

The Associate of Applied Science in Engineering Fundamentals provides the student with a sound understanding of mathematics, physics, electronics, and engineering mechanics. The degree enables the student to enter the workforce as an engineering technician and it prepares the student to pursue a bachelor's degree in any engineering discipline such as electrical, computer, mechanical, biomedical, civil, chemical, and systems engineering.

Associate in Applied Science 62 Credits

Course		Credits
Technical Courses		30 Credits
EL-100	Introductory DC/AC Circuits	3
EL-150	DC/AC Circuits`	3
EL-200	Electronic Device and Circuits	3
EL-204	Digital Electronics	3
EL-261	Intr/Commun Circuits/Systems	3
EL-262	Microprocessor/Microassembly	3
MEC-155	Intro to Materials Science	3
MEC-210	Engineering Mechanics - Statics	3
MEC-211	Engineering Mechanics—Dynamics	3
MEC-215	Intro to Engineering Design CAD	3
CS-150	Intro to Programing Using C	3
Mathematics and Sciences		17 Credits
MA-112	Intermediate Algebra	3
MA-114	Algebra and Trigonometry	4
MA-261	Calculus I	4
PH-201	General Physics I	3
PH-202	General Physics II	3
English Communications		6 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
Humanities/Social Sciences		6 Credits
History/Humanities/Philosophy Elective*		3
Social Science Elective*		3

*See appropriate department for approved list

Engineering Technology (BS)

The Bachelor of Science degree in Engineering Technology prepares the student for an exciting career in a wide range of industries. Career paths include design, development, manufacturing, analysis, field service engineering, purchasing, technical sales, technical supervision, and management. The degree provides a firm foundation in mathematics, applied science, circuit analysis, digital and microcontrollers systems, and engineering mechanics. Students use hands-on projects to practice designing, building, and testing.

Bachelor of Science **124 Credits**

All requirements for the associate in applied science degree, plus the following:

Course		Credit
Technical Courses		66 Credits
EL-100	Introductory DC/AC Circuits	3
EL-150	DC/AC Circuits`	3
EL-200	Electronic Device and Circuits	3
EL-204	Digital Electronics	3
EL-261	Intr/Commun Circuits/Systems	3
EL-262	Microprocessor/Microassembly	3
MEC-155	Intro to Materials Science	3
MEC-210	Engineering Mechanics - Statics	3
MEC-211	Engineering Mechanics—Dynamics	3
MEC-215	Intro to Engineering Design CAD	3
CS-150	Intro to Programing Using C	3
EE-304	Digital Design I	3
EE-362	Microcontroller System Design	3
EE-340	Systems Engineering	3
EE-406	Signals and Systems	3
EE-453	Control I	3
MEC-370	Electronics & Instrumentation	3
EE-457	Senior Design Project I	3
EE-458	Senior Design Project II	3
Technical Electives		9
Mathematics and Sciences		30 Credits
MA-112	Intermediate Algebra	3
MA-114	Algebra and Trigonometry	4
MA-128	Intro/Statistics	3
MA-261	Calculus I	4
MA-262	Calculus II	4
MA-340	Ordinary Differential Equations	3
CH-120	Chemistry	3
PH-201	General Physics I	3
PH-202	General Physics II	3
English Communications		6 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
Humanities/Social Sciences		18 Credits
BUS-301 Project Management		3
HU-331 or HU-332 Arts and Ideas		3
SS-351 Ethics	3	
History/Humanities/Philosophy Elective*		6
Social Science Elective*		3

*See appropriate department for approved list

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77

Management of Cyber and Information Technology (BS)

The Management of Cyber and Information Technology (MCIT) program prepares students for positions in the information assurance industry or in businesses that rely on the use of sophisticated information resources and tools. Students are trained to understand the demands of technical jobs and to facilitate, from a managerial standpoint, an effective and efficient working environment for employees. The main objective of the program is to produce systems thinkers with both management expertise and technical competence. MCIT majors study principles of management, organizational behavior, production and operations management, business telecommunications analysis, marketing and personnel management. All students complete a capstone course in which they propose, design, test and deliver a management project.

Course Requirements

Bachelor of Science **120 Credits**

Course		Credits
Business Foundations		18 Credits
BUS-174	Introduction to Business and Management	3
BUS-200	Business Communications	3
BUS-270	Financial Accounting I	3
BUS-275	Human Resource Management	3
BUS-280 or BUS-281	Macro/Microeconomics	3
BUS-372	Financial Management	3
Business Administration		24 Credits
BUS-208	Internet and the Law	3
BUS-279	Introduction to Leadership	3
BUS-301	Project Management	3
BUS-386	Organizational Theory and Behavior	3
BUS-410	Strategic Management	3
BUS-454	International Business	3
BUS-457	Senior Design Project I	3
BUS-458	Senior Design Project II	3
Information Technology		33 Credits
BUS-250	Database for Managers	3
BUS-362	Information Systems for Managers	3
CS-130	Computer Science Fundamentals I	3
CS-150	Introduction to Programming Using C	3
CT-152	Introduction to Unix	3
IAE-201	Introduction to Information Assurance Concepts	3
IAE-250	Comprehensive Computer and Network Security	3
IAE-315	Secure Systems Administration and Operation	3
IAE-325	Secure Data Communications/ Cryptography	3
IAE-402	Introduction to Incident Handling and Malicious Code	3
NT-100	Computer Architecture and Construction	3
Technical electives (2)*		6 Credits
English Communications		6 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
Humanities and Social Sciences		18 Credits
HU-331 or HU-332	Arts and Ideas	3
SS-351	Ethics	3
History/Humanities/Philosophy electives (2)*		6
Social Sciences electives (2)*		6
Mathematics and Sciences		15 Credits
BUS-246	Quantitative Methods for Business Analysis	3
MA-110	Business Math I	3
MA-111	Business Math II	3
MA-128	Introduction to Statistics	3
Science elective (1)*		3

* See appropriate department for approved list.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Mechatronics Engineering (BS)

The Mechatronics Engineering (MEC) program is structured to provide the student with the necessary knowledge and training to become a professional in the multidisciplinary field of mechatronics engineering. The main objective of the MEC program is to provide instruction and hands-on experience with mechanical systems, electronics, systems engineering and automation. In order to achieve this objective students study engineering mechanics and kinematics, fluid mechanics, electronics and instrumentation, systems engineering, circuit analysis and design, safety and power systems engineering. Graduates have the ability to work as part of a multidisciplinary team, combine different systems to come up with a solution for a real world problem, or design and build an integrated system.

Course Requirements

Bachelor of Science **120 Credits**

Course		Credits
Mechatronics		33 Credits
MEC-155	Intro to Materials Science	3
MEC-210	Engineering Mechanics - Statics	3
MEC-215	Intro to Engineering Design CAD	3
MEC-220	Principles of Mechatronics	3
MEC-310	Engineering Mechanics - Dynamics	3
MEC-330	Fluid Mechanics	3
MEC-370	Electronics and Instrumentation	3
MEC-375	Engineering Safety	3
MEC-410	Kinetics and Dynamics of Machinery	3
MEC-455	Mechatronics Systems Design	3
MEC-462	Automation Systems Design	3
Technical Courses		27 Credits
EL-100	Introduction to DC/AC Circuits	3
EL-150	DC/AC Circuits and Analysis	3
EL-200	Electronic Devices and Circuits	3
EL-204	Digital Electronics	3
EL-262	Microprocessors and Microassembly	3
EE-285	Programmable Logic Controllers and Networks	3
EE-340	Systems Engineering	3
EE-353	Power Systems Engineering	3
EE-453	Control I	3
Computer Science		6 Credits
CS-150	Intro to Programming Using C	3
CS-200	Intro to Programming Using C	3
Mathematics and Science		30 Credits
CH-120	Chemistry	3
MA-261	Calculis I	3
MA-261	Calculus II	3
MA-263	Calculus II	3
MA-340	Ordinary Differential Equations	3
PH-261	Engineering Physics I	4
PH-262	Engineering Physics II	4
PH-263	Engineering Physics III	4
Humanities/Social Sciences		24 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
BUS-301	Project Management	3
HU-331	Arts and Ideas	3
SS-351	Ethics	3
History/Humanities/Philosophy electives (2)*		6
Social Sciences elective*		3

* See appropriate department for approved list.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77

Mechatronics and Robotics Engineering Technology (BS)

The Mechatronics and Robotics Engineering program is structured to teach students fundamental theory, modeling methods, systems engineering, and practical applications of mechatronics and robotics. The main objective of the mechatronics and robotics engineering program is to produce engineers with the necessary to create more economic, reliable, integrated and simplified systems. As students progress through the degree program, they gain a solid grounding in circuit design and analysis, systems and control engineering and develop an understanding of the different components making up complex mechatronic and robotic systems. MRE majors will take courses in robotics systems engineering and analysis, digital electronics, control theory, power systems engineering and automation systems design which enable them to build and design integrated systems.

Course Requirements

Bachelor of Science **122 Credits**

Course		Credits
Mechatronics		30 Credits
MEC-155	Intro to Materials Science	3
MEC-210	Engineering Mechanics - Statics	3
MEC-215	Intro to Engineering Design CAD	3
MEC-220	Principles of Mechatronics	3
MEC-310	Engineering Mechanics - Dynamics	3
MEC-370	Electronics and Instrumentation	3
MEC-375	Engineering Safety	3
MEC-410	Kinetics and Dynamics of Machinery	3
MEC-455	Mechatronics Systems Design	3
MEC-462	Automation Systems Design	3
Engineering		27 Credits
EL-100	Introduction to DC/AC Circuits	3
EL-150	DC/AC Circuits and Analysis	3
EL-200	Electronic Devices and Circuits	3
EL-204	Digital Electronics	3
EL-262	Microprocessors and Microassembly	3
EE-285	Programmable Logic Controllers and Networks	3
EE-340	Systems Engineering	3
EE-353	Power Systems Engineering	3
EE-453	Control I	3
Computer Science		6 Credits
CS-150	Intro to Programming Using C	3
CS-200	Intro to Programming Using C	3
Robotics		12 Credits
ROB-100	Introduction to Robotics	3
ROB-200	Robotics Systems Engineering and Analysis	3
ROB-300	Industrial Robotics	3
ROB-382	Robotics Systems	3
Mathematics and Science		32 Credits
MA-112	Intermediate Algebra	3
MA-114	Algebra and Trigonometry	3
MA-128	Introduction to Statistics	3
MA-261	Calculus I	3
MA-262	Calculus II	3
MA-340	Ordinary Differential Equations	3
PH-261	Engineering Physics I	4
PH-262	Engineering Physics II	4
Humanities, Management and Social Sciences		15 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
BUS-301	Project Management	3
HU-331	Arts and Ideas	3
SS-351	Ethics	3

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77

Mobile Computing

The Bachelor of Science (B.S.) degree in Mobile Computing offers the student the opportunity to gain the skills and know-how needed for success in an increasingly critical arena of information technology. The degree produces programmers who can design and develop the next generation of mobile computer applications. Students in the program take courses in such specialized areas as iPhone application development and JavaScript, while also reinforcing the fundamentals of computer science, programming and software design. Mobile computing majors must also fulfill general requirements in mathematics and science. To help them in placing their studies and knowledge in a broader context, they must also take courses in the humanities and social science.

Course Requirements

Bachelor of Science **121 Credits**

Course		Credits
Computers and Software		60 Credits
CS-130	Intro to Programming Using Java	3
CS-220	Database Management	3
CS-225	Intermediate Java Programming	3
CS-230	Data Structures	3
CS-305	Android Applications Development	3
CS-316	Intelligent Systems	3
CS-330	iPhone Application Development	3
CS-356	Dynamic Web Page Development	3
CS-430	Game Programming/iPhone Platform	3
CS-431	Graphics and Game Programming	3
CT-102	Intro/Internet Applications	3
CT-152	Intro/Unix	3
CT-206	Scripting languages	3
CT-376	Javascript	3
CT-406	Web Programming Languages	3
IAE-201	Intro to Information Assurance	3
IAE-301	Comprehensive Computer/ Network Security	3
IAE-311	Mobile Computing Security	3
SE-321	Hunman Computer Interaction	3
SE-458	Senior Design Project	3
General Electives		6 Credits
Business		9 Credits
BUS-174	Intro to Business Management	3
BUS-208	E-Commerce and the Law	3
BUS-289	Entrepreneurship/Small Business Management	3
Humanities and Social Sciences		30 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
EN-408	Writing Seminar in Tech Research	3
HU-210	Game Design Theory	3
HU-331 or HU-332 Arts and Ideas		3
SS-351	Ethics	3
Humanities electives (2)*		6
Social Sciences electives (2)*		6
Mathematics and Sciences		16 Credits
MA-114	Algebra and Trigonometry	4
MA-124	Discrete Mathematics	3
MA-128	Introduction to Statistics	3
PH-201	General Physics I	3
PH-202	General Physics II	3

* See appropriate department for approved list.
** Any course may be taken to satisfy the general elective requirement.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Software Engineering (BS)

The software engineering (SE) program is structured to teach students to design and program computers and computer-based systems to meet the needs of all areas of society. The main objective of the program is to produce practical software engineers who can analyze and determine the needs of a system and apply engineering principles to create software and hardware solutions. SE majors study modern programming languages and applications, algorithm development, and software design and testing in the software component, computer organization and architecture, micro-controller system design and the latest programmable chip technology in the hardware portion, and modern approaches to knowledge acquisition using UML in both individual and team environments. All engineering majors must take courses in humanities and social science to broaden their understanding of professional and ethical responsibilities and the impact of their engineering solutions in a global context. All students complete a capstone course in which they propose, design, build, test and deliver a working software application.

Course Requirements

Bachelor of Science **120 Credits**

Course		**Credits**
Computers and Software		33 Credits
CS-130	Intro to Programming Using Java	3
CS-220	Database Management	3
CS-225	Intermediate Java Programming	3
CS-230	Data Structures	3
CS-250	Intro Net Programming with C	
OR	CS 356 Dynamic Web Page Dev	
OR	CS 406 Web Programming Lang	3
CS-310	Computer Algorithms	3
CS-330	IPhone App Development	
OR	CS-305 Android App Development	3
CS-405	Introduction to Software Design with Unified Model Language	3
CS-418	Operating Systems	3
CT-152	Introduction to Unix	3
CT-376	Javascript	3
Engineering		21 Credits
CS-406	Requirements/Resource Analysis	3
CS-452	Agile Methods for Software Engineering	3
SE-321	Human/Computer Interaction	3
SE-351	Software Testing	3
SE-458	Senior Project	3
Software electives (2)*		6
English Communications		9 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
EN-408	Writing Seminar in Technical Research	3
General Electives		3 Credits
General electives (1)**		3
Humanities and Social Sciences		18 Credits
HU-331 or HU-332 Arts and Ideas		3
SS-351	Ethics	3
Humanities electives (2)*		6
Social Sciences electives (1)*		6
Mathematics and Sciences		30 Credits
MA-114	Algebra and Trigonometry	4
MA-124	Discrete Mathematics	3
MA-128	Introduction to Statistics	3
MA-261	Calculus I	4
MA-262	Calculus II	4
PH-201	General Physics I	3
PH-202	General Physics II	3
Math or Science elective (2)*		6
Technical Courses		6 Credits
EL-204	Digital Electronics	3
EL-262	Microprocessors and Microassembly	3

* See appropriate department for approved list.
** Any course may be taken to satisfy the general elective requirement.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Technology and Business Management (BS)

The Technology and Business Management curriculum provides students with the knowledge necessary to integrate business, analytical and decision-making skills into a culturally, politically, socially and demographically diverse environment. Graduates will bring to the job market the ability to effectively apply the acquired skills and knowledge (theory, tools and models) to everyday work situations of current or future employers in the business and technology arenas. The goals of the program are to give students an understanding of how private and public sector organizations function effectively and efficiently. Students will gain a clear picture of how the functional business areas work together to achieve organizational success in a global environment. Course content builds a solid business and management foundation to include marketing, accounting, finance, information technology and human resource management. The combined required and elective courses provide students with a breadth of skills important in today's technology-driven business climate.

Course Requirements

Bachelor of Science **120 Credits**

Course		Credits
Business Administration		27 Credits
BUS-200	Business Communications	3
BUS-376	Marketing Principles	3
BUS-378	Legal Environment of Business	3
BUS-384	Production and Operations Management	3
BUS-386	Organizational Theory and Behavior	3
BUS-410	Strategic Management	3
BUS-454	International Business	3
BUS-457	Senior Design Project I	3
BUS-458	Senior Design Project II	3
Business Fundamentals		27 Credits
BUS-174	Introduction to Business and Management	3
BUS-270	Financial Accounting I	3
BUS-271	Financial Accounting II	3
BUS-275	Human Resource Management	3
BUS-279	Introduction to Leadership	3
BUS-280	Macroeconomics	3
BUS-281	Microeconomics	3
BUS-283	Managerial Accounting	3
BUS-372	Financial Management	3
Information Technology		12 Credits
BUS-250	Database for Managers	3
BUS-301	Project Management	3
BUS-362	Information Systems for Managers	3
IAE-201	Intro to Information Assurance	3
English Communications		6 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
Humanities and Social Sciences		18 Credits
HU-331 or HU-332 Arts and Ideas		3
SS-351	Ethics	3
Humanities/History/Philosophy electives (2)*		6
Social Sciences electives (2)*		6
Mathematics and Sciences		15 Credits
BUS-246	Quantitative Methods for Business Analytics	3
MA-110	Business Management Math I	3
MA-111	Business Management Math II	3
MA-128	Introduction to Statistics	3
Science elective		3
General Electives*		`15 Credits

* See appropriate department for approved list.
** Any course can be taken to satisfy the general elective requirements

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Unmanned and Autonomous Systems (BS)

The Bachelor of Science (B.S.) degree in Unmanned and Autonomous Systems (UAS) provides the student with the necessary knowledge and training to become a professional in the diverse field of Unmanned and Autonomous Systems. The degree provides a firm foundation in Unmanned and Autonomous Systems flight operations, mission planning, special sensors, weapons, surveillance and data collection, aeronautical engineering, aeronautical technologies and ground control. Students will design, construct, and fly an Unmanned Aerial Vehicle (UAV). Students of the program will be able to become a certified Unmanned Aerial Systems Operator and will have the knowledge and skills to support governmental and commercial employers. The Unmanned and Autonomous Systems core courses will prepare students to pass the Federal Aviation Administration (FAA) Part 107 test to become a Commercial UAV Pilot and Sport Pilot.

Course Requirements

Bachelor of Science		**122 Credits**
Course		**Credits**
Unmanned and Autonomous Systems Technical Core		46 Credits
UAS-101	Intro to Unmanned and Autonomous Systems (UAS)	3
UAS-102	Mechanics of UAS	
EL-100	Introduction to DC/AC Circuits	3
UAS-110	Air Traffic Control Communications	3
UAS-120	UAS Operator Certification	3
UAS-130	Unmanned and Autonomous Systems Safety Management Systems	3
UAS-140	Unmanned Autonomous Systems Operations	3
UAS-150	Unmanned and Autonomous Systems Crew Planning	3
UAS-201	Unmanned and Autonomous Systems Sensors	3
UAS-202	Unmanned and Autonomous Systems Ground Vehicles	3
UAS-210	Unmanned and Autonomous Systems Design	3
UAS-220	Intro to Processing Remotely Sensed Data	3
UAS-230	Unmanned Surface and Underwater Vehicles	3
UAS-240	Unmanned Space Vehicles	3
UAS-250	Unmanned Vehicle Environments	3
Unmanned And Autonomous Systems Management Core		15 Credits
UAS-310	Unmanned Vehicle Missions	3
UAS-320	Unmanned Vehicle Business Decisions	3
UAS-410	Unmanned Vehicle Laws and Regulations	3
UAS-458	UAS Mission Capstone Project	3
Unmanned and Autonomous Systems Data Core		18 Credits
CS-150	Intro to Computer Programming Using C	3
CS-220	Database Management	3
CT-206	Scripting Languages -- Python	3
IAE-201	Introduction to Information Assurance Concepts	3
UAS-420	Data Acquisition and Post-processing	3
UAS-430	UAS Data Visualization and Presentation	3
Mathematics and Sciences		19 Credits
MA-114	Algebra and Trigonometry	3
MA-124	Discrete Mathematics	3
MA-128	Introduction to Statistics	3
PH-201	General Physics I	3
PH-202	General Physics II	3
AE-390	Aviation Meteorology	3
English, Humanities, and Social Science		24 Credits
EN-101	English Communications I	3
EN-102	English Communications II	3
HU-331 or HU-332 Arts and Ideas		3
SS-351	Ethics	3
EN-408	Englsh Writing Seminar in Technical Research	3
Social Science Elective*		3
Humanities Elective (2)*		6

* See appropriate department for approved list.

All bachelor of science degrees require a minimum of 27 credits at the 300-level or above. For descriptions of required courses, see courses beginning on page 77.

Undergraduate Certificates

The undergraduate certificates are targeted at specialized jobs in distinct information technology and management fields. Students seeking an undergraduate certificate may only apply one relevant transfer course to certificate requirements. No course substitutions are permitted and students must complete all remaining coursework at Capitol Technology University. Once the course requirements are completed, students must apply for the certificate through the Office of Registration and Records. A $25 processing fee is due with the certificate request. A student must have a minimum cumulative GPA of 2.0 in all certificate coursework to be awarded the certificate.

For descriptions of required courses, see courses beginning on page 77.

Acquisitions Management
(12 credits)

This upper-level certificate is designed to provide students with knowledge of the broad concepts and strategies of procurement and contract management, which contributes to the ability to make sound business decisions. Major topics include the foundations of pricing and negotiations, basic aspects of contracting, procurement of services and products, software acquisitions, and mergers and acquisitions.

Required Courses

BUS-301	Project Management	3
BUS-385	Federal Acquisitions Management	3
BUS-387	Mergers and Acquisitions	3
BUS-388	Software Acquisitions	3

Computer and Network Security
(13 credits)

This upper-level certificate provides students with a fundamental knowledge of general network security concepts, which can then be applied to an advanced training program in specific security software and platforms. Students learn the basics of practical and theoretical network and computer security. The first course introduces students to introductory computer programming to support the advanced courses. The remaining courses provide students with an understanding of computer and network security issues, including encryption, SSL, privacy issues, directory services protocols such as LDAP, intrusion detection, viruses, firewalls and network management.

Required Courses

CS-130	Computer Science Fundamentals I	4
IAE-201	Introduction to Information Assurance Concepts	3
IAE-301	Compr. Computer & Network Security	3
IAE-315	Secure System Administration and Operation	3

Object-Oriented Programming
(13 credits)

This lower-level certificate provides a solid grounding in object-oriented programming to students with no prior programming experience. Students learn to analyze and design programs from the object-oriented perspective. Implementing object-oriented solutions to problems in two languages, C++ and Java, helps to reinforce an understanding of object-oriented concepts from coupling and cohesion to inheritance and polymorphism. In addition, Java provides students with the tool necessary to implement graphical user interfaces as well as a variety of features and classes useful in webpage and Internet programming. C++ requires students to develop a good understanding of structures, such as lists, queues and trees, and to implement them using the classes defined in the C++ Standard Template Library.

Required Courses

CS-130	Computer Science Fundamentals I	4
CS-150	Introduction to Programming Using C	3
CS-225	Intermediate Java Programming	3
CS-230	Computer Science Fundamentals II	3

Project Management
(12 credits)

This upper-level certificate is built on core processes defined in the Project Management Body of Knowledge (PMBOK). The certificate consists of four core courses, which provide students the opportunity to learn the basic concepts and strategies of project management required to successfully manage projects in both government and private industry.

Required Courses

BUS-301	Project Management	3

BUS-302	Methods of IT Project Management	3
BUS-303	Project Management Competitive Advantage	3
BUS-375	Human Resource Management	3

Programming and Data Management
(13 credits)

This lower-level certificate provides a good understanding of how programmers store and manage computer data. Students learn the fundamental aspects of the storage and management of computer data. Courses in C++ and Java introduce the student to the object-oriented paradigm and the underlying principles of the structures and methods associated with data management. In addition, Oracle is used in the database management course, which introduces students to relational databases and the techniques for analyzing and designing database solutions. Finally, a course in advanced data structures teaches students the theory and underlying techniques used to store, search, sort and access computer data.

Required Courses

CS-130	Computer Science Fundamentals I	4
CS-220	Database Management	3
CS-225	Intermediate Java Programming	3
CS-310	Computer Algorithms	3

Software Engineering
(13 credits)

This upper-level certificate introduces students to relational databases software design, and user interaction with technology. Students learn the practical aspects of programming and database management, as well as the theoretical issues involved in analyzing, designing and implementing computer applications that are accessible, reliable and maintainable. The software engineering course allows students to apply basic engineering principles to help them understand software performance, modularity, portability and reliability. A course in human-computer interaction investigates the relationship between the functionality and usability of computer systems in order to maximize their efficiency by selecting appropriate input-output devices and interaction styles.

Required Courses

CS-130	Computer Science Fundamentals I	4
CS-230	Computer Science Fundamentals II	3
CS-310	Computer Algorithms	3
CS-405	Introduction to Software Design with Unified Modeling Language	3

Space Missions and Operations Specialist
(12 credits)

This upper-level certificate provides students with a general overview of satellites, including simple physics of satellite orbits and the history of NASA and scientific mission operations. Students will learn satellite design with emphasis on power management, heating and cooling considerations, telemetry and communications and control systems. Coursework includes the study of orbital mechanics and the physics of the instruments used to monitor and analyze the earth and atmosphere. Prerequisites for the certificate include an understanding of math through differential equations with basic engineering physics.

Required Courses

AE-150	Introduction to Space	3
AE-250	Ground Systems Engineering	3
AE-350	Autonomous Ground Systems	3
AE-411	Space Systems Engineering	3

Web Programming
(12 credits)

This lower-level certificate provides students the foundation to write programs that support transactions conducted over the Internet. Students learn about the web and the basic tools used for webpage construction, including HTML, DHTML, scripting, CSS and an overview of XML. The database management course provides students with an understanding of relational databases, how they are designed, how data is stored in them, and how that data can be accessed. The final two courses, Intermediate Java Programming and Web/ CGI Programming Using Perl, provide students with the programming techniques and tools needed to create truly dynamic webpages.

Required Courses

CT-102	Introduction to Internet Applications	3
CT-206	Scripting Languages	3
CT-376	Javascript	3
CT-406	Web Programming Languages	3

Website Development
(12 credits)

This certificate is designed for students interested in building websites. Students learn a variety of tools and applications such as HTML, Java Script, ASP, PHP, Microsoft FrontPage and Macromedia Director used to build web pages and add content to them. The website construction course deals with website and browser requirements, platform selection issues, web server functions, client and server side applications, cookies and other topics. In the website administration course, students learn concepts in the use of software to monitor and optimize website operations, alternatives to CGI such as ASP, and website security.

Required Courses

CT-152	Introduction to UNIX	3
CS-130	Computer Science Fundamentals	3
CS-220	Database Management	3
CS-320	Database Administration	3

Graduate Program Offerings

Doctor of Philosophy (PhD) Degree

- Business Analytics and Decision Sciences
- Technology
- Technology Combination Program (MS/PhD)
- Unmanned Systems Applications

Doctor of Science (DSc) Degree

- Cybersecurity

The Technology and Unmanned Systems Applications doctoral programs are all asynchronous and have no residency requirements. Students research a topic and submit a thesis or meet a publication requirement. All other doctoral classes are taught in real-time, accelerated 8-week classes except for three residency courses that are held on campus over three weekends.

Master of Business Administration (MBA) Degree

- Business Administration
- Technical Master of Business Administration in Business Analytics and Data Science
- Technical Master of Business Administration in Cybersecurity

Master of Science (MS) Degrees

- Business Administration
- Computer Science
- Cyber Analytics
- Cyber and Information Security
- Electrical Engineering
- Unmanned and Autonomous Systems Policy and Risk Management

Post-baccalaureate Certificates

- Acquisitions Management
- Client/Server and Wireless Devices
- Component Technologies and Online Collaboration
- Digital Forensics and Incident Handling
- Information Assurance Administration
- Information Technology
- Project Management
- Network Protection
- Secure Cloud Computing
- Secure Software Development
- Security Management

Doctoral Admissions

Requirements

Cybersecurity (DSc)

Master's degree in information assurance, computer science, information technology or related field from a regionally accredited college or university

Minimum of five years of direct work experience

Three letters of recommendation

Currently hold one of the following industry certifications: CISSP, GSE, CGEIT or CISM. Applicants who do not have one of these certifications must pass a comprehensive entrance exam. Information about the exam and how to register will be sent to students lacking a certification.

All PhD programs

Master's degree in a relevant field from a regionally accredited college of university

A resume showing a minimum of 3-5 years of directly related work experience

Three letters of recommendation

Technology Combination Program (MS/PhD)

Bachelor's degree in a relevant field from a regionally accredited college of university

A resume showing some related work experience

Three letters of recommendation

The Technology and Unmanned Systems Application doctoral programs require a master's degree in the associated discipline and five years' experience. Without a master's degree, 10 years' experience is expected.

Doctoral Application Deadline

Start	Application Deadline
Fall	July 15 (classes start late Aug.)
Spring	Nov. 15 (classes start early Jan.)

Once an applicant's file is complete, it will be sent to the Admissions Committee for review. Qualifications will be reviewed individually and may require an interview. Applicants will be notified of their acceptance status.

Master's Degree Admissions

Applications for admission are accepted at any time and are processed and reviewed upon receipt of all necessary documents, on a case-by-case basis. Students whose application packages are incomplete will be classified as decision-pending.

Full Acceptance Status

For full acceptance, students must have a completed undergraduate degree from a regionally accredited institution, with a cumulative GPA of no less than 3.0 on a 4.0 scale. In addition, students must also meet the program-specific prerequisites for their intended program.

Provisional Acceptance Status

Students who have not met the 3.0 undergraduate cumulative GPA requirements or do not meet all of the program specific prerequisites are provided an opportunity to gain full acceptance. Depending on the degree program, additional information may be requested. In this case, students are provisionally admitted and limited to three courses of enrollment. To achieve full acceptance, provisional students must maintain a 3.0 cumulative GPA in their first three graduate courses. Upon doing so, students are automatically converted to full acceptance status. If a provisional student fails to achieve a minimum 3.0 cumulative GPA after completing three courses, then he or she will be academically dismissed, and will not be permitted to enroll in any further courses.

Decision-Pending Status

Students with incomplete application packages (missing transcripts, missing essay, etc.) are classified as decision-pending until the application package is complete.

Decision-pending students who have been approved to register are limited to two courses of enrollment and are not permitted to enroll in a third class until their application is complete.

Program-Specific Prerequisites

Business Administration (MBA)

Applicants who possess an undergraduate degree in business are waived from completing MBA-600 "Fundamentals of Professional Management." All other MBA-students must complete it. MBA-600 provides a broad foundation in accounting, finance, economics and statistics.

Computer Science

- Bachelor of science in computer science or related field preferred, but not required
- Proficiency in computer topics including object oriented programming, multiple languages, algorithm development, operating systems, databases, software architecture, distributed programming and other advanced work
- Fluency in mathematics: Calculus I, Calculus II and Linear Algebra

Cyber and Information Security

Courses are written to accommodate students with backgrounds in computer information systems, computer networking, telecommunications, information technology, network security, or computer science. Students are expected to have a working knowledge of servers, routers, hubs, switches, TCP-IP, etc. CCNA, Security+, SSCP, or CISSP certifications provide an excellent foundation for preparation, but are not required.

Electrical Engineering

- Bachelor of science in electrical engineering is preferred, but not required
- Fluency in mathematics: Calculus I, Calculus II, Linear Algebra, Ordinary and Differential Equations, Laplace and Fourier Analysis, and Probability and Statistics for Engineers required
- Engineering and Science: upper level courses in Control Theory, Signals and Systems, Communication Theory and Microprocessors required. Students with a BSET or equivalent are likely missing these course pre-requisites, and can gain access to the curriculum by completing the summer bridge course, EE-500 Advanced Signals and Systems

Business Analytics and Decision Sciences (PhD)

The Ph.D. in Management and Decision Sciences program is designed to prepare accomplished professionals for senior positions in either public or private sectors. The mission of the Doctor of Philosophy in Management and Decision Science degree (Ph.D. MDS) is to enable professionals from the field to understand and evaluate the scope and impact of decision sciences and associated technology from the institutional as well as from an industry and global perspective. The program will provide the student an academic environment to support the development of high-level critical thinking and leadership skills as they relate to management and decision sciences, to develop high-level decision science technical skills, and to provide doctoral level research experience allowing innovative and practical contributions to the management and decision sciences body of knowledge.

Graduates of Capitol Technology University's Ph.D. program can expect to lead local, national, or global organizations in related fields and provide expert guidance for the understanding of and the utilization of organizational information assets. Graduates can expect to be hired into senior leadership positions in industry, government and academia, and will be able to create and manage unique solutions for any business decision challenge that may arise.

Course Sequence of Study

Doctor of Science **54 Credits**

Course	Credits
YEAR 1	
First Semester	
DSM-802 Fundamentals of Doctoral Learning (Sixteen week course)	6
Second Semester	
PHL-900 Management Theory in a Global Economy (Term One)	3
DSM-905 Organizational Change and Information Systems Implementation and Practice I (Term Two)	3
Third Semester	
DSM-910 Analytics and Decision Analysis (Term One)	3
RSC-811 Professional Research Theory and Practice (Term Two)	3
RSC-821 Contemporary Research in Management (Residency)	3
YEAR 2	
First Semester	
DSM-915 Applied Statistics and Visualization for Analytics (Term Two)	3
DSM-920 Big Data Warehousing and Analytic Systems (Term One)	3
Second Semester	
RSC-826 Applied Research in Management & Decision Sciences (Term One)	3
PHL-880 Special Topics in Management (Term Two)	3
Third Semester	
PHL-813 Professional Ethics and Leadership (Term One)	3
RSC-815 Problem-Solving and Decision-Making Using Quantitative Methods (Term Two)	3
DSR-930 Management and Security of Information (Residency)	3
YEAR 3 – First 16 weeks/Term One/Term Two	
First Semester	
DSR-900 Graduate/Post-Graduate Elective (Term One)	3
Graduate/Post-Graduate Elective (Term Two)	3
Second Semester	
DSR-945 Dissertation Preparation, Part II: Proposal (Term One)	3
DSR-960 Dissertation Presentation and Oral Defense (Residency Course, 3-day weekend)	3
Electives	12 Credits
DSM-925 Supply Chain Design and Analysis	3
DSM-935 Decision Support and Knowledge Based Systems	3
DSM-940 Web Analytics	3
DSM-945 Optimization Techniques for Management Decisions	3
DSM-950 Strategic Management	3

As new electives are added, this list will expand. Please consult the School of Business and Information Sciences to inquire about new elective offerings or to propose new ones.

For descriptions of required courses, see courses beginning on page 77.

Cybersecurity (DSc)

The Doctor of Science in Cybersecurity degree program integrates content from academia, government, and industry into a challenging curriculum that adheres to high federal standards, prepares individuals for the rigors of federal agencies and industry, and results in graduates who are prepared to lead the field's top organizations.

Students take courses in small cohort groups comprised of government, industry, and military personnel. Upon graduation, doctoral students are able to conduct research as a foundation for executive action, demonstrate innovation and creativity as it relates to the strategic performance of an agency or organization, and apply a local, national, and global perspective to the decision-making process.

The program provides students an academic environment to support the development of high-level critical thinking and leadership skills, technical skills and research experience in order to provide significant contributions to the IA body of knowledge. The program maintains balance between a strong theoretical foundation, hands-on experience and innovative research. Graduates are well prepared to lead local, national or global organizations in IT-related fields and provide expert guidance for the protection of information assets.

Course Sequence of Study

Doctor of Science **54-66 Credits**

Course		Credits
YEAR 1		
First Semester		
RSC-802	Fundamentals of Doctoral Learning (Sixteen week course)	6
Second Semester		
IAE-830	IA Research Literature (Term One)	
RSC-810	Professional Research: Theory and Practice I (Term Two)	3
RSC-820	Situation Awareness Analysis and Action Plan Processes (Residency Course, 3-day weekend)	3
Third Semester		
RSC-825	Applied Research in IA (Term One)	
RSC-813	Professional Ethics and Leadership (Term Two)	3
YEAR 2		
First Semester		
IAE-860	Advanced Research Methods (Term One)	3
	Elective (Term Two)	3
Second Semester		
RSC-812	Professional Research: Theory and Practice II (Term One)	3
IAE-880	Special Topics in IA (Term Two)	3
DSR-925	Dissertation Preparation (Residency Course, 3-day weekend)	3
Third Semester		
	Electives (Term One)	
	Electives (Term Two)	3
YEAR 3 – First 16 weeks/Term One/Term Two		
First Semester		
DSR-900	Writing the Doctoral Dissertation, Part I: Proposal/Comp Exam II (Term One)	3
	Elective (Term Two)	3
Second Semester		
DSR-935	Dissertation Preparation, Part II: Proposal (Term One)	3
DSR-950	Dissertation Presentation and Oral Defense (Residency Course, 3-day weekend)	3

Electives		12 Credits
IAE-690	Healthcare Information Security	3
IAE-835	Information Assurance Strategic Management	3
IAE-837	Contemporary Issues in IA	3
IAE-845	Pedagogy and Information Assurance	3
IAE-871	Software Assurance Assessment	3
IAE-872	Software Assurance Development	3
IAE-873	Syllabus Software Assurance Management	3
IAE-874	Assured Software Analytics	3
IAE-880	Special Topics in IA	3
IAE-881	Special Topics in IA, Part II	3
IAE-882	Special Topics in IA, Part III	3
IAE-883	Special Topics in IA, Part IV	3
IAE-884	Special Topics in IA, Part V	3
RSC-815	Problem Solving and Decision Making with Quantitative Methods	3
DSR-940	Proposal Writing I (as needed)	3
DSR-941	Proposal Writing II (as needed)	3
DSR-942	Proposal Writing III (as needed)	3

As new electives are added, this list will expand. Please consult the IA department to inquire about new elective offerings or to propose new ones.

For descriptions of required courses, see courses beginning on page 77.

Technology (PhD)

The PhD program in Technology (PHDT) offers a different way to obtain your doctorate degree. It is tailored to research applications in which students either prefer or need a focused research topic that suits their careers or preferences. Typically, this will be for those that undertake research in their work lives or associated with these activities. Students start with TEC 800, which covers the fundamentals of writing, citation, and research ethics. Additionally, they start working on their proposal. At this point, students decide if they will undertake a thesis or select the publication route for completion of the degree requirements. Courses after this provide individual support for each student as they complete the thesis or publication route.

Course Sequence of Study

Doctor of Science **60 Credits**

Course		Credits
TEC-800	Writing the Doctoral Proposal I	6
TEC-810	Writing the Doctoral Proposal II	6
TEC-820	Writing the Doctoral Proposal III	6
TEC-830	Writing the Doctoral Proposal IV	6
TEC-840	Doctoral Proposal Oral Defense	6
TEC-900	Doctoral Research Preparation I	6
TEC-910	Doctoral Research Preparation II	6
TEC-920	Doctoral Research Preparation II	6
TEC-930	Doctoral Research Preparation III	6
TEC-950	Doctoral Research Preparation IV	6

All required courses are offered online only. For descriptions of required courses, see courses beginning on page 77.

Technology Combination Program (MS/PhD)

The Combination Program is an extension of the PhD in Technology. Those that do not have appropriate graduate level knowledge or experience are first required to complete a sequence of master's preamble courses that will then lead directly into the PhD in Technology.

The PhD program in Technology (PHDT) offers a different way to obtain your doctorate degree. It is tailored to research applications in which students either prefer or need a focused research topic that suits their careers or preferences. Typically, this will be for those that undertake research in their work lives or associated with these activities. Students start with TEC 800, which covers the fundamentals of writing, citation, and research ethics. Additionally, they start working on their proposal. At this point, students decide if they will undertake a thesis or select the publication route for completion of the degree requirements. Courses after this provide individual support for each student as they complete the thesis or publication route.

Course Sequence of Study

Doctor of Philosophy in Technology with Master of Science in Research Methods **90 Credits**

Course		Credits
MS in Research Methods Courses		
TEC-700	Project I: Fundamentals of Graduate Research and Design	6
TEC-710	Project II: Ethics and Philosophy of Research and Data Collection	6
TEC-720	Project III: Qualitative and Quantitative Research Design	6
TEC-730	Project IV: Applied Statistics, Analytics, Decision Analysis, and Visualization	6
TEC-740	Project V: Capstone Project	6
PhD in Technology Courses		
TEC-800	Writing the Doctoral Proposal I	6
TEC-810	Writing the Doctoral Proposal II	6
TEC-820	Writing the Doctoral Proposal III	6
TEC-830	Writing the Doctoral Proposal IV	6
TEC-840	Doctoral Proposal Oral Defense	6
TEC-900	Doctoral Research Preparation I	6
TEC-910	Doctoral Research Preparation II	6
TEC-920	Doctoral Research Preparation II	6
TEC-930	Doctoral Research Preparation III	6
TEC-950	Doctoral Research Preparation IV	6

All required courses are offered online only. For descriptions of required courses, see courses beginning on page 77.

Unmanned Systems Applications (PhD)

Unmanned Systems is a fast-growing sector of the aviation industry. The number of jobs is increasing each year and there are many exciting options and directions. This doctorate is also in the style of the PhD in Technology where students will pursue a thesis or publication option and they can focus their research on a large problem. There are no residencies and formal classes. The flexibility is enormous for those in a career with limited time for fixed date classes. This enables you to research at the time to suit your needs. An individual chair will support and guide you through all stages in the work.

Course Sequence of Study

Doctor of Science	**60 Credits**
Course	**Credits**
TEC-800 Writing the Doctoral Proposal I	6
TEC-810 Writing the Doctoral Proposal II	6
TEC-820 Writing the Doctoral Proposal III	6
TEC-830 Writing the Doctoral Proposal IV	6
TEC-840 Doctoral Proposal Oral Defense	6
TEC-900 Doctoral Research Preparation I	6
TEC-910 Doctoral Research Preparation II	6
TEC-920 Doctoral Research Preparation II	6
TEC-930 Doctoral Research Preparation III	6
TEC-950 Doctoral Research Preparation IV	6

All required courses are offered online only. For descriptions of required courses, see courses beginning on page 77.

Master of Business Administration

The master of business administration (MBA) program is crafted to support professionals who are seeking credentials necessary to qualify for high level management and leadership positions, both in government and industry. MBA-core coursework and projects focus on strengthening your leadership skills, enhancing your understanding of new technologies, expanding your ability to use technology to solve business problems, and understanding the process of innovation. Specialization options include leadership, information assurance, information technology, or technology management law and policy. An additional specialization option emphasizing federal acquisition and DoD contracting is under development. Students complete the 36-39 credit hour program through a combination of accelerated 8-week terms and 16-week semesters.

Course Requirements

Master of Business Administration 36-39 Credits

Course		Credits
Core Courses		24-27 Credits
MBA-600	Fundamentals of Professional Mgmt	3*
MBA-615	Financial Management	3
MBA-616	Financial and Contract Management	3
MBA-625	Organizational Behavior in Technical Environment	3
MBA-630	Marketing Process and Strategy	3
MBA-631	Technical Personnel Management	3
MBA-635	Technology Enables Operations	3
MBA-640	Managerial Economics	3
MBA-646	Federal Contract Project Management	3
MBA-650	Strategic Management	3
MBA-Electives		9 Credits

*MBA-600 is waived for students with a recent undergraduate degree (completed within the past 5 years) in business.

Master of Science in Computer Science

The computer science (CS) degree is structured to focus on new technologies, graphics aimed at virtual realities, and the Internet. The main objective of the program is to provide students with the advanced knowledge and skills necessary to design and use modern computer-based systems, with an emphasis on emerging technologies such as embedded languages, wireless technologies, miniaturization (PDAs), and data security.

CS majors study computer language design, intelligent systems design, and Multithreaded and distributed programming and may specialize in an area of their choice, including information architecture, network security or advanced computer science.

The master of science in computer science is a 30-credit degree program. All students complete a capstone course pair of Research Methods and the Capstone Research Project in which they identify a research topic in consultation with the faculty and develop a major project-based research paper by integrating prior coursework and personal experiences.

Course Requirements

Master of Science		**30-42 Credits**
Course		**Credits**
Core Courses		18 Credits
CS-504	Theory of Computation	3
CS-512	Computer Language Design	3
CS-701	Designing Intelligent Systems	3
CS-705	Multithreaded and Distributed Programming	3
CS-510	Algorithms	3
CS-714	Computer Science Seminar	3
Recommended Focus Areas		12 Credits
Data Science		
CS-507	Database Systems Implementation	3
CS-511	Numerical Methods of Data Science	3
CS-610	Machine Learning and Neural Networks	3
CS-710	Big Data	3
Software Engineering		
CS-505	Intro/Software Design w/UML	3
CS-551	Software Testing	3
CS-506	Requirements/Resource Analysis	3
CS-552	Agile Methods	3

Courses are offered only online in 16-week formats. For descriptions of required courses, see courses beginning on page 77.

Master of Science in Cyber Analytics

The Cyber Analytics curriculum is designed to meet the needs of government, industry and non-profits to evaluate the statistical data generated by their computing infrastructure to determine the state of the organization's security posture on an on-going basis. These statistics are often referred to generically as Big Data, but the reality is this information must be combined with relevant facts specific to the entity such as competitors, market position and sociopolitical factors to determine the threat landscape. This program combines a strong foundation in cybersecurity with hands-on project-based coursework providing analytic experience that can be applied to a wide range of growing concerns.

Course Requirements

Master of Science **33-39 Credits**

Course		Credits
Cybersecurity		21-27 Credits
IAE-500	Intro/Information Assurance*	3
CS-620	Operating System Principles for Information Assurance*	3
IAE-685	Principles of Cybersecurity**	3
IAE-640	Access and identity management	3
IAE-673	Secure Information Transfer and Storage	3
IAE-679	Vulnerability Mitigation	3
IAE-690	Healthcare Info System Security	3
IAE-692	Mobile Medical Device.Application Security	3
IAE-705	Master's Capstone	3
Cyber Analytics		12 Credits
MBA-510	Analytics and Decision Sciences	3
MBA-515	Applied Statistics and Visualization for Analytics	3
MBA-520	Big Data Warehousing and Analytics Systems	3
MBA-540	Web Analytics	3

Courses are offered only online in 16-week formats. For descriptions of required courses, see courses beginning on page 77.

Master of Science in Cyber and Information Security

The Master of Science in Cyber and Information Security (CIS) degree is structured to meet the needs of government and industry to understand, prepare for, respond to, and recover from threats to our information infrastructures. The main objective of the program is to provide information system and security professionals with in-depth instruction on new security ideas, concepts and techniques to prevent and react to malicious intrusion and to secure information assets. The National Security Agency and Department of Homeland Security have designated Capitol Technology University a National Center of Academic Excellence in Information Assurance Education. The Master of Science in Cyber and Information Security curriculum is mapped to all current federal domains at the most advanced level specified in the standards, and also covers the 8 domains of the CISSP (Certified Information Systems Security Professional), considered the gold-standard of industry certification. Some students may be required to take IAE-500 and CS-620; however, waivers may be granted in some cases with department chair or dean approval. CS-620 can be used as an elective or substituted with another course.

Course Requirements

Master of Science **36-39 Credits**

Course		**Credits**
Core Courses		24-27 Credits
IAE-500	Intro/Information Assurance*	3
CS-620	Operating System Principles for Information Assurance*	3
IAE-671	Legal Aspects of Computer Security and Information Privacy	3
IAE-675	Computer Forensics and Incident Handling	3
IAE-677	Malicious Software	3
IAE-679	Vulnerability Mitigation	3
IAE-680	Perimeter Protection	3
IAE-682	Internal Protection	3
IAE-685	Principles of Cybersecurity	

*IAE-500 and CS 620 may be waived with department chair or dean approval. CS must be substituted.

Capstone Course

IAE-674 Security Risk Management (Should be taken after IAE-680)

Elective Courses 9 Credits

Choose any combination of three courses from the following list of electives or, with permission, choose any courses from graduate course inventory:

Information Assurance Electives		
IAE-605	Master's Research	3
IAE-610	Advanced Penetration Testing	3
IAE-611	Mobile Computing Security	3
IAE-620	Mobile Device Forensics	
IAE-621	Applied Wireless Network Security	3
IAE-630	SCADA Networks and ICS Security	3
IAE-640	Access and Identity Management	3
IAE-670	Network Systems Security Concepts	3
IAE-672	Mathematics of Cryptography	3
IAE-673	Secure Information Transfer and Storage	3
IAE-684	Complementary Security	3
IAE-690	Healthcare Info System Security	3
IAE-692	Mobile Medical Device/Application Security	3
IAE-705	Master's Thesis	3

Network Engineering Electives		
IE-701	Principles of Designing and Engineering Computer Networks	3
IE-707	Network Architecture Convergence Using Wireless Technology	3
IE-712	Design of Cloud Networks and Services	3
IE-730	SCADA Networks and Industrial Control Systems	3

Project Management Electives		
MBA-501	Professional Writing Practicum	3
MBA-646	Project Management	3
MBA-647	Methods of Project Management	3
MBA-648	Project Management/Competitive Advantage	3

Software Assurance Electives		
IAE-571	Software Assurance Assessment	3
IAE-572	Software Assurance Development	3
IAE-573	Software Assurance Management	3
IAE-574	Assured Software Analytics	3

Courses are offered online in 16-week or 8-week accelerated formats. For descriptions of required courses, see courses beginning on page 77.

Master of Science in Electrical Engineering

The electrical engineering (EE) degree is structured to educate students to design and develop applications from the inception stage through the manufacturing, testing, and delivery of a product. The main objective of the program is to provide traditional engineers with the fundamentals of circuit modeling and design, circuit analysis, circuit construction and testing, government and industry regulations, and the advanced knowledge and skills necessary to design and use modern computer-based design and analysis software.

EE majors study mathematical modeling and analysis, electromagnetic interference and compatibility, and advanced concepts of design for reliability, manufacturability and testability with the emphasis of the program on the practical applications of theoretical principles to the design and construction of circuits to meet industrial, military and international standards.

The master of science in electrical engineering is a 30-credit degree program. All students complete a capstone course pair in which they choose a project in consultation with the faculty and carry the research of the project through proposal, design, testing and delivery. Students may choose to use the two elective courses in conjunction with the capstone courses to obtain a four-course certificate in an area of specialization.

The university has developed a bridge course, EE-500 Advanced Signal Processing, to allow students who do not meet the upper-level prerequisites an opportunity to qualify for acceptance. Credit for EE-500 is not awarded toward MSEE degree completion.

Course Requirements

Master of Science		**30 Credits**
Course		**Credits**
Core Courses		18 Credits
EE-600	Mathematical Analysis	3
EE-601	Modern Circuit Design and Simulation	3
EE-606	Signal Processing	3
EE-607	Electromagnetic Interference and Compatibility	3
EE-710	Designing for Reliability and Manufacturability	3
EE-720	Designing for Testability	3
Electives Courses		9 Credits
Choose any three courses below.		
EE-630	Electro Optics	
EE-614	Large Scale Integrated Design	3
EE-651	Communications Theory	3
EE-652	Microcontroller System Development	3
EE-653	Analog and Digital Control Theory	3
EE-656	Image Processing	3
EE-665	Microwave Circuit Theory and Design	3
IAE-621	Applied Wireless Network Security	3
IE-701	Principles of Designing and Engineering Computer Networks	3
IE-707	Network Architecture Convergence Using Wireless Technology	3
Capstone Courses		3 Credits
EE-758	Master's Project	3

Courses are offered only online in 16-week or 8-week accelerated formats. For descriptions of required courses, see courses beginning on page 77.

Technical Master of Business Administration in Business Analytics and Data Science

The Technical Master of Business Administration (TMBA) in Business Analytics and Data Science provides the student with the ability to integrate business and analytical decision-making skills in a technologically complex business environment and diverse world. Graduates will be able to apply their skills and knowledge of the business world to everyday work situations. While studying business analytics at the graduate level, the student will learn how for-profit and non-profit organizations function effectively and efficiently. The student will get a clear picture of how business areas meld to create a successful organization. The Business Analytics and Data Science core courses will prepare students to structure, transform, and analyze data to gain insights that will provide opportunities to improve business intelligence and managerial decision making. The required courses will build a solid foundation that encompasses technology, management, marketing, accounting, finance, Information Technology and human resource management. The student will learn to analyze patterns, employ technological tools and use Big Data to drive business decisions.

Course Requirements

Master of Science **36-39 Credits**

Course	Credits
Core Courses	24-27 Credits
MBA-600 Fundamentals of Professional Mgt	3*
MBA--616 Financial and Contract Management	3
MBA-626 Organizational Behavior in Technical Environment	3
MBA-627 Impact of Emerging Technology on Mgt and Public Administration	3
MBA-631 Technical Personnel Management	3
MBA-636 Technology-Enabled Operations	3
MBA-646 Federal Contract Project Management	3
MBA-650 Strategic Management	3
MBA-700 Capstone Project	3
Business Analytics Courses	12 Credits
MBA-510 Analytics and Decision Analysis	3
MBA-515 Applied Statistics and Visualization for Analytics	3
MBA-520 Big Data Warehousing and Analytic Systems	3
MBA-540 Web Analytics	3

*MBA-600 is required for students without a recent undergraduate business degree (completed within the past 5 years) or relevant professional experience.

Technical Master of Business Administration in Cybersecurity

The Technical Master of Business Administration (TMBA) in Cybersecurity provides the student with the ability to integrate business and decision-making skills in a technologically complex business environment and diverse world. Graduates will be able to apply their skills and knowledge of the business world to everyday work situations in the general business environment and cybersecurity. While studying business and cybersecurity at the graduate level, the student will learn how for-profit and non-profit organizations function effectively and efficiently. Students will develop a clear picture of how business areas meld to create a successful organization. The required courses will build a solid foundation that encompasses technology, management, marketing, accounting, finance, Information Technology and human resource management. The student will learn to analyze patterns, employ technological tools and to drive business decisions in the cybersecurity field.

Course Requirements

Master of Science **36-39 Credits**

Course		Credits
Core Courses		24 Credits
MBA-600	Fundamentals of Professional Mgt	3*
MBA-616	Financial and Contract Management	3
MBA-626	Organizational Behavior in Technical Environment	3
MBA-627	Impact of Emerging Technology on Mgt and Public Administration	3
MBA-631	Technical Personnel Management	3
MBA-636	Technology-enabled Operations	3
MBA-646	Federal Contract Project Management	3
MBA-650	Strategic Management	3
MBA-700	Capstone Project	3
Cybersecurity Courses		12 Credits
IAE-671	Legal Aspects of Cybersecurity and Information Privacy	3
IAE-674	Security Risk Management	3
IAE-684	Complementary Security	3
IAE-685	Principles of Cybersecurity	3

Unmanned and Autonomous Systems Policy and Risk Management

The Master of Science (M.S.) degree in Unmanned and Autonomous Systems (UAS) Policy and Risk Management provides the student with the necessary knowledge and training to become a professional in the diverse field of Unmanned and Autonomous Systems. The degree provides a firm foundation in Unmanned and Autonomous Systems policy, risk management, flight operations, mission planning, special sensors, weapons, surveillance and data collection, aeronautical engineering, aeronautical technologies and ground control. Students will develop policy and risk management plans for Unmanned and Autonomous Systems. Students of the program will also be able to become a certified Unmanned Aerial Systems Operator and gain the knowledge and skills to support governmental and commercial employers. A special optional course will prepare students to pass the Federal Aviation Administration (FAA) Part 107 test to become a Commercial UAV Pilot and Sport Pilot.

Course Requirements

Master of Science		**33 Credits**
Course		**Credits**
Core Courses		33 Credits
UAS-501	Unmanned Vehicle Theory and Practice	3
UAS-502	Unmanned and Autonomous Vehicle Systems	3
UAS-510	Unmanned Systems Autonomy and Automation	3
UAS-520	Unmanned Vehicle Sensors and Data	3
UAS-530	User Interface for Design and Evaluation	3
UAS-640	Data Analysis and Visualization	3
UAS-650	UAS Laws, Regulations, and Policy	3
UAS-660	Safety Management Systems and UAS Cybersecurity	
UAS-670	UAS Management for Masters	3
UAS-710	Unmanned and Autonomous Systems Capstone Project I	3
UAS-720	Unmanned and Autonomous Systems Capstone Project	3

Optional Course (may be added to the required 33 credits above)

UAS-500	UAS Operator Certification	1.5

Courses are offered only online in 16-week or 8-week accelerated formats. For descriptions of required courses, see courses beginning on page 77.

Post-baccalaureate Certificates

The post-baccalaureate certificates are targeted toward systems managers and information assurance professionals seeking to augment or update their skills and career with graduate-level credentials. Certificate students may only apply one relevant transfer course to certificate requirements. No course substitutions are permitted and students must complete all remaining coursework at Capitol Technology University. Once the course requirements are completed, students must apply for the certificate through the Office of Registration and Records. A $25 processing fee is due with the certificate request. A student must have a minimum cumulative GPA of 3.0 in all certificate coursework to be awarded the certificate.

The courses required for these certificates are offered only online in accelerated 8-week terms and 16-week semesters. Consult the schedule of classes for more information.

For descriptions of required courses, see courses beginning on page 77.

Acquisition Management
(12 credits)

This certificate is designed to provide students with knowledge of the broad concepts and strategies of procurement and contract management, which contributes to the ability to make sound business decisions. Major topics include the foundations of pricing and negotiations, basic aspects of contracting, procurement of services and products, software acquisitions, and mergers and acquisitions.

Required Courses

MBA-646	Project Management	3
MBA-701	Federal Acquisitions Management	3
MBA-702	Mergers and Acquisitions	3
MBA-703	Software Acquisitions	3

Client/Server and Wireless Devices
(12 credits)

This certificate provides students with a specialization in the hardware and software that drive local, Internet and wireless computing. Students learn the technical aspects of network and wireless devices and the standards and protocols of connectivity. An introductory course in network devices explores the technologies that link personal computers to servers and servers to servers. The three additional courses explore the movement from cable-connected terminals to remote server technology, the similarities and differences between operating systems and web servers, and the various wireless technologies and devices for personal and business communications.

Required Courses

IE-701	Principles of Designing and Engineering Computer Networks	3
IE-703	Thin and Fat Client Deployment with Multitiered/Service-Oriented Architecture and Web 2.0	3
IE-705	Comparison of Operating Systems and Web Servers	3
IE-707	Network Architecture Convergence Using Wireless Technology	3

Component Technologies and Online Collaboration
(12 credits)

This certificate provides students with an advanced understanding of the sophisticated technologies used to develop, integrate, and deploy e-business solutions. Students learn aspects of programming tools for online applications, technologies and policies of multimedia products, and component integration for on-demand communications. Courses in object-oriented and scripting languages and component collaboration technologies explore the development and optimization of electronic commerce applications. A multimedia and web casting course and a policy course in intellectual property explore the technical, marketing and legal aspect of online multimedia.

Required Courses

IE-709	Comparison of Object-Oriented and Scripting Languages	3
IE-713	Multimedia and Web Casting	3
IE-715	Identifying and Integrating Component Collaboration Technologies	3
IE-717	Invention, Innovation, and the Use of Intellectual Property	3

Digital Forensics and Incident Handling (12 credits)

This certificate prepares students to analyze computer systems and components such as hard drives, memory, networks and mobile devices. Students will also learn the art of detecting malware and effective incident handling to maintain the security of customer data. Students will also learn basic UNIX operating system commands and concepts, C programming as well as use state of the art Forensics tools.

Required Courses

IAE-620	Mobile Device Forensics	3
IAE-675	Computer Forensics and Incident Handling	3
IAE-677	Malicious Software	3
CS-620	Operating System Principles for Information Assurance	3
		3

Information Assurance Administration (12 credits)

This certificate provides a thorough understanding of the general methodologies for security risk assessment and security test and evaluation, including the interviews and documentation research necessary. Incident handling and response is addressed, as well as intrusion detection and defense in depth. In addition, students learn how to reduce their risk of potential legal liability for computer security or information privacy failures. This certificate is restricted to MSIA degree seeking students or seasoned IA professionals.

Required Courses

IAE-671	Legal Aspects of Computer Security & Information Privacy	3
IAE-674	Security Risk Management	3
IAE-675	Computer Forensics and Incident Handling	3
AE-680	Perimeter Protection	3

Information Technology (12 credits)

This certificate provides students with a foundational knowledge of systems management with respect to telecommunications systems as well as the computer systems that support managerial decision-making. Students learn principles of technology management and information systems. Introductory courses in systems management and telecommunications networks provide the fundamental principles applied in the decision support and expert systems course. A course in strategic management of business technology lays the foundation for business management in a global environment with specific attention given to electronic commerce management goals.

Required Courses

MBA-650	Strategic Management	3
SM-563	Managing Information Systems	3
SM-567	Business Data Communications and Networking	3
SM-569	Decision Support and Expert Systems	3

Network Protection (12 credits)

This certificate provides a detailed understanding of methods computer hackers utilize to infiltrate web and application technologies, including wireless networks. Emphasis is placed on how security professionals can anticipate and protect against attacks through internal and external vulnerability assessment. Students learn the anatomies of viruses and worms and study a range of defense mechanisms applicable to the daily challenges faced by today's security professionals. In addition, students are trained to use the most popular hacking, cracking and wireless security network analysis tools in order to test and secure wireless networks.

Required Courses

IAE-621	Applied Wireless Network Security	3
IAE-677	Malicious Software	3
IAE-679	Vulnerability Mitigation	3
IAE-682	Internal Protection	3

Project Management (12 credits)

The graduate certificate in Project Management is built on core processes defined in the Project Management Body of Knowledge (PMBOK). The certificate consists of four core courses, which provide students the opportunity to learn the basic concepts and strategies

of project management required to successfully manage projects in both government and private industry.

Required Courses

MBA-646	Project Management	3
MBA-647	Methods of IT Project Management	3
MBA-648	Project Management Competitive Advantage	3
MBA-659	Leadership and Managing Human Capital	3

Secure Cloud Computing (12 credits)

This certificate prepares students to design, develop, operate and maintain the security of cloud architectures, customer data and the services offered to customers. Students will learn basic and advanced cyber defense strategies and techniques to secure customer systems and data and incident handling in case a breach is detected. Students will also learn basic UNIX operating system commands and concepts, and C programming.

Required Courses

IAE-680	Perimeter Protection	3
IE-712	Design of Cloud Networks and Services	3
CS-620	Operating Systems Principles for Information Assurance	3
CS-710	Bigdata Warehousing and Analytics Systems	3

Secure Mobile Technology (12 credits)

This certificate prepares students to design, develop, operate and maintain the security of mobile technologies, devices and services. Students will learn how to properly assess the security of and secure mobile devices as well as IEES 802.11 networks. Students will also be exposed to state of the art mobile forensics tools. Students will be prepared to address their organizations requirements for mobile device management.

Required Courses

IE-707	Network Architecture Convergence Using Wireless Technology	3
IAE-611	Mobile Computing Security	3
IAE-620	Mobile Device Forensics	3
IAE-621	Applied Wireless Network Security	3

Secure Software Development (12 credits)

This certificate prepares students to design, develop, operate and maintain secure software (i.e., software that performs only its intended functions without the presence of exploitable vulnerabilities). Topics covered by this certificate are programming, security design principles, and IT systems components and analytics. This course prepares students to deliver software that is both secure and efficient code.

Required Courses

IAE-571	Software Assurance Assessment	3
IAE-572	Software Assurance Development	3
IAE-573	Software Assurance Management	3
IAE-574	Assured Software Analytics	3

Security Management (12 credits)

This certificate provides students with a fundamental understanding of network systems security as it applies to the overall enterprise mission. Students learn aspects of detection, recovery and damage control methods as well as the laws and rights to privacy. An introductory course in network systems security concepts introduces students to the terminology, principles and special issues facing industries, including the importance of user involvement, security training, ethics, trust and informed management. The three additional courses focus on secure data transfer and storage with a history of cryptography and a study of public- and private-key algorithms, risk management with detailed instruction in contingency/disaster recovery planning research and security policy formulation and enforcement, and computer forensics and incident handling with a focus on legal and ethical issues of privacy associated with information and intellectual property and managing trouble tickets and analyzing events.

Required Courses

IAE-611	Mobile Computing Security	3
IAE-670	Network Systems Security Concepts	3
IAE-673	Secure Information Transfer and Storage	3
IAE-684	Managing Information Security	3

Non Credit Course and Certificate Offerings

Professional Development and Workforce Training

Capitol provides workforce professional education and training for a variety of corporate and government needs. We specialize in offering practical, cutting edge educational programs in cybersecurity, IT, engineering, data analytics, unmanned systems applications and computer science. Training programs can be tailored to meet our client's unique needs. Programs are offered on-site, on campus or live online using our real-time, interactive educational platform. From technical training in areas such as SCADA protection and Amazon Web Services to managerial areas such as project management and business analytics, Capitol Technology University provides dedicated faculty who are industry leaders and bring years of experience and knowledge.

Credit Bearing Courses

The numbers in parentheses indicate the following: for undergraduate, (in sequence) class hours – laboratory hours – semester credit hours; for graduate, the number of semester credit hours. Students must have completed the listed prerequisite or its equivalent before registering for a course.

The following policy defines the credit hour at Capitol Technology University in accordance with applicable federal and state regulations.

Capitol Technology University defines the credit hour as an approximation of the learning outcomes equivalent of the Carnegie Unit. Courses are developed and evaluated to ensure that the amount of student learning required per credit is equivalent to one (50 minute) hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work for approximately fifteen weeks or two (50 minute) hours of direct faculty instruction and four hours of out-of-class student work in an eight week graduate sub-term for one semester hour of credit or at least an equivalent amount of work for other academic activities as established by the institution, including laboratory work, internships, independent study and other academic work leading to the award of credit hours.

Student learning outcomes reflect differences in course delivery methods, type of instruction and interaction, degree of supervision, measurements of student work, academic disciplines and degree levels.

All credit-bearing courses with the exception of doctoral dissertation research, writing and presentation courses require syllabi, which will include the number of credit hours, class meeting times and approximate schedule of required assignments.

Course Descriptions

AE-100 Introduction to Astronomy

Provides a general overview of topics in astronomy. Includes the history and evolution of our understanding of the solar system, stars, galaxies and cosmos. Basic processes that explain observations of phenomenon in our universe are discussed. May be used as a science elective. Corequisite: MA-114. Offered during Spring semester only. (3-0-3)

AE-150 Introduction to Space

Introduces the student to elements of astronomy and space sciences, the history of NASA and earth missions and operations and simple physics of satellite orbits, types of orbits and orbital terminology. Space environment and its effects on satellite and equipment. Discussion of satellites, types of satellites and their uses. Prerequisite: MA-114 or Corequisite: MA-261 Offered during Fall semester only. (3-0-3)

AE-200 High Vacuum Testing Techniques

This course covers the basic theory and practical knowledge to use, operate, manage or conduct tests in vacuum chambers. Terminology, equipment and methods of obtaining and maintaining vacuum environments, especially in regards to space simulation testing are covered. Topics will include types of vacuum pumps, system components, vacuum gauges, fittings, flanges, materials and their integration. Basic test procedures and standards. Offered semester only. (3-0-3)

AE-205 CubeSat Engineering

End-to-end rapid development of a CubeSat-type satellite sensor system, power bus, and Arduino-based CPU. Students will form multi-disciplinary teams to collectively build, integrate and test a working design. Emphasis on design formalism, key trades, resource calculations, and integration of systems. Recipes and hardware components will be provided. Prerequisites: AE-150 or CS-130 or EL-100 (3-2-2)

AE-250 Ground Systems Engineering

Provides an introduction to the components that make up a satellite ground system. Included is the design and analysis of ground system components. Provides an introduction into satellite telemetry, command and control subsystems, as well as the software needed to build and run a ground system. Introduction to CCSDS standards and mission planning. Prerequisite: AE-150. Offered spring semester only. (3-0-3)

AE-260 Ground System Testing

In this course students will study software testing techniques that are applicable to any satellite ground system. Topics covered include; what is a ground system and why we test, different types of ground system testing, developing test cases, creating test matrices and reports, writing testing requirements and understanding different requirement level requirements , what defines a good test / bad test , and SFOTC automated testing. Prerequisite: AE-250 or permission of the instructor/ department chair. (3-0-3)

AE-311 Spacecraft Systems

Design of spacecraft for different applications and missions. Passive and active devices. Designing with redundancy and reliability. Heating and cooling thermal issues. Power handling, telemetry and communications with antenna design. Propulsion, Thrusters and maneuvering. Command and control systems. Prerequisite: AE-150 or equivalent background Offered during Fall semester only. (3-0-3)

AE-350 Autonomous Ground Systems

Provides an in-depth introduction to the components that compose satellite ground systems in the commercial, military, and civil sectors from the inception of the space program to present day. Discusses conceptual and planned software development, integration and testing, launch operations, sustainment engineering, decommissioning of ground systems components and the system engineering processes involved in these activities. Introduces students to the tools and methods needed to create dynamic ground system components based on automation and autonomic principles. Cover CCSDS, ISO-900X, CMMI, UML, mission planning, flight dynamics principles and risk mitigation/anomaly resolution practices. Provides an introduction to STOL, CECIL, XML, and XTCE languages. Prerequisite: AE-150, AE-311, CS-130 (or equivalent), and EN-102 Offered Fall semester only.(3-0-3)

AE-351 Orbital Mechanics

Newton's equations and Keplers laws. Use of spherical coordinates to solve for orbital equations. Corrections to basic equations caused by earth's geometry, the moon and the sun. Other effects depending on orbital parameters. Corequisite: MA-340. Offered during Fall semester only. (3-0-3)

AE-361 Introduction to Satellite Imaging

This is an introductory remote sensing and sensor course with a focus on methods, instruments and techniques used to obtain satellite imagery. Students will be introduced to physical principles of remote sensing, Earth and other planetary observing systems and sensors, and various digital processing techniques related to satellite sensing imagery. Topics include optics, solar radiation, principles of satellite imaging, image quality analysis, introduction to charged coupled devices (CCDs), and basics of sensor design. Prerequisite: PH-262 and AE-150 Offered Spring semester only. (3-0-3)

AE-390 Aviation Meteorology

Prepares students with the knowledge necessary to comprehend the fundamentals of meteorology, analyze weather factors, hazards and in-flight weather conditions and weather conditions as they relate to aircraft and flight performance using aviation meteorology charts and internet weather resources. Prerequisite: None. (3-0-3)

AE-400 Special Topics in Astronautical Engineering

Research into astronautical engineering subjects. Student primarily works in a guided study format with a mentor. Permission required from the instructor and academic dean. This course may be repeated with different projects. (1-4)

AE-401 Computational Dynamics

Advanced Orbital Mechanics: Effects of various gravitational variations of the earth, moon sun and other bodies on orbital equations. Perturbation and modeling of orbital equations. Use of numerical methods and commercial computer modeling to determine orbital paths. Prerequisites: MA-340 and AE-351 Offered Spring semester only.(3-0-3)

AE-402 Special Topics in Astronautical Engineering II

Research into astronautical engineering subjects. Student primarily works in a guided study format with a mentor. Permission required from the instructor and academic dean. This course may be repeated with different projects. (3)

AE-411 Space Systems Engineering

Understand the basic principles and processes for designing effective systems, including how to determine customer needs vs wants, translate customer requirements into designs for systems that provide required performance and that are reliable, supportable and maintainable throughout the system life-cycle. Explore illustrative case studies. Team projects are assigned. Written reports and oral presentations are required. This is the undergraduate version of AE-611.Prerequisites: AE-311, AE-351 or permission of instructor. (3-0-3)

AE-451 Propulsion Systems

Introduction to rocket engineering, space missions and thrust requirements, liquid and solid-fueled rockets, nuclear and electric propulsion, propellant thermodynamics. Prerequisites: AE-351 (3-0-3)

AE-454 Spacecraft Dynamics and Control

Analysis of methods of monitoring maintaining and controlling spacecraft attitude and positioning. Propulsion systems. Effects of gravity gradients, space environment and atmospheric drag. Stabilization using controllers, actuators, sensors and impulse devices. Design of control subsystems. Systems engineering approach. Corequisite: EE-309 or EE-453 Offered Spring semester only.(3-0-3).

AE-455 Satellite Communications

Analysis of satellite communications systems. Communications subsystems, telemetry, tracking and monitoring, data handling, satellite link design, propagation effects, modulation techniques and performance, error control. Satellite control networks SN, GN. TDRSS systems, positioning command and control. Prerequisites: AE-311 and MA-262 or equivalent. Offered Fall semester only.(2-2-3)

AE-457 Senior Design Project I

Students/teams select a project, develop an understanding of the project scope that includes research and documentation of related work, prepare a feasibility study, develop project requirements (constraints) and engineering, software, and/or security specifications, propose solutions and multiple designs, analyze proposed designs, and select a final proposed design, and prepare and present a preliminary design review (PDR). Students are expected to apply proper systems engineering and project management to their work. Additional components may be required in some projects. Students/teams submit a final report at the end of the semester. Pre-requisite: Senior standing. (3-0-3)

AE-458 Senior Design Project II

Students/teams build and test their selected designs (completed in 457). Each student team delivers a tested prototype and defends its project in front of a panel of experts. Students/teams submit a final report that includes description of the design, realization, and test processes as well as test results, discussion, and conclusion. Failure to deliver a completed design and a working prototype that meets engineering, software, and/or security specifications by the end of the semester may result in failing the course. *Note: Course must be completed with a grade of "C" or higher to meet undergraduate graduation requirements. Prerequisite: AE-457 (3-0-3)

AE-463 Space Systems Engineering Simulation and Modeling

This course focuses on software-based simulation relating to current era space and ground operations industry toolkits. The course has four components: basic concepts, use of the STK toolkit and other network simulation tools such as OPNET, evaluation of a COTS system, and student presentations and papers. The initial lectures will cover both the basics of per-component computational modeling as well as end-to-end concerns mission and information assurance requirements for real-world full scale systems. There will be additional focus on a risk based approach to securing such communications systems based on confidentially, integrity and availability of data. Students will then work with the Satellite Tool Kit (STK) (and other network simulation tools) to model a single discrete space asset or a multi-component ground communications system, including preparation for the STK Certification Exam. The student will then model their own scenario using mission modeling software. Finally, each student will present their specific scenario to the class, including critical analysis (report) of advantages and deficiencies in the tool of choice in terms of end-to-end systems engineering to include information and mission assurance concerns. Offered Spring semester only. (3)

AE-513 Systems Management & Organization

Basic concepts applied to managing large-scale systems. Perspectives and philosophies of organization, functions and processes of systems management and organizational leadership. (3)

AE-518 Principles of Systems

Systems theories, methodologies, thinking and practice; hard and soft systems approaches; multidisciplinary approaches to organizational problem solving, feedback loops and system change. (3)

AE-571 Software Assurance Assessment

This course covers the fundamentals of establishing a required level of software and system assurance, applying methods and determining measures to assess whether the required level of assurance has been achieved. Topics include assessment methods; defining product measures, process measures and other performance indicators; measurement processes and frameworks; performance indicators for business survivability and continuity; and comparing selected measures to determine whether the software/system meets its required level of assurance. These fundamentals are applied to newly developed software and systems as well as during the acquisition of software and services. (3)

AE-572 Software Assurance Development

This course covers the fundamentals of incorporating assurance practices, methods, and technologies into software development and acquisition life-cycle processes and models. With this foundation, the course provides students with rigorous methods for eliciting software and system assurance requirements, using threat identification, characterization, and modeling; assurance risk assessment, and misuse/abuse cases. Students will also learn how to evaluate methods and environments for creating software and systems

that meet their functionality and security requirements. (3)

AE-573 Software Assurance Management
This course covers the fundamentals of software and system assurance management, including making the business case for assurance; planning and managing development projects that include assurance practices; compliance with laws, regulations, standards and policies related to assurance; and risk assessment, identification, analysis, mitigation and monitoring for assurance. The focus is on how to manage business and technical requirements. (3)

AE-574 Assured Software Analytics
This course covers methods for assuring the security and functionality of existing software and services, whether legacy, internally developed, or externally acquired, with emphasis on detection of vulnerabilities and malicious content. It also discusses assurance considerations for system architectures, networks and databases in their role as underlying enablers of software operations. Methods for structuring and reverse engineering of existing software are covered, as are techniques for acquiring and assuring software and services through suppliers, service-oriented architectures and cloud computing environments. (3)

AE-602 Spacecraft Mission Architecture and Design
Provides an overview of all aspects of space mission design for practical approaches to reducing cost. Also, will examine the different programmatic/conceptual design/choice creation methods for space missions. Aerospace system engineering/architecture tools will be used to create innovative projects (3)

AE-611 Space Systems Engineering

Understand the basic principles and processes for designing effective systems, including how to determine customer needs vs wants, translate customer requirements into designs for systems that provide required performance and that are reliable, supportable and maintainable throughout the system life-cycle. Explore illustrative case studies. Team projects are assigned. Written reports and oral presentations are required. This is the graduate version of AE-411. (3)

AE-621 Satellite Ground Systems Operation
Provides an introduction to satellite control centers in both the NASA and NOAA environments. Examines the roles of flight operations, communications, mission planners, and other entities needed to perform successful satellite ground systems operations. (3)

AE-647 Methods of IT Project Management
Methods of IT Project Management focuses on IT project management and is built around the Project Management Body of Knowledge (PMBOK). You will learn how IT projects differ from other kinds of projects and how the methods and techniques of project management must be modified/adapted for IT projects. In addition, you will gain an increased understanding of what managers do (or should be doing) and why managers ask you to do the things that they do. The course presents methods, tools, and techniques that can be used to effectively manage IT projects, both large and small. (3)

AE-652 Orbital Mechanics II
Continuation of Orbital Mechanics I. Theory of perturbations of orbits; numerical methods in orbital mechanics; satellite dynamics; averaging methods; resonance; mission analysis. Pre-requisite: AE-351 (3)

AE-654 Space Propulsion

Introduction to rocket engineering, space missions and thrust requirements, liquid and solid-fueled rockets,nuclear and electric propulsion, propellant thermodynamics. Prerequisites: AE-351 or equivalent, (3)

AE-655 Spacecraft Sensors

The operation, accuracy, resolution, and application of instruments which either produce images of ground scenes or probe the atmosphere as viewed primarily from space. Design of thermal and other satellite detectors and instrumentation as related to remote sensing applications. (3)

AE-661 Remote Sensing II

This course will build on the understanding and concepts of remote sensing introduced in the AE-361, Remote Sensing I, course. The course will emphasize the use of remote sensing data and image interpretation and processing techniques for environmental and urban applications. The main objective of this course is to provide students with the conceptual foundations and technical skills to work on remote sensing missions in the NASA and NOAA environments. Through laboratory projects students will be able to practice the concepts learned in lecture. Weekly discussion of peer reviewed journal articles or book chapters. (3)

AE-662 Atomic and Molecular Spectroscopy

The course will cover topics in Atomic and Molecular Spectroscopy applied to satellite-borne remote sensing instruments designed to study and monitor the earth system. The topics will include: Structure of one-electron and many electron atomic

systems; Influence of external magnetic and electric fields on atomic systems; Spectra of molecules and the signatures for rotational and vibrational energy transitions; Atmospheric scattering processes including Rayleigh, Mie and Raman scattering; Spectroscopic instruments including spectrometers, detectors, and filters; Fourier spectroscopy; Optical properties of materials. (3)

AE-700 Research Topics in AE
Research into astronautical engineering subjects. Students primarily works in a guided study format with a mentor. Permission required from the instructor and academic dean. (3)

AE-701 Project Management
Provides an introduction of planning, scheduling, and controlling a system project during its life cycle. Focus on ethical, theoretical, and practical challenges of the project management framework, including the basic project management phases from initiation to closure and interactions. Projects will focus on the integration of project management and strategic management of satellite missions. (3)

AE-708 Master's Project Research
This course will cover all aspects of proposing and executing a research and development task. Pin response to Broad Agency Announcements. Creating Preliminary response, including quad charts and white papers. Techniques for providing a rough order of magnitude (ROM) cost. Preparing the full final proposal, including abstract, statement of work, schedule, milestones, deliverables, risk mitigation, preplanned follow-on efforts, procurement, subcontracts, describing the labor mix, and developing a full cost proposal. Attention will be given to protection of proprietary information, protection of intellectual property, and to compliance with Federal Acquisition Regulations (the FAR). The course will culminate with the execution of a mock project, with final deliverables, and final closeout of the project. Examples from Federal R&D projects in public domain will be used throughout the course. (3)

AE-710 Space Systems Design for Reliability
Design methodology and standards applied in the construction and assembly of electronic circuits for reliability. Redundancy, parallel structure and majority rule circuits. Materials and component selection. Vibrational analysis, thermal analysis and packaging. Classification of hardware for commercial, military or space applications. MIL-spec and IPC standards discussed. Normally offered during summer semester. (3)

AE-711 Space Mission Analysis and Design
Spacecraft mission design, space environment, attitude determination and control, telecommunications, propulsion, structures and mechanisms, thermal control, power systems, launch systems and facilities. System components; vehicle structure, propulsion systems, flight dynamics, thermal control, power systems, telecommunication. Interfaces and tradeoffs between these components. Testing, system reliability, and integration. Emphasis on studying NASA and NOAA past and current space mission. (3)

AE-712 Principles of Space Navigation
Statistical orbit determination: least squares, batch and Kalman (sequential) processing, online ephemeris generation, determination of potentially hazardous bodies/objects; launch vehicles, payloads, and staging. Prerequisites: AE-401 and EE-600 (3)

AE-720 Space Mission Design
Focus is on the development of human spacecraft from Vostok to the International Space Station. Spacecraft design requirements based on the space environment and human physiology will be discussed and a design process will be with taught using systems providing life support. Students will study the designs of a spacecraft for a human interplanetary exploratory mission and will include technical design and program management. Course includes a student spacecraft system design project with presentation of proposals, design reviews and completed design projects. Prerequisite: AE-711 (3)

AE-758 Master's Project
Students integrate prior course work and personal experiences into a master's project. Students develop a full final proposal, including abstract, statement of work, schedule, milestones, deliverables as learned in EE-708. Proposal must be delivered to class and approval of project advisor required. Regular progress reports required. Final presentation will be live over the Internet. Prerequisite: AE-708. (3)

BUS-101 Introduction to Data Science
Fundamental coursework on the standards and practices for collecting, organizing, managing, exploring, and using data. Topics include preparation, analysis, and visualization of data and creating analysis tools for larger data sets. Prerequisite: MA-128. (3-0-3)

BUS-114 Advanced Excel
This course stresses the ten core areas of advanced Excel usage: advanced formula; tables and formatting; conditional formatting; advanced

charting; pivot tables and pivot reporting; VBA and macros; using Excel productively; data tables, simulations and solver; Excel integration with other tools; and optimizing Excel. Practice with data sets will allow students to use Excel in realistic simulations. (3-0-3)

BUS-174 Introduction to Business and Management
This course presents a survey of the general business and management environment. Topics include an introduction to the various forms of business, organizational structure, and their legal implications. Modern management and supervision concepts, history and development of theory and practice, the roles of managers, and the relationship between manager and employee are examined. This is a seminar course with emphasis on class discussion and collaborative learning. Prerequisite or Corequisite EN-001 or EN-101. (3-0-3)

BUS-200 Business Communications

This course includes preparation for various kinds of both written and oral business communication. The course will develop and sharpen the critical thinking and writing skills, including report/proposal preparation and presentation, needed in the workplace. Strategies for effective communication will also be explored. Prerequisite: EN-101. (3-0-3)

BUS-202 Introduction to Sports Management
This introduction to the professional area of sport management discusses basic philosophy and principles of sport management at all levels. Management encompasses the activities associated with administration, supervision, and leadership. This course satisfies a general or social science elective. (3-0-3)

BUS-208 E-Commerce and the Law
This course examines legal concepts that arise out of conducting business through the Internet. This course examines a wide variety of concepts and issues that have a significant influence on the use of the Internet for business or personal gain. In addition to basic legal terms, topics such as how courts assert personal and subject matter jurisdiction, the use of long-arm statutes, the state and federal court systems, patents, copyrights, trademarks, trade secrets, and statutes that deal with hacking, on-line privacy and the protection of data are introduced. International jurisdiction issues will also be discussed. The class is structured as a seminar course with an emphasis on in-class discussion and collaborative learning. Prerequisite: EN-101. (3-0-3)

BUS-240 Statistical Methods and Data Science
Statistical concepts and applications related to data science including advanced exploratory data analysis, nonparametric inference and simulation for larger datasets, logistic regression modeling, statistical programming, and basics of machine learning. Prerequisite: BUS-101. (3-0-3)

BUS-245 Writing and Communication in Data Science

This course emphasizes communication skills for professional situations, including effective quantitative summary and public speaking. The courses includes preparing and producing technical documents for specific audiences as well as analyses for general audiences. Prerequisite: MA-128. (3-0-3)

BUS-246 Business Research Methods
Students will learn the elements of the research process. The course encourages students to step outside the classroom and engage in research projects based on real life case studies. Non-Business Analytics Business majors must take this course. Prerequisites: MA 128. (3-0-3)

BUS-247 Quantitative Methods for Business Analytics
A project-based course where students pursue an approved data-science based research project. The course builds upon the skills acquired in BUS-101 and BUS-240. The course includes topics in advanced data mining, data ethics, and reproducible research. Business Analytics majors must take this course. Prerequisite: BUS-240. (3-0-3)

BUS-250 Database for Managers
A course that introduces the student to the basic concepts, organization, and implementation models of databases, with an emphasis on the relational model. Projects include hands-on work with entity-relationship and relational models. (3-0-3)

BUS-270 Financial Accounting I

This is an introductory accounting course that will provide students with a strong basic knowledge of accounting terms, concepts, and procedures. Analyzing business transactions as they relate to the General Ledger and the use of special journals will be addressed as well as the various processes and procedures related to the full accounting cycle. The accounting principles described are those endorsed by the Financial Accounting Standards Board. Corequisite: MA-110. (3-0-3)

BUS-271 Financial Accounting II

This course continues the focus on accounting principles, theories, and applications introduced in Financial Accounting I. It builds additional skills in ledger entry and organization, payroll accounting, and the development of financial statements. The foundation acquired in Accounting I is integral to exploring topics as accounting for partnerships

and corporations, promissory notes, and valuation of assets. Prerequisite: BUS-270. (3-0-3)

BUS-275 Human Resource Management
This course examines the role of the human resource professional as a strategic partner in managing today's organizations. Key functions such as recruitment, selection, development, appraisal, retention, compensation, and labor relations are examined in the context of government, private, and public sectors. Prerequisites: EN-102 and BUS-279. (3-0-3)

BUS-279 Introduction to Leadership
This course overviews the disciplines and competencies associated with leadership in the 21st Century. In particular, the study and application of skills, theories, and concepts in a multicultural society will be examined. This is a seminar course with emphasis on class discussion and collaborative learning. Prerequisite: BUS-174 Corequisite EN-101. (3-0-3)

BUS-280 Macroeconomics
This course is an introduction to macroeconomic concepts and analysis. It deals with the relationship between government, business, and the overall economy. The key areas focused on include gross domestic product, the public sector, unemployment, and aggregate supply and demand. The global economy is covered with discussion of issues such as international trade and protectionism. Prerequisite: EN-101. (3-0-3)

BUS-281 Microeconomics
This course is an introduction to microeconomic concepts and analysis. The course focuses on competitive market dynamics including individual and firm behavior through the study of market structure and economic decisions regarding production, pricing, and personnel. Labor markets and labor unions are addressed as well as regulatory and distributional issues. Prerequisite: EN-101. (3-0-3)

BUS-282 Foundations of Economics
This course is an introduction to economic concepts and analysis. It deals with the relationship between government, business, and the overall economy. The key areas focused on include gross domestic product, the public sector, unemployment, and aggregate supply and demand. The global economy is covered with discussion of issues such as international trade and protectionism. Prerequisite: EN-101. (3-0-3)

BUS-283 Managerial Accounting
This course focuses on budgeting and planning. Emphasis is on the use of accounting information to plan and redirect allocations to support business decisions. Managerial Accounting is designed to follow Principles of Accounting. Prerequisite: BUS-270. (3-0-3)

BUS-284 Data ID and Collection Strategies
This course introduces students to the location, collection, classification of data for business purposes. Sources, tools, processing, systems and legal parameters are examined. Prerequisite: BUS-240. (3-0-3)

BUS-289 Entrepreneurship and Small Business Management
This course provides an overview of the principles and processes of entrepreneurship and small business management. Students learn to identify characteristics of entrepreneurs; identify business innovations; conduct feasibility analyses; develop formal business plans; and finance, organize, and operate a small business. Prerequisite: EN-101. (3-0-3)

BUS-301 Project Management
This course is an introduction to project management. It covers the origins, philosophy, methodology, and involves actual applications and use of tools such as MS Project. The System Development Cycle is used as a framework to discuss project management in a variety of situations. Illustrative cases are used and project leadership and team building are covered as integral aspects of good project management. Prerequisite: EN-101. (3-0-3)

BUS-302 Methods of IT Project Management
Methods of IT Project Management focuses on IT project management and is built around the Project Management Body of Knowledge (PMBOK). You will learn how IT projects differ from other kinds of projects and how the methods and techniques of project management must be modified/adapted for IT projects. In addition, you will gain an increased understanding of what managers do (or should be doing) and why managers ask you to do the things that they do. The course presents methods, tools, and techniques that can be used to effectively manage IT projects, both large and small. Prerequisite: BUS-301 or equivalent. (3-0-3)

BUS-303 Project Management Competitive Advantage
Project Management takes decision-making and a business-oriented approach to the management of projects, which is reinforced throughout the course with current examples of project management in action. Project management is central to operations within the context of a variety of

successful organizations, whether publicly held, private, or not-for-profit. Prerequisite: BUS-301, Project Management, or equivalent (3-0-3)

BUS-310 Data Mining for Effective Decision Making
This course applies analytics to create useful information that provides insights, fosters inquiry, and supports effective decision-making and problem solving. The Students learn and practice utilizing analytics as a tool for achieving a desired outcome. This course provides a review of analytical methodologies and examines the importance of understanding problems, setting objectives, critical thinking and interpreting results. Problems will be addressed in a variety of disciplines. Prerequisite: and BUS-245 and CS-220. (3-0-3)

BUS-358 Internship
This course provides students with an alternate educational experience in industry and government that complements and strengthens their classroom education. Internship positions must be related to the students major and be creative and analytical in nature, for a minimum of eight weeks. The intern is under the supervision or mentorship of an experienced professional and faculty member. Prerequisites: junior or senior status. Cumulative GPA 2.8+ and 3.0+ in major required. (3-0-3)

BUS-350 Decision Models with Spreadsheets
The main objective of this course is to teach how to solve modern business problems using a spreadsheet application. Popular spreadsheet applications are examined. Students will use the case study method to address analytical problems. Prerequisites: MA-128, BUS-301 and BUS-384. (3-0-3)

BUS-362 Information Systems for Managers
Computer-based information systems and online information systems to increase individual and organizational efficiency and productivity constitute the foundation of this course. Topics include information systems for database management, transaction processing, knowledge worker, office automation, management information, decision support, and executive support. The course also includes system security, troubleshooting, and disaster recovery, system upgrading, and client/server issues. Prerequisites: EN-102 and BUS-279. (3-0-3)

BUS-372 Financial Management
This course is designed to familiarize the student with the principles that guide a firm's financial resources management. The primary philosophy around which this course is organized is wealth maximization and the decision criterion used to achieve such a state. Topics such as capital management, fixed-asset investment, cost of capital, capital structure, long-term finance, mergers, leasing, and multinational finance are covered. In addition, accounting terminology and concepts relevant to financial analysis and decision making will be presented. Prerequisites: BUS-270, MA-111 or MA-114. (3-0-3)

BUS-376 Marketing Principles
The role of marketing and the strategies used by marketing managers to solve problems is the content of this course. Emphasis is placed on the relationship among consumers, business, and government is regard to product, promotion, pricing, and distribution strategies. Industry standards and ethical practice are focal points of the course. Prerequisite: MA-128 and BUS-386. (3-0-3)

BUS-377 Special Topics in Marketing
This is an advanced course in selected issues in the theory and application of marketing. Actual topics and cases will be chosen by the instructor and may vary from term to term. Prerequisites: BUS-200, BUS-375, BUS-386 and BUS-378 or BUS-208 (3-0-3)

BUS-378 Legal Environment of Business
This course introduces the student to legal reasoning; ethical norms; the legal process and the American legal system; administrative law process and the role of business people in that process; the study of selected areas of public and private law, such as securities regulation, antitrust, labor, product liability, contracts, and consumer and environmental law; and international dimensions of the legal environment of law. The purpose of the course is to establish legal literacy and to develop an understanding of legal dynamics, particularly in the business world. Prerequisites: EN-102 and BUS-279. (3-0-3)

BUS-379 Integrated Marketing Communications
This course examines the development of marketing strategies and creative campaigns utilizing multiple marketing disciplines (paid advertising, public relations and promotions) and media (print, broadcast, online and social). Emphasis is placed on the coordinated impact of these communication tools in reaching target audiences. Prerequisite: BUS-376. (3-0-3)

BUS-384 Productions and Operations Management
This course stresses the decisions that managers make in increasing productivity in a world economy, productions and operations management examines the processes by which goods and services are produced. Strategies, techniques and problems in forecasting, statistical quality control, total quality management, inventory management, scheduling, maintenance and reliability, product,

process, technology, location, layout, and purchasing are the core topics of this course. Prerequisites: MA-128 and BUS-386. (3-0-3)

BUS-385 Federal Acquisitions and Contracting
This course covers the fundamentals of Federal acquisitions and contracting and will provide a comprehensive understanding of the acquisition environment. Students will develop professional skills for making business decisions and advising other acquisition team members to successfully meet customers' needs. Participation in small group simulation exercises will prepare students to provide contracting support within the overarching business relationships of government and industry. Prerequisite: BUS- 301 and BUS-384 or equivalent. (3-0-3)

BUS-386 Organizational Theory and Behavior

This course integrates the study of management principles and practices with the study of human behavior within organizations. The focus will be upon translation of management and organizational behavior theory to practices that result in organizational effectiveness, efficiency, and human resource development. To understand management and organizational behavior, concepts associated with continuous improvement in individual and group processes will be discussed. Specific attention will be given to Organizational Behaviors, Diversity in Organization, Attitudes and Job Satisfaction, Personality and Values, Perceptions and Individual Decision Making, Motivation Concepts, Foundations of Group Behavior, Communication, Leadership, Power and Politics, and Conflict.. Prerequisites: BUS-279 and EN-102. (3-0-3)

BUS-387 Mergers and Acquisitions

This course surveys the drivers of success in mergers and acquisitions (M&A) and develops your skills in the design and evaluation of these transactions. The M&A transactions will cover the foundation for a wide range of mergers and acquisition fields including corporate development, investment banking, consulting, and advising senior management. Prerequisite: BUS- 301 and BUS-384 or equivalent. (3-0-3)

BUS-388 Software Acquisitions
This course covers the acquisition of open systems and commercial off-the-shelf (COTS) products an increasingly vital element of corporate and government software development. Properly managed software acquisition offers potential for significant time and cost savings over a system's lifetime. The transition from proprietary, custom-built systems to systems based on standards and commercial products is not easy, however. Managers and their staff must understand the risks and opportunities associated with this acquisition approach. Prerequisite: BUS- 301 and BUS-384 or equivalent. (3-0-3)

BUS-389 Logistics & Supply Chain Management
This course examines the efficient flow of materials, products and information within and among organizations. Logistics management examines a wide variety of activities that have a significant influence on customer service, including inventory control, transportation, warehousing, facility location analysis, packaging, materials handling, parts and service support and product returns. Supply chain management examines the integration of business processes across organizations, from material sources and suppliers through manufacturing and processing, to the final customer. Prerequisites: BUS-386 and MA-128. (3-0-3)

BUS-390 eMarketing
This class will prepare students for the dynamic and evolving field of Internet Marketing. Through classroom and hands-on activities, students will gain experience with e-marketing approaches including websites, search engine marketing, online advertising, email marketing, various forms of social media, and mobile commerce. The emphasis is on the practical application of e-marketing technologies, including promotional methods, web analytics tools, and customer relationship management (CRM) processes used for consumer, business, and institutional markets. Students will study both current and emerging online marketing methods, along with their benefits and limitations. The objective is for students to develop an understanding of Internet marketing both in terms of strategy and tactics. Prerequisite: BUS-174 and BUS-376. (3-0-3)

BUS-391 eCommerce

This course examines the opportunities and challenges faced in an increasingly digital world. More and more product information and selling strategies are linked to the worldwide web. The course is for those students who wish to learn the principles and processes of electronic commerce. The course provides an overview of web promotional strategies, technology and infrastructure concerns, security, supply chain management, and back-office processes. Students will study topics such as: website development and promotion, online marketing and advertising, outsourcing or in-house development decisions, back office operations and information technology, and sourcing and cost analysis of key services and technologies. Prerequisite: BUS376 and BUS-384. (3-0-3)

BUS-392 Retail Management
This course examines retailing theory and research to understand the way retailing works. Methods, strategies, resources and techniques required for retail management are stressed. Both brick and mortar and online retailing are covered. Prerequisite: BUS-386. (3-0-3)

BUS-393 Consumer Analysis
This course examines the identification and evaluation of distinguishing customer characteristics so as to better segment them in the marketplace and target marketing efforts to them. Prerequisites: BUS-376, MA-128 and SS-171. (3-0-3)

BUS-400 Research Methods
This course provides an overview of the disciplines of governing data by examining the basic concepts, principles and practices of a data governance program and techniques used to measure success. The essential components of an enterprise-wide program are covered and a roadmap to execute a successful data governance program is outlined. The course makes data governance real by illustrating the concepts, principles, and practices using case studies. (3-0-3)

BUS-410 Strategic Management

This senior level course is designed to provide students with a general overview of systematic and continuous planning processes used by management to gain strategic and competitive advantage. The students are exposed to, and practice, the complex interrelationships between strategy, structure, culture, and management. Strategic and tactical strategies are explored using case studies, projects and discussions. Students develop and assess the role of management in strategy formulation, implementation and evaluation. Prerequisites: BUS-372, BUS-384, BUS-375 and BUS-378 or BUS-208. (3-0-3)

BUS-443 Marketing Analytics: Decision Making in the Information Age

This course demonstrates the benefits of using a systematic and analytical approach to marketing decision-making, and helps students develop their skills and confidence in doing such analyses. Analytical approaches covered enable (a) the identification of alternative marketing options and actions, (b) the calibration of opportunity costs associated with each option, and (c) the choice of one or more options with the greatest likelihood of achieving the business goals. With the knowledge gained here, students are better able to make the case for marketing expenditures (based on ROI) that companies are increasingly asking of their executives. Prerequisites: BUS 310 and BUS 376. (3-0-3)

BUS-454 International Business
Drawing upon previous management and business courses, this course studies the nature and scope of international trade and investment, international institutions, the international monetary system and exchange markets, and the cultural factor affecting international business operations and their influence on the principal business functions. The effects of the revolution in electronic technologies on global business are also examined. Case study analysis and a variety of current media are used in this course. Prerequisites: BUS-372, BUS-376 and BUS-386. (3-0-3)

BUS-457 Senior Design Project I
Students/teams select a project area, develop an understanding of the project scope that includes research and documentation of related work, prepare a feasibility study, develop project requirements, propose solutions and multiple designs, analyze proposed designs, and select a final proposed design, and prepare and present a preliminary design review (PDR). Students are expected to apply proper business and/or systems concepts and project management to their work. Additional components may be required in some projects. Students/teams submit a final report at the end of the semester. Pre-requisite: Senior standing. (3-0-3)

BUS-458 Senior Design Project II
This is the TBM/MCIT capstone course designed to challenge students as they work individually or in small teams on a real-world business/industry problem requiring technical expertise and management acumen. Drawing upon the course in technical report writing, students are required to submit a major report outlining and analyzing the problem and proposing management solutions. *Note: Course must be completed with a grade of "C" or higher to meet undergraduate graduation requirements. Prerequisites: BUS-400, BUS-410 and BUS-457. BUS-457 should be taken immediately before this course. (3-0-3)

BUS-460 Special Topics in Business

Research into business subjects. Student primarily works in a guided study format with a mentor. Permission required from the instructor and academic dean. This course may be repeated with different projects. Prerequisite: EN-102. (3-0-3)

CH-120 Chemistry
Metric system and significant figures; stoichiometry; fundamental concepts of atomic structure and its relationship to the periodic table; electron configuration; bonds and electronegativity; gases; oxidation states and redox; solutions, acids and bases, changes of state, thermodynamics,

chemical kinetics and equilibrium. Prerequisties: MA-114 (2-2-3)

CM-120 Intro to Construction Management
This course will introduce the basic history and management concepts of the construction industry to students with the expectation that upon completion students will have an overview of the industry. Career choices, industry firms, and key players in the Construction Management process will be explored. Prerequisite: None. (3-0-3)

CM-125 Construction Graphics and Plan Reading
This is an introductory course designed to prepare students to identify, read and interpret construction drawings. The course will be delivered from an applied perspective with an emphasis on understanding the processes involved in construction and interpreting them from drawings. Prerequisite: CM-120 (3-0-3)

CM-220 Construction Methods and Materials
This course focuses on vertical construction, emphasizing comprehensive analysis of materials, design and specifications, installation methods, testing and inspection, and appropriate construction methodology for application. Prerequisite: CM-120 and MA-114 (3-0-3)

CM-230 Estimating I
This course is an introduction to the classification of work from plans and specifications. The course covers discussion of the estimating function and review and applications of material quantity survey techniques used in estimating costs of construction projects. The course includes types of approximate and precise methods of estimating as well as the use of each method and related computer applications. Prerequisite: CM-125 (3-0-3)

CM-250 Legal Issues in Construction
The course is an overview of standard construction contracts traditionally used between contractors, owners, design professionals and subcontractors from a general contractor's point of view. Prerequisites: CM-220. (3-0-3)

CM-260 Statics and Strengths of Materials
This algebra-based course is the study of forces acting upon structural elements. Analytic and graphic methods are used to illustrate resultants and reactions, equilibrium, centroids and moments of inertia applied to static structures. Analysis includes stress, strain, axial loading, bending, and deflection of beams. Prerequisite: MA-112 and PH-201. (3-0-3)

CM-270 Safety Management
This course covers OSHA liability, general safety, hazard communication, fire, material handling, tools, welding, electricity, scaffolding, fall protection, cranes, heavy equipment, excavation, concrete, ladders and stairways, confined space entry, personal protective equipment, and health hazards. Prerequisite: CM-120 (3-0-3)

CM-301 Construction Project Management
This course covers construction procedures and administration processes using the latest construction management technologies and methods to explain typical project management functions and documentation. Prerequisites: CM-120, CM-125, CM-220, CM-230, CM-250, CM-260, CM-270. (3-0-3)

CM-330 Estimating II
This course covers pricing and bidding of construction work, including cost factors, labor and equipment, productivity factors, prices databases, job direct and indirect costs, methods of estimating time, materials, equipment, subcontractors' work, general expenses, and profit, bid preparations and submission, and computer applications. Prerequisite: CM-230 (3-0-3)

CM-350 Construction Planning and Scheduling
This course focuses on construction scheduling software with plans and specifications that will be used in planning a construction project from start to finish. Prerequisite: CM-330 (3-0-3)

CM-375 Mechanical and Electrical Construction
This course is an introduction to the basics of mechanical, electrical, plumbing and fire protection systems (MEP) in construction. This includes installation of systems and the necessary resources. Prerequisite: CM-220 (3-0-3)

CM-380 Environmental Systems
This course is a comprehensive overview of environmental impact of common construction processes; and, environmental/occupational hazards and liability associated with those processes. Prerequisites: CH-120, CM-120, CM-250, and PH-201

CM-450 Management of Field Operations
This course is intended to equip students with knowledge and skills required to successfully manage and support construction field operations. Knowledge areas include contract administration, project engineering, site superintendence, and other topics critical to field operations. (3-0-3)

CM-457 Internship in Construction Management

Successful completion of an approved internship is a graduation requirement. The internship program complements classroom learning by exposing students to various construction management functions on real-life projects. Prerequisite: None. This course is intended to equip students with knowledge and skills required to successfully manage and support construction field operations. Knowledge areas include contract administration, project engineering, site superintendence, and other topics critical to field operations. (3-0-3)

CM-458 Senior Design Project
The student proposes, designs, completes and construction management and critical infrastructure capstone project. Students write a report according to specifications and deliver an oral presentation for review. Prerequisite: Senior status

CRI-210 Critical Infrastructure I
This course will introduce participants to the key terms, policy, guidance, and preparedness efforts required to safeguard the Nation's critical infrastructure. Students will learn relevant policy and guidance, discuss the risk management framework, describe Federal critical infrastructure security and resilience and information sharing programs, and relate critical infrastructure programs to individual actions. Primary focus will be on incorporating Critical Infrastructure protection in to construction of facilities in six of the sixteen critical infrastructure sectors: chemical facilities, commercial (e.g., retail, entertainment, lodging), communications facilities, critical manufacturing facilities, dams, and energy facilities. Students will complete hands-on Critical Infrastructure projects related to the construction of those types of facilities. Prerequisite: None. (3-0-3)

CRI-310 Critical Infrastructure II
The national and economic security of the United States depends on the reliable functioning of critical infrastructure. This course examines collaboration efforts among the entities responsible for constructing physical and cybersecurity protection as well as the development of integrated risk management strategies for our Nation's critical infrastructure. Primary focus will be on incorporating Critical Infrastructure protection in to construction and renovation of facilities in five of the sixteen critical infrastructure sectors: Defense industrial facilities, emergency services facilities, financial services facilities, government facilities, and public healthcare facilities. Students will complete hands-on Critical Infrastructure projects related to the construction and renovation of those types of facilities. Prerequisite: CRI-210. (3-0-3)

CRI-410 Critical Infrastructure III
This course will explore how threats, vulnerabilities, and consequences determine risk as it relates to the protection of Critical Infrastructure. Primary focus will be on incorporating Critical Infrastructure protection in to construction of facilities in five of the sixteen critical infrastructure sectors: food and agriculture facilities, Information Technology facilities, nuclear facilities, transportation facilities, and water/wastewater facilities. Students will complete hands-on Critical Infrastructure projects related to the construction, hardening, and recovery of those types of facilities. Prerequisite: CRI-310. (3-0-3)

CS-100 Introduction to Programming Logic
This course will introduce students to the various techniques used in programming logic. The purpose of this course is to build baseline skills in the building of logic for procedural and object oriented programming with minimal coding but with an in-depth approach to design. This course is an excellent choice for programming beginners that want to obtain a good foundation to program in various languages using various programming approaches. (3-0-3)

CS-101 Intro to Programming Logic Lab
This course is a one credit lab for students enrolled in CS-100. Students will complete mini projects at the intermediate and advanced level in the lab based on CS-100 lecture concepts. Assignments are individual efforts.

CS-130 Intro to Programming Using Java
Introduces students to the discipline, methodologies, and techniques of software development. The emphasis is on developing essential programming skills, an understanding of object-oriented design and good software engineering practices using the Java programming language. Program constructs include selection, looping, arrays, graphical output of data, the use of the standard Java class library, and construction of simple user-defined classes. Programming projects are assigned as part of the homework requirements. Prerequisite: MA-110. MA-112 or MA114. (3-2-3)

CS-150 Introduction to Programming Using C
This introductory course in programming will enable students to understand how computers translate basic human instructions into machine executable applications. The language of choice for this course is C. The C syntax that will be covered includes functions; variables and memory allocations including pointer notation; conditional statements and looping. Students will also learn binary to hexadecimal and decimal conversions along with basic computer architecture. Memory management, data input output and file manipulations will be among some other topics discussed

and applied during this course. Prerequisite: MA-111 or MA-112 and CS-100. (3-2-3)

CS-200 Programming in C++
Students learn how to program in C++ using an object oriented approach. Design of classes and objects. Inheritance and polymorphism: Use of pointers and data structured based projects. Prerequisite CS-130 or CS-150. (2-2-3)

CS-220 Database Management

An overview of database systems, with an emphasis on relational databases. Terminology, basic analysis and design using Entity-Relationship diagrams and relational schemas. Database implementation, queries and updates in a modern relational database management system. An overview of database administration, transactions and concurrency. Data warehouses. Projects, which are assigned as homework, are implemented in Oracle. Prerequisite: A grade of C or better in CS-130 or CS-150. You may take this course and CS-130 concurrently. (3-0-3)

CS-225 Intermediate Java Programming

This course provides a deeper look into the Java language with a special emphasis on object oriented design. Topics include multidimensional arrays, inheritance, interfaces, polymorphism, graphical user interfaces, exception handling, I/O, multithreading and Java Database Connectivity (JDBC). Programming projects are assigned as homework. Prerequisite: CS-130 Corequisite: CS-220. Offered spring semester only. (3-0-3)

CS-230 Data Structures

Advance pointers and dynamic memory usage. Concepts of object-oriented design and programming. Includes classes, friend functions, templates, operator overloading, polymorphism, inheritance, exception handling, containers, iterators and the standard template library. Applications involve the use of simple data structures such as stacks, queues, linked lists and binary trees. Recursion, searching and sorting algorithms. The above concepts are implemented through a series of hands-on programming projects, all of which are completed as part of the homework requirements. Prerequisite: CS-225 or CS-200 or completion of CS-150 with a grade of A. Corequisite: MA-124. (3-0-3)

CS-250 Introduction to Network Programming Using C

An introductory network programming course using the C programming language. Students will be provided an overview of the principles of computer networks with a detailed look at the OSI reference model and the TCP/IP stack. The emphasis is on understanding UNIX interprocess communication and developing network programs using connectionless and connection-oriented sockets. Extensive programming assignments will include the development of client/server and peer-to-peer network applications. Prerequisites: CS-230. (2-2-3)

CS-300 Secure Coding
This course introduces the secure coding process including designing secure code, writing code that can withstand attacks, and security testing and auditing techniques to detect secure coding weaknesses. The course focuses on the security issues a programmer faces including, but not limited to, common code security weaknesses and modern security threats. The course explores core secure coding principles, strategies, coding techniques, and tools that aid programmers in developing more resilient and robust code. Students will develop and analyze C language code that demonstrates mastery of these secure coding principles. The course will also rely on industry standards and best practices such as SEI-CERT coding standards and OWASP top 10 web application security risks. Prerequisite: CS-250 (3-0-3)

CS-305 Android Application Development
Writing applications for mobile devices using the Android operating system. Installing and using the Android SDK. Creating GUI layouts, menus and dialog boxes. Graphics and event handling. Interfacing with built-in GPS, accelerometer, audio and video. User and file input and output. Web interfaces and sockets. Writing native applications. Debugging native applications from a host. Preparing an application for publication. High-level programming will be performed using Java and XML. Native programming will be performed in C/C++. Programming in ARM-7 assembly language will be introduced. Prerequisites: CS-225 or CS230. Some Unix/Linux experience is recommended. (3-0-3)

CS-310 Computer Algorithms
Mathematical fundamentals of algorithms and algorithmic techniques. Running Time Analysis of an algorithm. Searching, Sorting, and other techniques associated with retrieving information. Advanced Data structures such as Binary Search Trees and Heaps. Graph algorithms. Dynamic Programming (Knapsack, Floyd, DNA Algorithms, ..). Greedy algorithms (Coins, Scheduling, Huffman encoding, ..) . Course requires written programming assignments. Prerequisites: CS-230, MA-124 and MA-262. Offered spring semester only. (3-0-3)

CS-316 Intelligent Systems

Fundamental techniques and concepts of intelligent systems: tree searching techniques including recursive searches, minmax algorithms, heuristics, alpha beta pruning. Lisp and Prolog programming languages. Genetic and a priori algorithms. Homework and programming assignments. Prerequisites: CS-230. Offered spring semester only. (3-0-3)

CS-320 Database Administration
This course covers the tasks performed by a database administrator. Topics include database architecture, capacity and performance requirements, database creation, user management, transaction management, backup and recovery, security, performance tuning and other administrative functions. Students will work with a modern relational database management system. Prerequisite: CS-220 and CT152 (3-0-3)

CS-330 iPhone App Development
Introduction to objective C, the programming language used for iphone app development. Overview of the xcode development environment, including debugging tools, versioning tools, object library, object attributes tools. Object oriented programming using Objective C. Model-View-Controller architecture in xcode. Graphical User Interface library and components. File system on the iphone; SqlLite and the iphone. Students learn how to make a complete iphone app with significant functionality and industry-standard user interface from scratch. Security issues with iphone software development. Prerequisite: CS-150 and CS-230 (3-0-3)

CS-340 Game Programming Using 3D Graphics
Students learn how to build a game using the Unity game engine. Students learn how to use 2D and 3D graphics, sound files, and user driven programming to build a game using a game engine and a physics engine. Students learn how to use the Unity development environment, design a user interface, make scenes, retain persistent data, create and manage animation, collision detection, level management, use of game characters. Students learn how to create and code an end-to-end design of a playable game. Prerequisite: CS-230 and (CS-225 or CS-305 or CS-330). (3-0-3)

CS-341 3D Asset Creation
Students learn how to create 2D and 3D graphics and sound files for use in animation and game design. Prerequisites: CS-150 or CS-130. (2-0-2)

CS-351 Assembly Language Programming
This course introduces the student to assembly language, specifically which is used with the Intel 80x86 computer architecture. Topics include data representation, branching and looping, procedures, string operation, bit manipulation and macros. Secure coding techniques will be taught by exploring integer overflow and buffer overflow attacks. By learning how to write in assembly language, the student will better understand how programs are executed in a computer and how to optimize performance of programs written in high-level languages, such as C++. The student will be assigned programming projects as homework. Prerequisite: CS-130 or CS-150 (3-0-3)

CS-356 Dynamic Web Page Development
This course teaches the student how to generate dynamic web pages using data from a database. The course begins with an overview of the C# programming language and object-orientation. Using ASP.NET, this course explores the processing of web forms and controls, state management, validation and error handling, SQL database access and secure web site coding. Programming projects, including a group project, are assigned as part of the homework requirements. Prerequisites: CS-220 and CS225 or CS-230 and CS-200. (3-0-3)

CS-400 Special Topics in CS
Applications of computer science principles or research into computer science subjects. Student primarily works in a guided study format with a mentor. Permission required from the instructor and academic dean. This course may be repeated with different projects. (1-4)

CS-405 Introduction to Software Design with UML
Undergraduate version of CS-505. Object Oriented principals and concepts, classes, objects and interfaces; as well as inheritance, encapsulation, polymorphism and aggregation; Students will explore the Unified Process and Object Oriented software life cycle. CASE tools and iterative and incremental software development approaches are also covered. Advantages of Object Oriented design patterns are demonstrated. Prerequisite: CS-225 or CS-230 or CS-200. (3-0-3)

CS-406 Requirements and Resource Analysis
Requirements analysis is crucial to avoid failure of a system or project. The requirements should be well documented, measurable, verifiable, plausible to fulfill, easy to keep track of and precise. Students will learn to identify stakeholders and elucidate needed information from them to formulate software requirement specification agreements, as well as examine the resources and skill sets needed to support the requirements. Among the strategies studied will be: goal modeling, software

prototyping, and use case development. Prerequisite: CS-225 or CS-230 or CS-200

CS-407 Database Systems Implementation

This is an undergraduate version of the graduate database course CS-507. Emphasis on DBMS architecture and implementation issues such as storage structures, multidimensional index structures, query optimization, concurrency control and recovery, distributed processing, database security, and parallel database systems. Prerequisite: CS-220 or equivalent. (3-0-3)

CS-412 Design of Cloud Networks and Services

This course will help students understand the design and architecture of networks and network services that enable the delivery of business-grade cloud services. Students will understand how virtualized data-center infrastructure lays the groundwork for cloud-based services, automated self-service portals, how to classify cloud services and deployment models, and understand the actors in the cloud ecosystem. Students will review the elements, requirements, challenges, and opportunities associated with network services in the cloud, optimize data centers via network segmentation, virtualization-aware networks, virtual network services, and service overlays, and systematically secure cloud services. Students will learn about the crucial role of organizations such as Federal Risk and Authorization Management Program (FedRAMP), National Institute of Standards and Technology (NIST), Cloud Security Alliance (CSA), and the International Standards Organization (ISO) in creating standards. Students will be challenged with cutting edge hands on labs from leading cloud vendors and a major cloud project. Students will also learn about containerization and micro services. This course is appropriate for Computer Science, Engineering and Cyber Security majors. Pre-requisite: CS-418 or instructor permission. (3-0-3)

CS-418 Operating Systems

Principles underlying computer operating systems are presented from a computer designer's perspective. Concepts explained include process concurrency, synchronization, resource management, input/output scheduling, job and process scheduling, scheduling policies, deadlock, semaphore, consumer/producer relationship, storage management (real storage management policies in a multiprogramming environment), virtual memory management (segmentation and paging), secure memory management, access control lists and kernal protection. An overview of contemporary operating systems with these principles. Students program in a high-level language. Projects are assigned as part of the homework requirements. Prerequisites: CS-150, CT-152, CS-230 and senior status. (3-0-3)

CS-430 Game Programming on iPhone Platform

Students learn how to develop a game on the iPhone/iPad portable. Students learn the xcode development environment and use the Model-View-Controller architecture. Students will learn animation of objects, control of characters, collision avoidance and tracking the state of a game. Real world projects will be assigned as part of requirements. Prerequisite: CS-230. (3-0-3)

CS-431 Graphics and Game Programming

Students learn how to develop and build a game using an industry-standard game engine such as Unity. Students learn how to use 2D and 3D graphics, sound files, and user driven programming to build a 3D game. Students learn how to design and build a scene, manage game characters, manage game levels, manage and store game data. Prerequisite: CS-230 and PH-201 or PH-261. (2-2-3)

CS-432 Computer Graphics

Discussion of some basic types of computer graphic devices. Graphics and text modes, point plotting and line drawing, area filling image array plotting, mathematics and generation off two and three-dimensional translations. Rotations, scaling, reflections, orthogonal and perspective transformations. Projects are assigned as part of the homework requirements. Prerequisite: MA-330 and either CS-230 or CS-225. Offered on demand. (3-0-3)

CS-452 Agile Methods for Software Engineering

Modern alternatives to traditional software engineering project management which promote collaboration between self-organizing/cross-functional teams, adaptive planning, evolutionary development, early delivery, and continuous improvement. Students will explore several popular agile processes and frameworks which may include some of the following, amongst others: Adaptive Software Development, Agile Unified Process, Crystal Clear Methods, Extreme programming, Lean, Scrum. Benefits and pitfalls of this approach as compared to more traditional models will be discussed. Prerequisite: CS-225 or CS-230 or CS-200

CS-457 Senior Design Project I

Students/teams select a project, develop an understanding of the project scope that includes research and documentation of related work, prepare a feasibility study, develop project requirements (constraints) and engineering, software, and/or security specifications, propose solutions and multiple designs, analyze proposed designs, and select a final proposed design, and prepare

and present a preliminary design review (PDR). Students are expected to apply proper systems engineering and project management to their work. Additional components may be required in some projects. Students/teams submit a final report at the end of the semester. Pre-requisite: Senior standing. (3-0-3)

CS-458 Senior Design Project II
Students/teams build and test their selected designs (completed in 457). Each student team delivers a tested prototype and defends its project in front of a panel of experts. Students/teams submit a final report that includes description of the design, realization, and test processes as well as test results, discussion, and conclusion. Failure to deliver a completed design and a working prototype that meets engineering, software, and/or security specifications by the end of the semester may result in failing the course. *Note: Course must be completed with a grade of "C" or higher to meet undergraduate graduation requirements. Prerequsite: CS-457 (3-0-3)

CS-504 Theory of Computation
An investigation into the fundamental ideas and models underlying computing. Automata languages, determinism, Chomsky hierarchy, computability, Turing machines, Church's Thesis, complexity, NP-completeness, intractability. (Offered as a full semester course.) (3)

CS-505 Software Design with UML
Object Oriented principals and concepts, such as classes, objects and interfaces; as well as inheritance, encapsulation, polymorphism and aggregation; etc. Students will explore the Unified Process and Object Oriented software life cycle. CASE tools and iterative and incremental software development approaches are also covered. Advantages of Object Oriented design patterns are demonstrated. (3)

CS-506 Requirements and Resource Analysis
Requirements analysis is crucial to avoid failure of a system or project. The requirements should be well documented, measurable, verifiable, plausible to fulfill, easy to keep track of and precise. Students will learn to identify stakeholders and elucidate needed information from them to formulate software requirement specification agreements. They will learn how to perform goal modeling, software prototyping, and use case development, so that they can identify and document Architectural Requirements, Structural Requirements, Behavioral Requirements, Functional Requirements, Performance Requirements, and Derived Requirements, amongst others. They will also examine the resources and skill sets needed to support the requirements. (3)

CS-507 Database Systems Implementation
The course introduces DBMS (Database Management System) architecture and implementation issues such as storage structures, multidimensional index structures, concurrent access, data warehousing, and business intelligence. NoSQL concepts, including MongoDB are also introduced. (3)

CS-510 Algorithms
Mathematical fundamentals of algorithms and algorithmic techniques. Running Time Analysis of an algorithm. Searching, Sorting, and other techniques associated with retrieving information. Advanced Data structures such as Binary Search Trees and Heaps. Graph algorithms. Dynamic Programming (Knapsack, Floyd, DNA Algorithms...). Greedy algorithms (Coins, Scheduling, Huffman encoding...). Course requires written programming assignments. (3)

CS-511 Numerical Methods
This course introduces numerical methods and statistics as a discipline of analyzing data i.e. estimating errors, modeling relationships between two or more variables, interpretation of the results. Concepts of machine learning and big data analytics will be introduced. Students will use industry standard tools like R and SAS. (3)

CS-512 Computer Language Design
Using parsers and code generation techniques to fashion new mini-languages that can be used to creatively modify the interface between a user and the computer. Topics include language design; grammars; regular expression grammars; parsers and parser construction; parsing expressions; tokenizing; assemblers; engines vs. interpreters; logic, query and imperative language parsers and assemblers. (3)

CS-513 Gaming Theory-Real-Time 3D Graphics
The growing importance of virtual realities in training, scientific modeling, and communication comes on the heels of increasing processor capabilities, new innovations in hardware, increasingly sophisticated programming languages, and advanced math-based modeling techniques. Real-time 3D graphics are at the leading edge of these developments. Topics include mathematical foundations and modeling techniques, mapping, anti-aliasing, real-time rendering, Binary Space Partition Trees, object control issues. Uses C++ and the OpenGL graphics interface. (Offered as a full semester course.) (3)

CS-520 Database Management
An overview of database systems, with an emphasis on relational databases. Terminology, basic

analysis and design using Entity-Relationship diagrams and relational schemas. Database implementation, queries and updates in a modern relational database management system. An overview of database administration, transactions and concurrency. Data warehouses. Projects, which are assigned as homework, are implemented in Oracle. Note: This is not an acceptable elective for any master level degree. Corequisite: CS-530 (3)

CS-524 Discrete Mathematics
Logic sets and sequences; algorithms, divisibility and matrices; proof, induction and recursion; counting methods and probability; relations, closure and equivalence relations, graphs and trees; Boolean algebra (3)

CS-530 Object Oriented Programming
Introduces students to the discipline, methodologies, and techniques of software development. The emphasis is on developing essential programming skills, and understanding of object-oriented design and good software engineering practices using the Java programming language. Program constructs include selection, looping, arrays, graphical output of data, the use of the standard Java class library and construction of simple user-defined classes. Programming projects are assigned as part of the homework requirements. (3)

CS-531 Data Structures
Advanced pointers and dynamic memory usage. Concepts of object-oriented design and programming. Includes classes, friend functions, templates, operator overloading, polymorphism, inheritance, exception handling, containers, iterators and the standard template library. Applications involve the use of simple data structures such as stacks, queues, linked lists and binary trees. Recursion, searching and sorting algorithms. The above concepts are implemented through a series of hands-on programming projects, all of which are completed as part of the homework requirements. Prerequisite: CS-530, Corequisite: CS-524 (3)

CS-551 Software Valid & Integ/Version Ctrl
This course covers the concepts and methodologies required for software testing and deployment. Topics include unit testing, module testing, subsystem and system level testing; coverage criteria, manual and automated techniques for test validation and data generation; formal testing processes and standards; black box vs. white box testing; functional testing; and testability analysis. Students will also learn to use profilers, practice advanced features of popular debugging tools, learn to use version control software such as SVN and GIT, and build tools like Ant, Maven and Gradle. (3)

CS-552 Agile Methods for Software Eng.
Agile is an alternative to the traditional waterfall approach discussed in other software engineering courses. Its key principals include: active user involvement in the design process, empowering the development team to make decisions, allowing requirements to evolve while keeping the timescale fixed, iterating with small/incremental releases, testing early and often, and high degree of collaboration between all stakeholders. Students will explore several popular agile processes and frameworks which may include some of the following, amongst others: Adaptive Software Development, Agile Unified Process, Crystal Clear Methods, Extreme programming, Lean, Scrum. Benefits and pitfalls of this approach as compared to more traditional models will be discussed. (3)

CS-575 Secure Coding
This course introduces the secure coding process including designing secure code, writing code that can withstand attacks, and security testing and auditing techniques to detect secure coding weaknesses. The course focuses on the security issues a programmer faces including, but not limited to, common code security weaknesses and modern security threats. The course explores core secure coding principles, strategies, coding techniques, and tools that aid programmers in developing more resilient and robust code. Students will develop and analyze C language code that demonstrates mastery of these secure coding principles. The course will also rely on industry standards and best practices such as SEI-CERT coding standards and OWASP top 10 web application security risks. Prerequisite: Permission for graduate students. (3)

CS-610 Machine Learning and Neural Networks
B Basics of neural network computing, important neural network models such as Adaline, Perceptron, back propagation, self-organizing maps, Hopfield nets. Analysis and limitations of neural networks; programming neural networks using OOP. CS-511 recommended. (3)

CS-620 Operating System Principles for IA
This course is an overview of the UNIX operating system. The content will include shell programming, process management, processor management, storage management, scheduling algorithms, resource protection and system programming. The course will include programming projects focused on Information Assurance problem solving utilizing the C programming language primarily.Students are expected to be familiar with virtual machines, the UNIX command line and a basic programming language. Basic knowledge of C programming and UNIX helpful. (3) Note: This

course is not an approved elective for the MSCS program.

CS-701 Designing Intelligent Systems

The artificial intelligence revival of the late 1980s has produced many new and innovative approaches to the creation of intelligent systems. Such systems permeate today's computer environment supporting everything from computer games to autonomous robotic systems and intelligent agents. The focus of this course will vary over time. Topics include knowledge representation and rule-based systems, fuzzy-logic systems, learning systems such as artificial neural networks and genetic algorithms, genetic programming and evolutionary computing, hybrid intelligent systems, and intelligent agents. (3)

CS-705 Multi-threaded and Distributed Program

Modern applications such as GUI interfaces use multithreaded programming to achieve responsiveness and to make efficient use of computer resources. In addition, the Internet has made distributed programming an integral part of almost every computing system. In today's world programmers and computer professionals must understand the principles underlying both these paradigms. Topics include concepts and applications of multithreaded and distributed programs. Process interaction using shared variables and message passing; systematic development of correct programs; general problem solving techniques; scientific computing; distributed systems. (3)

CS-710 Big Data Warehousing and Analytic Systems

This advanced course will equip the student with the necessary skills to solve complex problems and design solutions using Big Data. The student will be able to gain an understanding of how to design databases to manage large volumes of data, and how that data can be analyzed and translated into meaningful results. The student will be introduced to the field of Analytics, gain an understanding of Enterprise Data Warehousing models, be introduced to Data Mining techniques and tools used for mining the data warehouse, and build specific Data Marts. The student will be introduced to predictive analysis, and will be expected to develop models to extract data, perform trend analysis, establish patterns, and make projections. CS-511 recommended. (3)

CS-712 Research Methods

This is part one of a two course sequence in research and writing. In part one, students work to identify a research topic and, as initial research begins, they investigate the requirements for maintaining a research journal, writing a research paper, and presenting a research paper. (3)

CS-713 Design of Cloud Networks and Services

This course will help students understand the design and architecture of networks and network services that enable the delivery of business-grade cloud services. Students will understand how virtualized data-center infrastructure lays the groundwork for cloud-based services, automated self-service portals, how to classify cloud services and deployment models, and understand the actors in the cloud ecosystem. Students will review the elements, requirements, challenges, and opportunities associated with network services in the cloud, optimize data centers via network segmentation, virtualization-aware networks, virtual network services, and service overlays, and systematically secure cloud services. Students will learn about the crucial role of organizations such as Federal Risk and Authorization Management Program (FedRAMP), National Institute of Standards and Technology (NIST), Cloud Security Alliance (CSA), and the International Standards Organization (ISO) in creating standards. Students will be challenged with cutting edge hands on labs from leading cloud vendors and a major cloud project. Students will also learn about containerization and micro services. This course is appropriate for Computer Science, Engineering and Cyber Security majors. Prerequisite: instructor permission. (3)

CS-714 Computer Science Seminar

This is part two of a two course sequence in research and writing. The course is in graduate seminar format. Students integrate prior course work and personal experiences into researching an approved topic to produce a project-based paper. Prerequisite: completion of at least 18 credit hours of graduate coursework. (3)

CS-755 Intro to Python Programming

The Python programming course will assist students with their understanding of the application, programming, and analytical use of Python as a means to making intelligent decisions based on the results of pulling and parsing through big data. Python is typically used for sorting and analyzing large data files and evaluating online sites to illustrate the larger issue of any type of research project or study. The fast pace of never ending digitalized data and emerging technology research makes Python programming language the ideal resource for collecting and presenting such vast amounts of data in a sensible and easy to understand format. (3)

CSH-410 Honors Seminar in Neural Networks

Basics of neural network computing, important neural network models such as Adaline, Perceptron, back propagation, self-organizing maps,

Hopfield nets. Analysis and limitations of neural networks; programming neural networks using OOP. Prerequisites: MA-261. CS-130 or CS-225 with grade of B or better; Junior or Senior status; Good programming skills, knowledge of matrices and some calculus. (3-0-3)

CSP-101 Introduction to Engineering Methods I

Students are introduced to MATLAB. Using MATLAB to do calculations, solving systems of equations. Using data for data analysis statistics, graphing with applications in engineering. Special focus on trig and advanced trig functions, precalculus. Prerequisite placement exam. (2-2-3)

CSP-102 Introduction to Engineering Methods II

Students are introduced to MATLAB. Using MATLAB to do calculations, solving systems of equations. Using data for data analysis statistics, graphing with applications in engineering. Introduction to C++, classes and objects, CGI programming, Graphics and GUI's. Prerequisite placement exam. (2-2-3)

CT-102 Introduction to Internet Applications

Introduces students to dynamic HTML Web pages, designed using tables,style sheets, cascading style sheets (CSS), images, and dynamic images, with emphasis on page layout, navigation bars and forms. Scripting languages are used to enhance Web page features. Graphic, video and audio file standards, such as GIF, TIF, JPEG, WAV and MIDI are discussed. SGML and XML are defined, and role of XML in enabling the communication of data between disparate applications is discussed. Students are required to complete assignments as part of the homework requirements. (3-0-3)

CT-152 Introduction to UNIX

Unix file and operating system. Understanding multi-user and multitasking concepts. Editors, X-windows, Awk, email, Internet commands, shell commands and shell scripts. Projects, which provide practical experience, are completed as part of the homework requirements. Prerequisite: CS-100. (3-0-3)

CT-201 Multimedia Applications

Use online and resident window tools to create, edit and enhance text, audio, and video for multimedia applications, including multimedia Web pages and presentations. Study the philosophy, aesthetics and theory behind the layout, construction and display of multimedia material. Flash projects that include drawing, painting tools, color animation, buttons and actionscript are completed as part of the homework requirements. Prerequisite: CT-102 or equivalent. (3-0-3)

CT-206 Scripting Languages

Introduces students to the use of scripting and the scripting languages of Perl and Python. The class will cover the use of scripting to solve short problems, automate routine tasks, integrate across pieces of software, and prototype code ideas. The merits of code-complete design versus on-the-fly coding as well as coding and code documentation styles will be discussed. Tasks involving input/out, regular expressions, and file operations are included. Students are expected to fully script solutions for real-world tasks assigned as part of the course. Prerequisites: CS-130 or permission of instructor. (3-0-3)

CT-240 Internetworking with Routers/Switches

Configuring routers and switches to build multiprotocol internetworks. OSI reference model, basic LAN and WAN design, dial access services, TCP/IP protocol suites, IP addressing, subnetting, static and dynamic routing, WAN technologies such as HDLC, PPP, Frame Relay, ATM and ISDN. Prerequisites: NT-150 or professor approval. (2-2-3)

CT-376 Javascript

This course introduces the student to client-side web programming. Students learn javascript. Topics include programming fundamentals using javascript, functions, event handlers, how to create and use javascript libraries. Labs include how to use the prototype and scriptaculous libraries for visual effects. Use of google maps from a programmer's perspective. Debugging of javascript code. Other topics include CSS style sheets, XML,. JSON and AJAX. Programming projects are assigned as part of the homework requirements. Prerequisites: CS-130. (2-2-3)

CT-406 Web Programming Languages

This course will explore how to make a dynamic website using Enterprise Java frameworks, which may include: Java Servlets, Java Server Pages, Java Server Faces, Web Services, Java Persistence API, among others. Students will use the Model-View-Controller design pattern to produce N-tier applications. These applications will be build on top of a modern Web Server and Relational Database Management System. Prerequisites: CS-220 and CS-225 or CS-200 or CS-230. (3-0-3)

CT-451 Special Topics

S Students research current trends in telecommunications and emerging technologies. Oral presentation required. Prerequisite: Senior status. (3-0-3)

DSM-802 Fundamentals of Doctoral Learning

Students of doctoral level programs are taught the ability to create knowledge through original research in their areas of specialization. This

course will orient new doctoral students to learning, researching, and writing, and prepare them for the entire program of study. Students will be introduced to critical thinking skills necessary for doctoral research. Students will be introduced to the standards of ethical research. (6)

DSM-905 Organizational Change & Information Systems

Information systems represent a critical resource to organizations; yet, there are many unknowns about how to successfully design and implement those systems and many firms today continue struggle with the deployment process. This seminar explores issues associated with the implementation of information systems in organizations – including requirements analysis, project management, outsourcing, and virtual teams – using a variety of theoretical or conceptual lenses such as control and coordination, organizational change, and trust. The emphasis of this course is on understanding Information Systems implementation from an organizational perspective.(3)

DSM-910 Analytics and Decision Analytics

Course focus is predominantly on prescriptive analytics with some parts focused on predictive analytics. Topics include operations research techniques and their application to decision making such as mathematical optimization, networks modeling, stochastic modeling, and multi-objective modeling. Other topics such as PERT, CPM, computer simulation, decision analysis using decision trees and quantitative value functions, and heuristic methods are covered, as well as use of contemporary computer software for problem solving. In particular, the course will extensively use MS Excel for solving the decision-making problems. Case-study approach to problem solving is used. Prerequisite: DSM-802 (3)

DSM-915 Applied Statistics for Analysis

Introduces multivariate regression and random forests for modeling data. Addresses data access, variable selection and model diagnostics. Introduces foundations for visual thinking. Reviews common statistical graphics such as dot plots, box plots, q-q plots. Addresses more advanced methods such as scatterplot matrices enhanced by smoothed or density contours, and search tools for finding graphics with suggestive patterns. Course will introduce R software for analysis. A final project will involve visualization of a real data set. Prerequisite: Undergraduate statistics. (3)

DSM-920 Big Data Warehousing and Analytic Systems

This course will equip the student with the necessary skills to solve complex problems and design solutions using Big Data. The student will be able to gain an understanding of how to design databases to manage large volumes of data from multiple sources, and how that data can be analyzed and translated into meaningful results. The student will be introduced to the field of Analytics, gain an understanding of Enterprise Data Warehousing models, be introduced to Data Mining techniques and tools used for mining the data warehouse, and build specific Data Marts. The student will be introduced to predictive analysis, and will be expected to develop models to extract data, perform trend analysis, establish patterns, and make projections. Prerequisites: Ability to use Structured Query Language with a basic relational database system; ability to read pseudo code, and understand basic data structures like arrays; and, an understanding of algebra and basic probability and statistics would be helpful, though not required. Prerequisite: DSM-915

DSM-929 Strategic Management

This course introduces strategy as a key function of management and leadership. Students will explore strategy from both the theoretical and practical vantage points. Students will be introduced to a variety of literature that serves as a foundation for developing a sound understanding of the strategy-related dilemmas that leaders face.

DSM 945 Optimization Techniques for Management Decisions

This course seeks to enable the students to develop the ethical leadership strategies and communication skills needed to motivate and mobilize co-workers so all can achieve core business goals. The theoretical framework for the course will be drawn from histories' great military and political leaders. The practice will involve the participants in competing and cooperating with their peers to maximize development of the resources their unit needs to grow and succeed. The exercises will enhance negotiation skills and self-insights into each participant's ethical world view. (3)

DSM 955 Introduction to Python Programming

The Python programming course will assist students with their understanding of the application, programming, and analytical use of Python as a means to making intelligent decisions based on the results of pulling and parsing through big data. Python is typically used for sorting and analyzing large data files and evaluating online sites to illustrate the larger issue of any type of research project or study. The fast pace of never ending digitalized data and emerging technology research makes Python programming language the ideal resource for collecting and presenting such vast

amounts of data in a sensible and easy to understand format. (3)

DSR-881 Special Topics in Research
This course provides students the opportunity to examine in-depth issues relevant to their research. This course may result in a publishable paper. (3)

DSR-882 Special Topics in Research II
This course provides students the opportunity to examine in-depth issues relevant to their research. This course may result in a publishable paper. (3)

DSR-883 Special Topics in Research III
This course provides students the opportunity to examine in-depth issues relevant to their research. This course may result in a publishable paper. (3)

DSR-884 Special Topics in Research IV
This course provides students the opportunity to examine in-depth issues relevant to their research. This course may result in a publishable paper. (3)

DSR-900 Writing the Doctoral Dissertation
Students work individually with the dissertation mentor to complete the dissertation proposal and prepare for the competency examination. Prerequisite: DSR-925. (3)

DSR-925 Dissertation Preparation I

(Residency) Students will generate significant portions of the dissertation proposal and receive faculty feedback on completed sections. Prerequisite: RSC-812. (3)

DSR-930 Management and Security Information
The goal of this course is to provide an overview of the multi-faceted, global, and interdisciplinary field of security management. It takes a ?view from the top and presents future managers need to know about information security. The material covered addresses the managerial aspects of information security for future managers. Examples of information security issues and practices implemented in today's business environment are presented and skills reinforced as they are learned through hands-on activities and a real world case project. The course features numerous examples and case studies specific to security management, identifies specific security applications and examines the issues encountered within those areas. Prerequisite: DSM-920; RSC-815 (3) RESIDENCY Students will also have the opportunity receive guidance from faculty mentors in both the group and one-on-one environment in the development of the dissertation proposal.

DSR-935 Dissertation Preparation II

Students complete the dissertation milestones developed by the student and the mentor. Students who are not prepared to defend after completing DSR-935 must enroll in DSR-940. Prerequisite: DSR-900. (3)

DSR-940 Proposal Writing I

This course focuses on completion of chapters one and two.(3)

DSR-941 Proposal Writing II

This course focuses on completion of chapters two and three. (3)

DSR-942 Proposal Writing III

This course focuses on submission of proposal to IRB and ARB. (3)

DSR-945 Dissertation Presentation
Assists students through the proposal and dissertation writing processes. Prerequisite: DSR-930 (3)

DSR-946 Dissertation Presentation II
Assists students through the proposal and dissertation writing processes. Prerequisite: DSR-930 (3)

DSR-947 Dissertation Presentation III
Assists students through the proposal and dissertation writing processes. Prerequisite: DSR-930 (3)

DSR-950 Dissertation Presentation and Oral Defense

Learners prepare the dissertation for publication. Learner research is examined through an oral defense. Prerequisite:: DSR-935. (3)

DSR-960 Dissertation Preparation and Oral Defense
Learners prepare the dissertation for publication. Learner research is examined through an oral defense. (3)

EE-159 Circuit Theory
Network analysis, mesh analysis, nodal analysis, Thevenin, Norton, superposition, reciprocity, capacitors, inductors, RC circuits, RL circuits, RLC circuits. Steady state and transient conditions involving RC time constants, RL time constants. AC circuit analysis involving sine waves, phasors, reactance, impedance in series circuits, parallel circuits, and series-parallel circuits. Thevenin, Norton, network theorems. Power, effective power, resonance and filter circuits. Prerequisite: MA-114. Students who have taken EL-100 and EL-150 may not take this course for credit. (3-2-4)

EE-300 Power Supply and Regulator Design
Design and analysis of power supplies and regulators. Includes special adjustable and fixed voltage regulator ICs, three-pin regulators, switch-mode supplies. DC to DC convertors. Supply topologies, power handling, current limiting methods. Prerequisites: EL-250 and MA-261. (2-2-3)

EE-300 Digital Design I
Minimization of Boolean functions using Kamaugh Maps and Quine-McCluskey Tabulation. Multilevel circuits: PLAs, PALs, gate arrays. Combinational logic design with MSI LSI. Chip count reduction. Sequential circuit analysis and design. State tables and state diagrams. Asynchronous circuit design. Introduction to PAL design software. Students design, simulate and build circuits. Design using programmable devices. Prerequisite: EL-204. (2-2-3)

EE-309 Circuit Design and Simulation

An advanced circuit analysis course that introduces students to computer-aided electronics packages and automated design. Students design and analyze circuits both mathematically and with computer simulation. Students build the circuits and compare predicted results with measured results obtained in the laboratory. Prerequisites: MA-261 and EL-250 or equivalent. (2-2-3)

EE-353 Power System Engineering
Fundamentals of power transmission and electric motors. Single versus three-phase, poly-phase systems, synchronous, asynchronous machines. DC and compound DC motors, induction motors. Equivalent circuit modeling of motors. Start-up conditions. Transformers, Transmission of Electrical Energy, Energy Distribution and Harmonics. Prerequisites: EL-150 or EE-159 and MA-261. (3-0-3)

EE-354 Digital Design II

Continuation of Digital Design I. Students explore larger-scale digital arithmetic and logic development using VHDL and a current FPGA development board. Students design and build circuits according to design objectives in two parts: students design, compile and verify their circuits using timing simulation on computers; then build and test circuits for upload to an FPGA. Final project involves design, assembly and testing of a VHDL-based system. Prerequisite: EE-304. Offered during spring semester only. (2-2-3)

EE-359 High Frequency Circuit Design
Students are taught to design, build and test microwave amplifiers using S-parameters and Smith Charts in conjunction with modern circuit design and simulation software. Both bipolar and field effect transistors are used to design amplifiers to specifications regarding signal flow gain, noise figure and intercept point. Students fabricate microstrip circuit boards using an in-house milling machine and then test the completed amplifiers in the laboratory. Actual and simulated results are presented. Prerequisite: EE-309. (2-2-3)

EE-362 Microcontroller System Design

Study of a state of the art microcontroller and related families. Evaluation board hardware preparation and checkout. PC to board interfaces. Assembler and C-compiler. Configuration registers for code and program protection. On-chip memories. Serial peripheral interface and parallel I/O routines. A/D converter, real-time interrupts and timer applications. A series of three group projects are required leading up to a final stand-alone project. Prerequisite: EL-262 or microcomputer, micro-assembly background. (2-2-3)

EE-364 Computer Architecture

Design and architecture of modern computers. System components: processor, memory and interfaces. Instruction sets and operations. Reduced instruction sets (RISC) and RISC architecture. Processor design to support RISC instruction set. Evolution to parallel processing and multiprocessing. Prerequisite: EL-204. Offered during spring semester only. (2-2-3)

EE-382 Robotic Systems

An introduction to the design and control of autonomous robots. Mechanical considerations and review. Interfacing issues and programming. Sensors for perception and environmental detection and navigational ability. Students will develop algorithms and use machine learning techniques to generate programs to control electromechanical systems to perform tasks. Team based projects and laboratories. Prerequisites: EL-262. (2-2-3)

EE-400 Special Projects in Engineering
Application of engineering principles of research into a special project. Projects vary from semester to semester. Students primarily work in a guided study environment with a faculty mentor. Prerequisites: permission of instructor and department chair and at least junior standing. This course may be repeated with different projects. (1-4-3)

EE-403 Environment/Renewable Energy Systems
Teaches the students theory and practice for direct production of electricity from alternate energy sources such as solar, wind and geothermal. Course material includes characteristics of direct energy conversion, and storage devices used in alternate energy sources. Impact of solar

heating and lighting on building design is also introduced. Concepts of engineering economics are discussed as well. This course will expose students to concepts applied in electrical, civil and mechanical engineering and architecture. Prerequisite: Senior status. (3-0-3)

EE-404 Large-Scale Digital Design

Analysis and modeling of digital systems, VLSI, VHDL timing, objects and classes. VHDL-based design processes, concurrent and sequential assignments. Variable modes and operators, entities and architectures, behavioral descriptions. Dataflow, synchronous and asynchronous processes using procedures and sub-functions. Library support packages and generation of test-bench data. Prerequisite: EE-354. Offered during fall semester only. (2-2-3)

EE-406 Signals and Systems

Mathematical models, systems, signal classifications, I/O differential and difference equations, block diagram realizations, discrete-time systems. Convolutions: discrete-time and continuous-time. The Z-transform in linear discrete-time systems, transfer functions. Trigonometric Fourier series, polar and rectangular forms, odd/even functions, response of a linear system to periodic input. Fourier transform, symmetry properties, transform theorems, linear filtering, modulation theorem. Laplace and Fourier transforms and their properties. Prerequisite: MA-262 and MA-340. Offered during fall semester only. (3-0-3)

EE-409 Network Analysis and Synthesis

Comparison of analysis and synthesis. Transfer function and frequency response: phase and time delay. Familiarization with complex impedance and admittance functions. Active filter design: bandpass, bandreject, FDNR and gyrator. Impedance evaluation: Foster I, Foster II, Cauer I and Cauer II. Synthesis of Butterworth and Chebyshev filters. Sensitivity of networks to parameter changes. Prerequisite: EE-309 (2-2-3)

EE-415 Microwave Theory and Devices

Waveguide theory: modes of operation. Waveguide components: tuners, windows, sifters, tees and couplers, filters, mixers, isolators, circulators. Microwave tubes. Klystrons: multicavity and reflex. Magnetron, traveling wave tubes, backward wave oscillators, amplifier techniques, microwave semiconductors: operations and applications. Microwave measurement techniques. Prerequisite: MA-340 and PH-262. Offered during fall semester only. (2-2-3)

EE-419 Electrostatics

Stationary electric and magnetic fields. Gauss's Law, Laplace and Poisson's equations. Solutions to static field problems. Ampere's Law, Faraday's Law. Prerequisites: PH-263 and MA-340. Offered during fall semester only. (3-0-3)

EE-452 Advanced Microcontroller System Design

Extension of EE-362. Project course utilizing commercially available microcontroller EVB boards. Fuzzy logic introduction. Programming using fuzzy logic rules and high performance design techniques. Students design, select, build, and generate code for microcontroller-based systems. Prototypes are evaluated and debugged before final assembly. Written report and oral presentation required. Prerequisite: EE-362. Offered spring semester only. (1-4-3)

EE-453 Control I

Introductory concepts. Feedback control systems and derivation of transfer function. System response for undamped and damped systems. Testing for system stability, coefficient test, Routh-Hurwitz technique. System performance, system types, steady state error and error coefficients calculation. Design of compensator. System bode plots, crossover frequencies, gain and phase margins. The course will stress use of a variety of famous industrial computer-aided control system design software packages. Prerequisite: MA-340 (2-2-3)

EE-456 Digital Signal Processing

Discrete-time methods applied to continuous-time processes. Use of Z, fast-Fourier and discrete transforms. Design methods for digital filters. Digital filter software packages introduced. Prerequisite: EE-406. Offered during spring semester only. (2-2-3)

EE-457 Senior Design Project I

Students/teams select a project, develop an understanding of the project scope that includes research and documentation of related work, prepare a feasibility study, develop project requirements (constraints) and engineering, software, and/or security specifications, propose solutions and multiple designs, analyze proposed designs, and select a final proposed design, and prepare and present a preliminary design review (PDR). Students are expected to apply proper systems engineering and project management to their work. Additional components may be required in some projects. Students/teams submit a final

report at the end of the semester. Pre-requisite: Senior standing. (3-0-3)

EE-458 Senior Design Project II

Students/teams build and test their selected designs (completed in 457). Each student team delivers a tested prototype and defends its project in front of a panel of experts. Students/teams submit a final report that includes description of the design, realization, and test processes as well as test results, discussion, and conclusion. Failure to deliver a completed design and a working prototype that meets engineering, software, and/or security specifications by the end of the semester may result in failing the course. *Note: Course must be completed with a grade of "C" or higher to meet undergraduate graduation requirements. Prerequsite: EE-457 (3-0-3)

EE-459 Electromagnetic Field Theory

Continuation of EE-419. Time-varying electric and magnetic fields. Boundary conditions. Maxwell's equations and applications to wave phenomena. Relation of classical circuit theory to Maxwell's equations. Prerequisites: PH-263 and MA-340 Offered during spring semester only. (3-0-3)

EE-460 Electromagnetic Fields

Stationary electric and magnetic fields. Gauss's Law, Laplace and Poisson's equations. Solutions to static field problems. Ampere's Law, Faraday's Law. Time-varying electric and magnetic fields. Boundary conditions. Maxwell's equations and applications to wave phenomena. Prerequisites: PH-263 and MA-340. (3-0-3)

EE-461 Communications Theory

Fourier analysis. Signal and spectral analysis of AM and FM systems. Noise representations; power spectral density and quadrate decomposition. Signal-to-noise improvement in AM and FM demodulators. Maximum likelihood digital signal detection. Signal space representation of modulated signals. Modulated signal detection and bit-error rate calculations for OOK, BPSK, QPSK, QAM, M-ary PSK and M-ary FSK. Prerequisites: EL-261 and MA-345. (3-0-3)

EE-463 Control II

Introduction to state diagrams and state equations. Solutions of state equations for simple systems. Root-locus techniques, compensation, optimization of stability and error. Multiparameter root locus. Nyquist criterion and time domain design. System performance indexes: ISE, IAE, ITAE and ITSE. Modern control engineering: state variable methods, controllable and observable/estimator, observer design and design of optimal control system. Prerequisites: EE-453. Offered during spring semester only. (3-0-3)

EE-500 Advanced Signals and Systems

Signal representation using step and impulse functions. Differential equation description of linear systems and classical solutions. Laplace transforms in linear systems. Trigonometric and complex exponential Fourier series. Fourier transforms. Parseval's theorems. State-variable equations and solutions. The sampling theorem and the Nyquist criterion. Using Z-transforms to represent and analyze sampled data systems. (3)

EE-600 Mathematical Analysis

Advanced mathematics for scientists and engineers as either a review or an advanced introduction. Differential equations, Laplace transforms, linear algebra, vector analysis, introduction to tensor analysis, complex variables and probability. Many calculation techniques using MATLAB are introduced. Projects are performed using MATLAB and Simulink. Offered during fall semester. (3)

EE-601 Modern Circuit Design and Simulation

A A study of the various SPICE based software tools used by engineers to design and simulate circuits. Analog, digital and mixed simulation. Component selection and modeling use of libraries and customizing components and models. Students design and calculate theoretical results and compare results to simulations. Students will be required to obtain software for purchase. Prerequisite: normal undergraduate course in circuit modeling. Offered during fall semester. (3)

EE-606 Signal Processing

Review of Laplace and Z-transforms. Synthesis of networks from transfer functions. Complex variable theory applied to Z-transforms. Filter design techniques from "brick wall" specifications. Mixed-radix FFT's. Spectral estimation. Quantization theory. Introduction to recursive estimation. Prerequisite: normal undergraduate course in signal processing. (3)

EE-607 Electromagnetic Interference and Compatibility

Overview of Electromagnetic Interference with examples. Conducted and radiated emission. Mutual Capacitance and Inductance. Coupling Paths. Crosstalk. Shielding Theory and Applications. Modeling of circuits in noise applications. Parasitics and their reduction. Ferrite beads and chokes. Open Area Test Sites. Anechoic chambers. TEM cells. Reverberation chambers. Frequency and time domain analysis of noise. Grounding issues and their reduction. Bonding Electrostatic Discharge. Extremely Fast Transients, Surge EMI filters Cables, Connectors and Com-

ponents. Electromagnetic pulses and Lightning. Offered during spring semester. (3)

EE-614 Large-Scale Integrated Design

Introduction to VLSI and VLSI CAD software tools. Digital design and logic verification, layout, timing analysis and programing, with synthesis, simulation and verification. Applications change from semester to semester. Subjects included designing ASIC's, DSP, and processor chips. Students design and verify chip. Offered based on demand. Prerequisite: Advanced course in digital chip design equivalent to EE-354. (3)

EE-651 Communications Theory

State-Space Model of Signals. Calculation of bit-error-rate for BPSK, QPSK, M-ary PSK, M-ary Orthogonal Signals. Trellis-Code Modulation and Demodulation (using trellis diagrams). Fading channels and random phase in analog systems. Offered during spring semester. Prerequisite: EE-600 or equivalent. (3)

EE-652 Microcontroller System Development

The course covers both the hardware and software aspect of the 16-bit Motorola microcontroller. Overview of onboard chip components and available instruction sets with emphasis on the newer and enhanced version. Student is required to develop a hardware application and write and test modular code. Software developmental tools will be employed. High level language compliers will be discussed. Students are required to purchase an evaluation board and deliver a final project for testing. (3)

EE-653 Analog and Digital Control Theory

State Equations, Simulation and Modeling, Controllability and Observability, Specification and Structures, Feedback System Stability Classical and Modern Approach, Multivariable Control, Sampled-Data Digital Control System, Impulse Samples, Aliasing, Zero-Order Hold, Z-Transform, Discrete-Time Systems, Sampled-Data Systems, Stability by Jury Criterion, Root Locus, Nyquist Criterion, Discretization of Continuous-Time Design. Prerequisite: EE-600 and EE-601 or equivalent. (3)

EE-656 Image Processing

Two-dimensional Fourier Transforms and Z-Transforms. Two-dimensional convolution. Filtering and masking. Discrete Cosine transforms, Haddamard transforms, Karhunen-Loeve transforms. Radon transformations. Contour estimation (Sobel, Snake algorithm). Motion estimation and compensation. Compression techniques (JPEG,MPEG). Prerequisite: EE-606. (3)

EE-660 WEB Data Analysis for Engineering & Science

Introduction to the statistical error analysis of imprecise data and the estimation of physical parameters from data with uncertainty. Interpolation and filtering. Data and parameter covariance, with emphasis on time series analysis in the time- and frequency-domains. Linear and nonlinear least squares. Confidence intervals and belts. Hypothesis testing. Introduction to linear and nonlinear estimation of dynamic systems in engineering.

EE-665 Microwave Circuit Theory and Design

Transmission lines, two port networks scattering parameters. Measuring scattering parameters. The Smith Chart and impedance matching. Impedance matching circuits. Microstrip design. Microwave amplifiers. Broadband amplifiers. Applications to broadband circuit design. Prerequisite: EE-601 and EE-607. (3)

EE-708 Master's Project Research

T This course will cover all aspects of proposing and executing a research and development task, in respond to Broad Agency Announcements. Creating preliminary response, including quad charts and white papers. Techniques for providing a rough order of magnitude (ROM) cost. Preparing the full final proposal, including abstract, statement of work, schedule, milestones, deliverables, risk mitigation, preplanned follow-on efforts, procurement, subcontracts, describing the labor mix, and developing a full cost proposal. Attention will be given to protection of proprietary information, protection of intellectual property, and to compliance with Federal Acquisition Regulations (the FAR). The course will culminate with the execution of a mock project, with final deliverables, and final closeout of the project. Examples from Federal R&D projects in public domain will be used throughout the course. Offered during fall semester. (3)

EE-710 Design for Reliability and Manufacturing

Design methodology and standards applied in the construction and assembly of electronic circuits for reliability. Redundancy, parallel structure and majority rule circuits. Materials and component selection. Vibrational analysis, thermal analysis and packaging. Classification of hardware for commercial, military or space applications. MIL-spec and IPC standards discussed. Normally offered during summer semester. (3)

EE-720 Designing for Testability

Design for testability. Types of testing, functional testing, and structural testing. Automatic test pattern generation. Scanning and scan based design rules. Critical paths. Memory test and diagnos-

tics. Built-in self-testing. ATE equipment, local and remote testing and limitations. Students will have access to on-line test workstations. Normally offered during summer semester. (3)

EE-758 Master's Project

Students integrate prior course work and personal experiences into a master's project. Students develop a full final proposal, including abstract, statement of work, schedule, milestones, and deliverables. Proposal must be delivered to class and approval of project advisor required. Regular progress reports required. Final presentation will be live over the Internet. Offered during spring semester. Prerequisite: Completion of at least 18 credit hours of graduate coursework. (3)

EL-100 Introduction to DC/AC Circuits

Basic electrical concepts and laboratory techniques. Current, voltage, resistance and power. Ohm's law, series and parallel resistive circuits. Kirchhoff's voltage and current laws. Loading effects on meters and supplies. Capacitors and Inductors. Charging and discharging. RC and RL time constants. Introduction to AC. Sinusional waveforms, phasors and use of the J operator. Reactance and admittance. Average values and RMS. Laboratory emphasis is on the proper use of standard meters, testing equipment and circuit breadboarding. MATLAB Part I: Introduction to MATLAB, variables, MATLAB functions, data types, writing a MATLAB program, using basic plotting functions. Corequisite: MA-112. (2-2-3)

EL-150 DC/AC Circuits and Analysis

Applications of Kirchhoff laws to multiple source and complex series-parallel circuits. Determinants and matrices. Mesh and nodal analysis. Network Theorems: Thevenin, Norton, superposition, maximum power transfer. Review of complex number manipulation. Application to capacitive and inductive circuits, impedance. Complex Mesh analysis. Network theorems applied to complex RLC networks. Frequency response of RL and RC circuits. Plotting frequency response. Bode plots. Laboratory emphasis on the use of standard test equipment to verify theory. MATLAB Part II: input and output statements, importing data from spreadsheets, text files and other formats into MATLAB, conditional statements, loops, arrays, array functions. Prerequisites: EL-100 Corequisite: Math (MA-114 or MA-114 Placement Test equivalent or MA-261 or MA-261 Placement Test equivalent). (2-2-3)

EL-200 Electronic Devices and Circuits

Principles and characteristics of semiconductor devices. Devices covered include diodes, Zener diodes, bipolar junction transistors, field-effect transistors, and operational amplifiers. Includes bias networks, operating points, maximum output and optimum bias, and DC and AC load lines. Input and output impedances, and voltage and current gains for each amplifier configuration. Prerequisite: EL-150 or EE-159. (2-2-3)

EL-204 Digital Electronics

Number systems, including binary, octal and hexadecimal bases. Binary arithmetic. Boolean algebra, Karnaugh map simplification. Design of combinational circuits. Decoders, multiplexers, flip-flops and other multi-vibrator circuits. Logic families including TTL, CMOS, ECL and others. Memory, shift registers and counters. (2-2-3)

EL-212 Transmission Lines

Study of transmissions lines: characteristic impedance, propagation constant, standing wave ratio and reflection coefficient. Transmission line response to transients. Bounce diagrams. Lossless and lossy line analysis using classical approach as well as graphical approach (Smith Chart). Voltage and power calculations on transmission lines. Matching techniques for transmission lines and discrete circuits. Measurements using vector network analyzers. Prerequisite: EE-159 or EL-150. Offered spring semester only. (2-2-3)

EL-220 Fabrication and Troubleshooting

Covers the basic methods of circuit construction and troubleshooting, including IC fabrication, wire wrapping, soldering, etching and chassis layout. Identification and removal of components; project oriented; may be used as a technical elective. Prerequisite: EL-150 or EE-159. (1-4-3)

EL-250 Advanced Analog Circuits

Amplifier theory. Analysis of circuits in small signal operation, equivalent circuit models, frequency response and Bode plots. Cascaded stages with direct, capacitor and transformer coupling of amplifier stages, loads and signal sources. Analysis of power transfer, efficiency, thermal effects, and distortion of amplifier circuits in large signal operation, amplifier operating classes and push-pull amplifier circuits. Operational Amplifier applications. Regulators. Oscillators: Wein Bridge, RC phase shift, Hartley, Colpitts, Clapp, Negative resistance and crystal types. MATLAB Part III: using Simscape Electronics for modeling integrated circuits such as operational amplifiers. Prerequisites: EL-200. (3-2-3)

EL-255 Introduction to Control and Robotics

Principles and characteristics of semiconductor devices. Devices covered include diodes, Zener diodes, bipolar junction transistors, field-effect

transistors, and operational amplifiers. Includes bias networks, operating points, maximum output and optimum bias, and DC and AC load lines. Input and output impedances, and voltage and current gains for each amplifier configuration. Prerequisite: EL-150 or EE-159. (2-2-3)

EL-261 Introduction to Communication Circuits and Systems

Fundamental concepts in communications. Amplitude and frequency modulation. Waveform and waveform analysis. Spectral content of signal. Circuits used to generate signal. Signal recovery circuits. Introduction to digital modulation and digital waveforms. Students build and test circuits. MATLAB Part IV: using Communications System Toolbox for analysis, design, simulation and verification of communication systems. Prerequisites: EL-200. Corequisite: MA-261. Offered during spring semester only. (2-2-3)

EL-262 Microprocessors and Microassembly

Introduction to microprocessors. Architecture. Fetch and execute cycles. Microprocessor instruction set and assembly language programming. Hardware configuration, pin functions and modes of operation of a typical microprocessor. Basic I/O timing, control and memories. Prerequisite: EL-204. (2-2-3)

EL-301 Advanced Communication Circuits and Systems

A continuation in the study and analysis of communications circuits as they apply to communications systems. Circuits such as voltage controlled oscillators, modulators, mixers, phase-locked loops, frequency synthesizers, passive and active filters are analyzed and mathematically discussed. Students build and test their circuits. Prerequisites: EL-250, EL-261 and MA-261. Offered during fall semester only. (2-2-3)

EL-307 Noise and Shielding

Noise types and specifications. Natural, manmade and intrinsic noise sources. Thermal, shot, contact, popcorn and avalanche noise as related to electronic devices. Reactive network effects on thermal noise. Signal-to-noise ratio, noise figure, noise factor, noise temperature and noise bandwidth. Low noise design techniques, measurement techniques for noise factor and noise bandwidth. Ground loops and how to eliminate them. Grounding techniques, shielding, digital circuit radiation, electrostatic discharge and electromagnetic pulse. Prerequisites: EL-261. (2-2-3)

EL-400 Special Projects in Technology

Guided Study. Project-oriented course. Students are expected to design and build electronic systems in their specialization. Students will produce a final project including a written report and an oral presentation. Prerequisite: permission of instructor. (0-6-3)

EL-452 Automated Test Systems

Systems design course for automating the testing of electronic circuits and systems in both the engineering and production environments; stresses both hardware design and system software development. Begins with simple PC-based systems assembly for circuit testing as part of the design process and progresses to the design and development of full-scale systems for testing of large production volumes. Detailed study of the operation of the IEEE STD-488 and its use in test systems assembly. Prerequisites: CS-130 or CS-150. Offered during spring semester only. (2-2-3)

EN-001 Basic Writing Skills

Course in the basic skills of written expression, reading comprehension and vocabulary building, which will enable the students to clearly present feelings, ideas and opinions. It includes a review of spelling, punctuation, and word usage plus sentence construction and other basic writing skills. Students will be expected to complete numerous short writing assignments with an emphasis on paragraphs. Study skills are also stressed. This course is required of all students whose test scores and writing samples indicate the need. This course provides three semester credits but does not meet the AAS, BS degree requirements for graduation. Grades given will be P-pass or R-repeat. (3-0-3)|

EN-002 Reading Development

This course is designed to provide students with the skills they need to develop their comprehension of the written word. Content will include: expansion of written and spoken vocabulary, improved reading comprehension and the promotion of critical thinking. The course will focus on teaching students to use active strategies such as graphic organizers, SQ3R, Cornell Note-Taking, text-marking and annotating. The reading will be focused on non-fiction materials to increase knowledge in specialized areas. This course provides three semester credits but does not meet the AAS, BS degree requirements for graduation. Grades given will be P=pass R=repeat (3-0-3)

EN-101 English Communications I

This introductory college-level course focuses on effective oral and written communication skills and the development of analytical abilities through various reading and writing assignments. Students must demonstrate competence in writing mechanics, including grammar, sentence structure, logical content development, and research

documentation through 2 essays and 2 research papers. Rhetorical modes may include description, comparison/contrast, narrative, and process analysis. Students are expected to develop effective oral communication skills through speeches. Group projects will develop effective team skills such as decision-making, time management, and cooperation. Prerequisites: acceptance based on placement test scores (3-0-3)

EN-102 English Communications II

This sequel to EN-101 involves more sophisticated reading, writing, speaking, and research assignments. Students must demonstrate competence in writing mechanics, as well as advanced research skills, the ability to handle complex information, and effective team skills. Students write research papers: an information paper, a cause-and-effect paper, an argument paper, and a final research paper. Course includes group work. Presentations are required. Prerequisite: EN-101 (3-0-3)

EN-408 Writing Seminar in Technical Research

This course prepares the student for the Senior Design course. It requires the application of certain basic principles in developing documentation needed for technical communication. Each student must be able to identify a particular problem and devise a proposal for solving it. A series of written assignments should provide a thorough literature review and analysis of relevant issues, expert opinions, and the author's (student's) recommendations for solving the problem. Students are also expected to present their work via oral presentations. Prerequisite: EN 102 and senior status (earned 96 or greater credits). (3-0-3)

EN-409 Writing Seminar in Management and Cybersecurity

This is a project-oriented course requiring the application of certain basic university principles in developing a major research paper in the student's academic area. Each student must devise an original research-based approach for solving a technical problem. The research paper should provide a thorough literature review and analysis of relevant issues, expert opinions and the aurthor's recommendations for solving the problem. Emphasis will be placed on the properly formatted, comprehensive final research paper, complete with supporting documentation. Formal presentations are required. Prerequisite: EN-102 and senior status (96 or greater credits earned.) This course is limited to BSCIS and BSMCIT seniors preparing for senior project.(3-0-3)

ENI-101 English Communications I – Intensive

This introductory college-level course focuses on effective oral and written communication skills and the development of analytical abilities through various reading and writing assignments. Students must be able to demonstrate competence in writing mechanics, including grammar, structure and logical content development when writing essays, summaries, and short reports. Rhetorical modes may include description, compare/contrast, personal experience, definition, illustration and process demonstration. Oral presentation skills are developed throughout the delivery of two speeches on related topics. Prerequisite: acceptance based on placement test scores. (3-0-3)

ENI-LAB English Communications Intensive Lab

Based on placement test scores, students in this lab will focus on specific areas for improvement including punctuation, grammar, verb formation and usage. Must be taken with EN-001 and ENI 101, and can be taken with EN 101. (0-1-0)

FS-100 Freshman Seminar

Throughout this course students will learn skills to better prepare them for the rigors and challenges of college. Students will learn and practice various proven techniques and tools to help them be successful with college level work. Additionally students will explore the personal characteristics necessary for success, learn about the college culture, and develop a support network. (2-0-1)

HP-252 Critical Issues US History I

This is a survey course designed to give students an overall view of the development of the United States from the time of its founding through the Civil War. This course is directed toward the emergence of American political, economic, and social traditions through critical analysis and student research. Prerequisite: EN-101. (3-0-3)

HP-253 Critical Issues in US History II

This is survey course designed to give students an overall view of the United States from after the Civil War until recent history. This course is directed toward the emergence of American political, economic, and social traditions through critical analysis and student research. Prerequisite: EN-101. (3-0-3)

HU-163 Horror Fiction

This course offers the student a survey of horror fiction beginning with Edgar Allan Poe and ending with present-day writers such as Stephen King. Students read short stories as well as novels. The translation of horror literature into film is also examined. Prerequisite or Corequisite: EN-101. (3-0-3)

HU-164 Science Fiction

This course will examine science fiction from the early 20th century to the present, with some attention to the cultural and historical issues that shaped its development. Special attention will be placed on the role of science in science fiction. The relationships between literature, film and television as expressions of science fiction will also be studied. Prerequisite/Corequisite: EN-101. (3-0-3)

HU-165 History Through Fiction

This course provides a broad survey of a selected historical period and compares/contrasts fictional historical accounts with what is generally regarded as historical fact. Both oral and written presentations are required of students. The selected time period and associated literature is chosen by the professor, and will vary over time. Students will learn to distinguish between historical fact and fiction, as well as to apply critical thinking toward identifying the fine lines that often exist between disparate accounts of history. Prerequisite: EN-101. (3-0-3)

HU-175 Ancestral Research

This course offers students a survey of library research methods and tools to do research on their family through the use of electronic resources. Students will learn how to document their finds, conduct oral interviews and utilize governmental records and resources. Students will conduct genealogical research to find their "roots" both in the United States as well as overseas. Students will be required to do oral and written presentations discussing their family research. Assignments will direct students in documenting research, utilizing proper research methods and forms and developing their own "family tree". Corequisite: EN-001 or EN-101. (3-0-3)

HU-201 History of Food

This class will explore the cultural history of food. The course will examine specific foods/spices and how they affected the social, cultural, and geography of the various areas of the world. The relationship between technology and the history of food will also be explored. This class will be driven by student exploration of products, processes, culture, and history as it relates to course content. Some food products explored include salt, pepper, bananas and the apple. Corequisite: EN-101. (3-0-3)

HU-205 Twenty-First Century Mass Media

A broad survey of contemporary mass media such as film, radio and television with particular attention paid to emerging media such as the Internet, related technological and commercial infrastructures, as well as the globalization of the new media. Corequisite: EN-101. (3-0-3)

HU-210 Game Design and Theory

This course teaches how to design a standalone game that is balanced, playable and has that intangible of 'fun'. Topics include history of games, player psychology, mathematical game theory, topology, statistics, multiplayer interactions, and art and aesthetics. We also cover the milestones needed to produce a game. Each student will take their concept from idea to creating their choice of a tabletop game or a paper prototype for a future marketable game. (3-0-3)

HU-215 Professional Communications

This course examines the theory and practice of multiple communication channels encountered in today's professional environment. Topics include presentations, groups and specialized writing formats. Pre-requisite: EN-102. (3-0-3)

HU-225 Writing for the Internet

This course introduces students to writing for the Internet allowing more effective online communication in such forums as blogs and Websites. Students will learn how to write in a more active voice, bringing more energy and vibrancy to their articles and commentaries. Course material examines the work flow and demands of Internet writing and publishing. Students will learn how to launch their own blog and develop an audience as well learn how to prepare articles for other blogs and web sites. This course is designed for all students, regardless of their communication, writing, or journalism experience. This is not a Web design course. Prerequisite: EN-101. (3-0-3)

HU-310 Multi-Cultural Literature

This course surveys literature from a variety of cultures, both here in US and around the world. Authors and works covered vary by semester. Prerequisite: EN-101. (3-0-3)

HU-331 Arts and Ideas

This course enables students to study and appreciate various forms of art, including painting, sculpture, architecture, music, drama, film, and literature through in-class and on-site experiences. The arts are also surveyed from an historical perspective, focusing primarily on eras in Western civilization. This enables students to sense the parallel development of the arts, of philosophy, and of sociopolitical systems and to recognize various ways of viewing reality. Prerequisite: EN-102. (3-0-3)

HU-332 Arts and Ideas: Special Topics

This course has the same general requirements as HU-331, but the orientation of the course will

be on alternate traditions to the Western canon. Students will study various forms of art, including painting, sculpture, architecture, music, drama, film, and literature through in-class and on-site experience. Students will gain an appreciation for the arts as they are represented by a particular culture or national identity. The course will concentrate on how the arts are shaped by cultural/social forces that result in distinct philosophies and ideologies. Prerequisite: EN-102. (3-0-3)

HU-364 Science Fiction Literature

This course will examine science fiction and social commentary. Special attention will be placed on critical analysis and discussion on the role of science fiction in determining the impact of social growth and events in modern society. Prerequisite: EN-102. (3-0-3)

HU-365 Mystery Literature

This course will examine the genre of mystery literature from the early 20th century to the present, with some attention to mystery writers prior to this time period who built the foundation of the genre. Special attention will be given to the elements of a mystery story, the characters and plot development of the "who done it" through reading of popular authors as well as classical authors. Also the class will look at the relationships between mystery literature, film and television as literary art forms. Prerequisite: EN-102. (3-0-3)

HU-371 Film Appreciation

The course introduces the narrative and stylistic techniques used in filmmaking to better understand how meaning is constructed, conveyed, and interpreted in film. In a participatory lecture format and by viewing a wide variety of films, the student will critically explore thought-provoking works and the creative approaches behind each one to develop an informed perspective. Other key aspects of filmmaking including film genres, film criticism, and mythic structures are explored. Prerequisite: EN-102 (3-0-3)

HU-400 Humanities: Special Topics

Research into humanities. Student primarily works in a guided study format with a mentor. Permission required from the instructor and the dean of academics. Prerequisite: EN-101. (3)

HU-402 Classical Mythology

Students will examine gods, goddesses, and heroes of ancient Greece and Rome. A comparison of myths from Greece and Rome with myths from other cultures will be studied. Myths and other stories will be analyzed based on their relation to nature, history, politics, and psychology. Students will apply myth interpretations to stories in contemporary media. Prerequisite: EN-102 (3-0-3)

HU-403 Engineering Poetry

In this course, poetry is explored through readings by engineers, mathematicians, and others in STEM fields. Students will see how poetry expanded the technologists' creative thought in both professional and personal ways. Students will hone their ability to read and understand poetry, as well as have the chance to write some of their own. Pre-requisite: EN-102 or permission of instructor. (3-0-3)

HU-404 Science & Science Fiction-19th Cent Sc & Scifi

This course examines the transformative nature of 19th century literature from a scientific perspective. Students will see how the industrial, scientific and cultural changes wrought by the Industrial Revolution and the rapid pace of scientific breakthroughs of the century influenced the creative nature of literature at the time and their effects today. Period short stories, novels and publications will be analyzed and discussed. Individual and group written and oral assignments are required. Prerequisite: EN-102 or permission of the instructor. (3-0-3)

IAE-201 Introduction to Information Assurance Concepts

This course covers topics related to administration of network security. Topics include a survey of encryption and authentication algorithms; threats to security; operating system security; IP security; user authentication schemes; web security; email security protocols; intrusion detections; viruses; firewalls; Virtual Private Networks; network management and security policies and procedures. Laboratory projects are assigned as part of the homework requirements. This course prepares students for the (ISC)2 Systems Security Certified Practitioner (SSCP) Certification. Corequisites: MA-110 or MA-112 or MA-114 or MA-261. (3-0-3)

IAE-301 Comprehensive Computer and Network Security

Building on IAE-201, this course provides learners with detailed and hands-on knowledge of computer and network security. The course emphasizes current topics such as network security, compliance and operational security, threats and vulnerabilities, application security, access control, as well as cryptography. Additionally, underlying theory and concepts are presented in order to extend learners' understanding of computer and network security. Weekly laboratory exercises are utilized to reinforce practical, real-world security techniques. Classes are a mixture of lecture, current event discussions, and laboratory exercise review and will prepare learners for the CompTIA

Security+ certification. Pre-requisite: IAE-201 (3-0-3)

IAE-260 Secure System Admin & Operation SecSys-Adm & Op

Formerly IAE-315. his course introduces students to security settings and requirements of Linux and Windows-based systems and web services. It also introduces students to Linux and Windows-based web services, including methods of configuring, testing the security and the implementing of countermeasures to discovered vulnerabilities. Topics include Linux security settings, IP tables, securing IIS web service, securing Apache web service, access control methods and host auditing and tools. Prerequisites: CT-152 and IAE-250 (3-0-3)

IAE-301 Compr Computer & Netwk Secur Cmpr Cmp & NS

Building on IAE-201, this course provides learners with detailed and hands-on knowledge of computer and network security. The course emphasizes current topics such as network security, compliance and operational security, threats and vulnerabilities, application security, access control, as well as cryptography. Additionally, underlying theory and concepts are presented in order to extend learners' understanding of computer and network security. Weekly laboratory exercises are utilized to reinforce practical, real-world security techniques. Classes are a mixture of lecture, current event discussions, and laboratory exercise review and will prepare learners for the CompTIA Security+ certification. Pre-requisite: IAE-201 (3-0-3)

IAE-310 Strategies for Cyber Competition

This course prepares students to participate in national and international cyber competitions. Two competition archetypes, are explored in detail: Capture The Flag (CTF) and Jeopardy. Students will gain practical experience in these competition archetypes, as well as specific competition subtypes, through a rigorous schedule of hands-on challenges, laboratory exercises, and full scale competitions. This course will explore strategies of game play within the competition archetypes, review the skills necessary to compete in cyber competitions, as well as the cognitive science that empowers competitions as learning devices. Individual classes will be a mixture of lecture, laboratory exercises, as well as puzzle solving. The course will conclude with students participating in a real cyber competition. Prerequisites: IAE 201, IAE 301 or permission from Professor.

IAE-311 Mobile Computing Security

Emphasizing wireless computing security, this course addresses how to secure mobile wireless computing devices and applications and wireless network security as it impacts those portable computing devices. Wireless network security is discussed as it pertains to decisions on which network security works best with particular applications loaded into wireless computing devices. The course covers security of CMRS and PCS (Cellular Mobile Radio Service and Personal Communications Service), CMRS and PCS second, third and fourth generations (2G, 3G and 4G) , laptops equipped with Wireless Network Interface Cards (WNICs), Personal Digital Assistants (PDAs), Bluetooth and Zigbe devices and "Radio Frequency Identity (RFID) devices. Retail store security and proximity payment application security are also discussed. Note: students are required to purchase a mobile device specifically to fulfill course lab requirements. Prerequisite: IAE-301 (2-2-3)

IAE-315 Secure System Administration and Operation

This course introduces students to security settings and requirements of Linux and Windows-based systems and web services. It also introduces students to Linux and Windows-based web services, including methods of configuring, testing the security and the implementing of countermeasures to discovered vulnerabilities. Topics include Linux security settings, IP tables, securing IIS web service, securing Apache web service, access control methods and host auditing and tools. Prerequisites: CT-152 and IAE-301 (3-0-3)

IAE-320 Mobile Device Forensics

Mobile device forensics is a branch of digital forensics relating to recovery of digital evidence or data from a mobile device under forensically sound conditions. The scope of devices can include mobile phones and any digital device that has both internal memory and communication ability, including PDA and GPS devices and tablet computers. This course focuses on the forensic study of mobile devices due to the rapid proliferation of smartphones and applications such as contacts, photos, calendars and notes, SMS and MMS messages, video, email, web browsing information, location information, and social networking. This increased usage has also seen a marked increase in cybercrime involving smartphones. Students will learn how to perform the forensic examination of mobile devices using the most advanced tools available. Note: Students are required to purchase a mobile device specifically to fulfill course lab requirements. Prerequisite: IAE 301, 311 (3)

IAE-321 Applied Wireless Network Security

This course will explore the unique challenges presented by wireless networking, including the management of dual network devices (Bluetooth, 3G, 4G, and WiFi). Students will evaluate emerg-

ing business and technical initiatives, such as bring your own device (BYOD) and securely implement mobile IP networks based on IPv4, IPv6 and the 3GPP. Students will learn penetration testing strategies to effectively evaluate currently implemented security controls, utilizing cutting edge tools such as BackTrack 5, Vistumbler, Wireshark, and inSIDDer for network discovery and packet analysis. Additionally, students will be exposed to the site survey, network management and analysis capabilities of industry leading software such as Air Magnet, Ekahau and OmniPeek. Students are required to purchase an Alfa wireless adapter and acquire a wireless router for this class. This course prepares students for the Certified Wireless Security Professional (CWSP) Certification. Pre-requisites: IAE-250 and CT-240 (3-0-3)

IAE-325 Secure Data Communications and Cryptography

This course follows the protocol education provided in IAE-301 with a more detailed and practical look at secure transactions and correspondence, as well as protection of data in storage. Within the confines of the ISO-OSI model, this course discusses data communication with emphasis on the security available at the layers, secure sockets layer, and both wired and wireless security topics. One-way message digests/hashes and encryption history and protocols are explored in-depth. Topics include virtual private networks, one-way hashes/message digests, digital signatures, secret-key and public key cryptography processes and algorithms. Prerequisite: IAE-250 and CT-152 (3-0-3)

IAE-335 Advanced Secure Data Communications

In today's world it is nearly impossible to not be connected in one way shape or from to the Internet. Students will be introduced to multiple methods of secure communication using the Internet and how to minimize the impact of being tracked. In addition, Students will be introduced to methods, tools, techniques, and tricks on how to remain anonymous while using untrusted mediums such as the Internet. Students will learn through lecture, labs, and real-world exercises. Prerequisite: IAE-301, IAE-325. (3-0-3)

IAE-351 Intro to Cyber Network Operations

Full spectrum information superiority and dominance is key to influencing operations associated with war or Military Operations Other Than War (MOOTW). This survey of Computer Network Operations (CNO) introduces the concept of how Computer Network Attack (CNA), Computer Network Defense (CND) and Computer Network Exploitation (CNE) are leveraged to collect information, disrupt, deny, degrade or destroy the information within computers and computer networks and/or the computers/networks that host them. Strategic and operational considerations will be considered to affect an adversary's decision cycles with information superiority. (3-0-3)

IAE-372 Mathematics of Cryptography

Cryptography is indispensable for providing confidentiality of information in computer systems. This course explains the inner workings of cryptographic primitives and how to correctly use them. Students will learn how to reason about the security of cryptographic constructions and how to apply this knowledge to real-world applications. Students will examine many deployed protocols and analyze mistakes in existing systems. The course discusses public-key techniques that let two or more parties generate a shared secret key. Students will cover the relevant number theory and discuss public-key encryption and basic key-exchange. Prerequisite: IAE-301, MA-114 (3-0-3)

IAE-390 Penetration Testing

This course explores the foundational concepts, methods and techniques in preparing and conducting penetration tests. Throughout the course students are introduced to various tools as well as unravel complex methods for exploiting client-side, service side and privilege escalation attacks. Most importantly students learn how to construct a final report outlining discovered vulnerabilities, make suggested recommendations to remediate and/or mitigate those vulnerabilities. Students also learn how to describe the findings wherein non-technical personnel understand the ramifications of these vulnerabilities in a business sense. This course prepares students for the EC Council Certified Ethical Hacker (CEH) certification. Prerequisites: CT-240 and IAE-260. Recommended corequisite: IAE-402. (3-0-3) *FORMERLY IAE-410

IAE-400 Special Topics in Information Assurance

Research into information assurance subjects. Student primarily works in a guided study format with a mentor. Permission required from the instructor and academic dean. This course may be repeated with different projects. Prerequisite: Varies. (1-4)

IAE-402 Introduction to Incident Handling and Malicious Code

This course provides a detailed understanding of incidents from attacks of malicious software. This course addresses the history and practice of coding that occurs in viruses, worms, spyware, Trojan horses, remote management back doors and root kits. Students learn preventative measures and tools, and explore how to rid systems of malicious software and prevent re-infection. Recovery processes and backup methods are

explored. In addition to covering basic incident handling preparation, response and recovery practices, and the course goes into detail regarding malicious software. Prerequisite: IAE-260 (3-0-3)

IAE-405 Malware Analysis/Reverse Engineering

This course introduces students to malware research and analysis. The course will provide students an overview of malware research, intelligence gathering related to malware, and provide students basic skills required to analyze and dis-assemble malicious programs. Students will explore the tools required for analysis and reverse engineering of malicious code, learn malware defense techniques, how malware functions, and will perform live analysis and reverse engineering exercises. Prerequisite: IAE-402 (3-0-3)

IAE-406 Digital Forensics and the Investigative Process

Students explore forensics and the investigation processes. Students explore current computer forensics tools, conduct live computer forensic analysis, conduct e-mail investigations, recovery of graphics files and data carving, and engage in report writing for high-tech investigations. This course prepares students for the AccessData Certified Examiner (ACE) and Mobile Phone Examiner Plus (MPE+) Certifications. Lab fee required. Prerequisites: IAE-260 and IAE-402. (3-0-3).

IAE-410 Penetration Testing

This course explores the foundational concepts, methods and techniques in preparing and conducting penetration tests. Throughout the course students are introduced to various tools as well as unravel complex methods for exploiting client-side, service side and privilege escalation attacks. Most importantly students learn how to construct a final report outlining discovered vulnerabilities, make suggested recommendations to remediate and/or mitigate those vulnerabilities. Students also learn how to describe the findings wherein non-technical personnel understand the ramifications of these vulnerabilities in a business sense. This course prepares students for the EC Council Certified Ethical Hacker (CEH) certification. Prerequisites: CT-240 and IAE-315. Recommended corequisite: IAE-402. (3-0-3)

IAE-412 File System Analysis

This course explores the rudimentary foundations of data structures, encoding, FAT16/32, exFAT, NTFS, EXT2/3/4, and UFS1/2 file systems as well as a look into volume analysis, including multiple disk volumes and volume spanning. This course also discusses the basic fundamentals of hard disk drives and solid state drives, their components and their role in information systems. Prerequisites: MA-111 or MA-114 and IAE-315. (3-0-3)

IAE-440 Secure Access and Identity Management

Students will learn fundamental and advanced IdM (Identity Management) topics, concepts and current issues. The course will prepare the students for real-world IdM challenges faced by professionals in industry and government today. Students will leave the course with an awareness and understanding of a variety of topics pertaining to IdM, including broad technical aspects, legal and policy issues, implementation scenarios, case studies and industry and government applications of IdM components. Students will be provided hands on design, implementation and operations of ICAM systems in a lab environment. Prerequisite: IAE-301 (3-0-3)

IAE-457 Senior Design Project I

Students/teams select a project, develop an understanding of the project scope that includes research and documentation of related work, prepare a feasibility study, develop project requirements (constraints) and engineering, software, and/or security specifications, propose solutions and multiple designs, analyze proposed designs, and select a final proposed design, and prepare and present a preliminary design review (PDR). Students are expected to apply proper systems engineering and project management to their work. Additional components may be required in some projects. Students/teams submit a final report at the end of the semester. Pre-requisite: Senior standing. (3-0-3)

IAE-458 Senior Design Project II

Students/teams build and test their selected designs (completed in 457). Each student team delivers a tested prototype and defends its project in front of a panel of experts. Students/teams submit a final report that includes description of the design, realization, and test processes as well as test results, discussion, and conclusion. Failure to deliver a completed design and a working prototype that meets engineering, software, and/or security specifications by the end of the semester may result in failing the course. *Note: Course must be completed with a grade of "C" or higher to meet undergraduate graduation requirements. Prerequsite: IAE-457 (3-0-3)

IAE-480 Perimeter Protection

In this Defense-in-Depth course, firewalls and network IDS issues will be discussed. A detailed understanding of firewall configuration and rule sets, load balancing, web farms, wireless access, web security issues and network intrusion detection will be explored to prepare the student with the basic tools to coordinate the design and

implementation of perimeter network defenses for a high-volume, high-access site. Prerequisite: IAE-402 and IAE-406 (3-0-3)

IAE-490 Design & Mgmt of Operations Centers
Modern organizations operate in a very dynamic and fast moving environment which requires collaboration with personnel both internally and externally via state of the art communications systems and technologies. Operations Centers (OC) can be chartered for daily operations as well as response to specific crisis or situations. This course will address the design and operation of an OC to include Mission, Network, Intelligence and Security missions. This course is designed to address how such OC's are chartered; designed; built, operated, and maintained. This course can be taught in multi-disciplinary or departmental approach. The course is built upon a virtualized infrastructure which provides a look at the systems, databases, applications, personnel, and procedures required to perform the assigned mission. Tours of local OC's will be scheduled and students will conclude the course with a capstone exercise which they will plan and execute. MOC/NOC/SOC. Prerequisite: IAE-201 and permission from department head. (3)

IAE-500 Intro to Information Assurance
This course will provide the requisite computer, data communications, Internet and database skills to students embarking on careers in information assurance (IA), at the senior levels. It is designed primarily for professionals who seek concentrated professional education in one or more of the many fields associated with IA. Students who complete this course successfully will be able to master the more technical application and analysis skills demanded by the Master of Science in Information Assurance (MSIA) degree program, and the several certificate programs offered in various IA concentrations. Labs, simulations and special problems will be used throughout the course.

IAE-571 Software Assurance Assessment
This course covers the fundamentals of establishing a required level of software and system assurance, applying methods and determining measures to assess whether the required level of assurance has been achieved. Topics include assessment methods; defining product measures, process measures and other performance indicators; measurement processes and frameworks; performance indicators for business survivability and continuity; and comparing selected measures to determine whether the software/system meets its required level of assurance. These fundamentals are applied to newly developed software and systems as well as during the acquisition of software and services. (3)

IAE-572 Software Assurance Development
This course covers the fundamentals of incorporating assurance practices, methods, and technologies into software development and acquisition life-cycle processes and models. With this foundation, the course provides students with rigorous methods for eliciting software and system assurance requirements, using threat identification, characterization, and modeling; assurance risk assessment, and misuse/abuse cases. Students will also learn how to evaluate methods and environments for creating software and systems that meet their functionality and security requirements. (3)

IAE-573 Software Assurance Management
This course covers the fundamentals of software and system assurance management, including making the business case for assurance; planning and managing development projects that include assurance practices; compliance with laws, regulations, standards and policies related to assurance; and risk assessment, identification, analysis, mitigation and monitoring for assurance. The focus is on how to manage business and technical requirements. (3)

IAE-574 Assured Software Analytics
This course covers methods for assuring the security and functionality of existing software and services, whether legacy, internally developed, or externally acquired, with emphasis on detection of vulnerabilities and malicious content. It also discusses assurance considerations for system architectures, networks and databases in their role as underlying enablers of software operations. Methods for structuring and reverse engineering of existing software are covered, as are techniques for acquiring and assuring software and services through suppliers, service-oriented architectures and cloud computing environments. (3)

IAE-600 Special Topics in Information Assurance
Research into information assurance subjects. Student primarily works in a guided study format with a mentor. Permission required from the instructor and academic dean. This course may be repeated with different projects. (1-4)

IAE-605 Master's Research
This is part one of a two course sequence in research and writing. In part one, students work to identify a research topic and, as initial research begins, they investigate the requirements for maintaining a research journal, writing a research

paper, and presenting a research paper. Students may petition for a job related substitute course. (3)

IAE-610 Advanced Penetration Testing
This course explores the foundational concepts, methods and techniques in preparing and conducting penetration tests. Throughout the course you will be introduced to various tools as well as unravel complex methods for exploiting client-side, service side and privilege escalation attacks. Most importantly you will learn how to construct a final report outlining discovered vulnerabilities, make suggested recommendations to remediate and/or mitigate those vulnerabilities. You will also learn how to describe the findings in a way that non-technical personnel understand the ramifications of these vulnerabilities in a business sense. Students in this course will conduct a final exercise penetration testing networks created in the IAE-680 course. This course prepares students for the EC Council Certified Ethical Hacker (CEH) certification. Prerequisite: IAE 685 (3)

IAE-611 Mobile Computing Security
Emphasizing wireless computing security, this course addresses how to secure mobile wireless computing devices and applications, and wireless network security as it impacts those portable computing devices. Wireless network security is discussed as it pertains to decisions on which network security works best with particular applications loaded into wireless computing devices. The course covers security of CMRS and PCS (Cellular Mobile Radio Service and Personal Communications Service), CMRS and PCS second, third and fourth generations (2G, 3G and 4G), laptops equipped with Wireless Network Interface Cards (WNICs), Personal Digital Assistants (PDAs), Bluetooth and Zigbe devices, and Radio Frequency Identity (RFID) devices. Retail store security and proximity payment application security are also discussed. Prerequisite: IAE-685. (3)

IAE-620 Mobile Device Forensics
Mobile device forensics is a branch of digital forensics relating to recovery of digital evidence or data from a mobile device under forensically sound conditions. This course focuses on the forensic study of mobile devices due to the rapid proliferation of smartphones and applications such as contacts, photos, calendars and notes, SMS and MMS messages, video, email, web browsing information, location information, and social networking. Students will learn how to perform the forensic examination of mobile devices using both commercial and open source tools. Students will describe and analyze effects of mobile device malware on forensic examinations Students in this course will learn how to properly identify, preserve, analyze, examine data and report on mobile device data. Prerequisite: IAE-685 (3)

IAE-621 Applied Wireless Network Security
This course provides students with practical, real-world experience with an understanding of wireless fundamentals, wireless network threats, tools to test wireless security, and safeguards. Specifically, this course addresses the most popular hacking, cracking and wireless security network analysis tools and trains students to use them to test and secure wireless networks. Current industry best practices for managing wireless networks in a secure environment are addressed. Students need access to a second computer (for hacking) and will be required to purchase and install wireless network equipment to create a home wireless network for the purpose of conducting experiments on various wireless security vulnerabilities and countermeasures. NOTE – students must have access to a computer network they personally own and can modify. This course prepares students for the Certified Wireless Security Professional (CWSP) Certification. Case studies will be used throughout the course. Students are required to purchase an Alfa wireless adapter and acquire a wireless router. Prerequisite: IAE-675 (3)

IAE-630 SCADA Networks and ICS Security
Industrial Control Systems (ICS) have been in existence for decades in the United States. These systems are relatively unknown to the general public and were designed to control our critical infrastructure such as utilities (electricity, nuclear power, and water treatment plants). Until recently, these systems were connected to company networks by privately owned IT networks based on private line technology. Public utility companies have begun to connect ICS networks to public networks such as the Internet as they transition to TCP/IP based networks. This trend is accomplishing the much needed modernization of the nation's IT networks supporting the critical infrastructure and setting the groundwork for developing the federally mandated Smart Grid. The ICS network transition to public networks has many benefits and risks. The increased risk to the smart grid must be addressed by the USG partnering with private industry. Prerequisite: IAE 685 (3)

IAE-640 Access and Identity Management
Students will learn fundamental and advanced IdM (Identity Management) topics, concepts, and current issues. The course will prepare the students for real-world IdM challenges faced by professionals in industry and government today. Students will leave the course with an awareness and understanding of a variety of topics pertaining

to IdM, including broad technical aspects, legal and policy issues, implementation scenarios, case studies, and industry and government applications of IdM components. Prerequisite: IAE 685 (3)

IAE-651 Intro to Cyber Network Operations
Full spectrum information superiority and dominance is key to influencing operations associated with war or Military Operations Other Than War (MOOTW). This survey of Computer Network Operations (CNO) introduces the concept of how Computer Network Attack (CNA), Computer Network Defense (CND), and Computer Network Exploitation (CNE) are leveraged to collect information, disrupt, deny, degrade, or destroy the information within computers and computer networks and/or the computers/networks that host them. Strategic and operational considerations will be considered to affect an adversary's decision cycles with information superiority. Prerequisites: None. (3)

IAE-652 Identity Management
Students will learn fundamental and advanced IdM (Identity Management) topics, concepts, and current issues. The course will prepare the students for real-world IdM challenges faced by professionals in industry and government today. Students will leave the course with an awareness and understanding of a variety of topics pertaining to IdM, including broad technical aspects, legal and policy issues, implementation scenarios, case studies, and industry and government applications of IdM components. (3)

IAE-670 Network Systems Security Concepts
This course explores security terms, definitions, concepts, and issues that face industries today. This course also will examine how the concept of security, and being secure, integrates into the overall enterprise mission. The importance of user involvement, security training, ethics, trust, and informed management will be explored. (3)

IAE-671 Legal Aspects Computer Security and Information Privacy
This course provides an overview of the legal rights and liabilities associated with operation and use of computers and information, including the legal and regulatory compliance issues critical for chief information security officers. It discusses the key statutes, regulations, treaties, and court cases (in the United States and abroad) that establish legal rights and responsibilities as to computer security and information privacy. The course also helps students to learn how to reduce their risk of potential legal liability for computer security or information privacy failures, and how to enforce their security and privacy rights against other parties. Case studies and lessons learned from information security failures are used throughout the course. (3)

IAE-672 Mathematics of Cryptography
Cryptography is indispensable for providing confidentiality of information in computer systems. This course explains the inner workings of cryptographic primitives and how to correctly use them. Students will learn how to reason about the security of cryptographic constructions and how to apply this knowledge to real-world applications. Students will examine many deployed protocols and analyze mistakes in existing systems. The course discusses public-key techniques that let two or more parties generate a shared secret key. Students will cover the relevant number theory and discuss public-key encryption and basic key-exchange. Students are expected to have knowledge of Calculus I and a scripting language such as python. Prerequisite: IAE 685 and CS-620 or permission of department chair. (3)

IAE-673 Secure Information Transfer and Storage
This course provides the student a history of cryptography from Caesar's cipher to elliptic-curve cryptography of today. Students study public and private key algorithms and understand their functionality, and how they work with network protocols. One-way hashes and digital signatures are discussed, and used by the students in submissions to the instructor. Public-key infrastructure with certificate authorities and web-of-trust infrastructure methods is addressed. It is recommended that students complete IAE-685 before taking this course, but this is not a requirement. (3)

IAE-674 Security Risk Management
This course begins with an understanding of why risk management evaluations are useful. The general methodologies for security risk assessment and security test and evaluation, including the interviews are discussed and documentation research necessary, the student is provided practical lab exercises to provide a hands-on analysis of a fictitious site. Detection, recovery, and damage control methods in contingency/disaster recovery planning research, documentation and training; methods of and procedures for contingency planning and security policy formulation and enforcement. (3)

IAE-675 Computer Forensics and Incident Handling
This course begins with lectures discussing the laws and rights to privacy by individuals and what organizations may or may not do. Online ethics are considered. It then moves on to understanding incident handling and how incident response teams work, managing trouble tickets, and basic

analysis of events to determine if an incident has occurred. It concludes with computer forensics issues and practices, and rules of evidence. This course prepares students for the AccessData Certified Examiner (ACE) and Mobile Phone Examiner Plus (MPE+) Certifications. Prerequisite: IAE-685. (3)

IAE-677 Malicious Software
This course examines malicious software detection and malicious software defenses including tripwire and signature software techniques. Viruses, worms and Trojan horses, logic bombs, malicious CGI scripts will be discussed. Students will review the anatomy of well-known viruses and worms to understand how they work. Mobile code issues as they apply to web and application technologies and resulting insecurities will be discussed in detail. Students will then review the underlying methodologies used by the antivirus vendors and freeware offerings to protect electronic assets from harm or other compromise. Co-requisite: IAE-675 (3)

IAE-679 Vulnerability Mitigation
This "Defense-in-Depth" course provides the student detailed understanding of the need for internal and external vulnerability assessment. An integral technical part of any risk management program, this course goes hand-in-hand with the more analytical practices in IAE-674. Co-requisites: IAE-685 . (3)

IAE-680 Perimeter Protection
In this "defense-in-depth" course, firewalls and network IDS issues are discussed. A detailed understanding of firewall configuration and rule sets, load balancing, web farms, wireless access, web security issues and network intrusion detection is explored to prepare the student with the basic tools to coordinate the design and implementation of perimeter network defenses for a high volume, high access site. Prerequisite: Completion of at least 24 credit hours in IAE coursework. This class is best completed in the last term. (3)

IAE-682 Internal Protection
In this "defense-in-depth" course, firewalls and network IDS issues are discussed. A detailed understanding of firewall configuration and rule sets, load balancing, web farms, wireless access, web security issues and network intrusion detection is explored to prepare the student with the basic tools to coordinate the design and implementation of perimeter network defenses for a high volume, high access site. Prerequisite: Completion of at least 24 credit hours in IAE coursework. This class is best completed in the last term. (3)

IAE-684 Complementary Security
Complementary Security is best defined as taking holistic, defense-in-depth approach to designing a complete Information Security Program. In the course, students will learn how individual domains of security from the (ISC)2 CISSP Common Book of Knowledge work together to properly address cyber risks within an organization. At the end of the course, students will be able to: (a) utilize industry best practices and frameworks to design a complete and customizable Information Security Program for any organization; (b) understand how to manage the program from an executive (CISO) level; (c) and have the knowledge necessary to take the CISSP exam. Prerequisite: IAE-685 (3)

IAE-685 Principles of Cybersecurity
This class explores the overarching security architectures and vectors of information assurance from a management perspective to allow the learner to formulate the basis for sound business decisions. Students gain an appreciation for systems, networks, processes, methodologies, documentation requirements, recovery processes, certification and accreditation processes as well as "best practice" implementation, training and continuous improvement. Discussions in this course give the correct acumen of personnel security, physical security, and technical operational security as these principles relate and interface with information security principles. Defense-in-depth principles also are covered for designing proper physical security programs. At the completion of the course students should be able to manage an IA function and evaluate an organization's Contingency Planning process for adequacy. (3).

IAE-686 Managing Information Security
This class explores the overarching security architectures and vectors of information assurance from a management perspective. The course will provide a basic understanding of all aspects involving IA management, needs analysis, risk assessments, policy formulation, security planning, and integrating technologies. Students will gain an appreciation for systems, networks, processes, methodologies, documentation requirements, recovery processes, certification and accreditation processes as well as "best practice" implementation, training and continuous improvement. Discussions in this course will give the correct acumen of personnel security, physical security, and technical operational security as these principles relate and interface with information security principles. Defense-in-depth principles will also be covered for designing proper physical security programs. Prerequisites: IAE 685. IAE 682 recommended. (3)

IAE-690 Healthcare Information System Security
This course addresses healthcare IS within the framework of the guiding principles of Information Assurance (confidentiality, integrity, and availability). This course covers the security and privacy controls covering healthcare information systems, preventing loss and unauthorized access to healthcare information within information systems, and protecting the integrity of healthcare data (data-at-rest, and data-in-transit) within information systems. The student will gain and understanding of the mandated regulatory, legal, and governance requirements covering privacy and confidentiality of healthcare information. The student will also be able to identify and manage risks and conduct Information Risk Assessments pertaining to healthcare information. Prerequisite: IAE 685 or permission. (3)

IAE-692 Mobile Medical Device/Application Security
This course goes into the details of the information security risks accompanying the widespread use of mobile devices and mobile apps in the healthcare community. The student will gain an overall understanding of the inherent security risks associated with patient information medical apps and devices, how to protect healthcare information on mobile devices, including identifying vulnerabilities, associated threats, risks, how to mitigate against those risks; and the regulatory guidelines governing and health and safety risks associated with mobile medical apps and devices, along with the privacy impacts. Prerequisite: IAE 685 (3)

IAE-705 Master's Capstone
The course is in graduate seminar format. Students integrate prior course work and personal experiences into researching an approved topic to produce a project-based paper. Students may petition for a job related substitute course. (3)

IAE-820 Situation Awareness Analysis

This is a course in operational leadership from the long-term perspective to crisis intervention. Class activities will be designed to enhance student awareness of action plan processes leading to effective strategy execution. (3)

IAE-825 Applied Research in Information Assurance

This course prepares students to select topics and conduct successful research in information assurance's many fields. Topics include research such as the Computer Fraud and Abuse Act, the Electronic Communication Privacy Act and the National Research Act. Special considerations governing research using human subjects will be given in-depth treatment. The productive and legally sufficient use of the Department of Homeland Security's new Protected Repository for the Defense of Infrastructure against Cyber Threats (PREDICT) program will be discussed. (3)

IAE-830 IA Research Literature
Learners examine literature and research in the information assurance field. Literature will be examined in the context of both the historical and current environment. Prerequisite: RSC-801. (3)

IAE-835 Information Assurance Strategic Management

Learners examine the objectives, elements and framework of analysis for strategic management of information assurance management. Learners focus on synthesizing information and applying sound judgment. (3)

IAE-837 Contemporary Issues in IA
This course focuses on contemporary issues in the field of information assurance. It examines the ways in which science contributes to the study of significant problems in the contemporary world to help individuals and society make informed decisions about these issues. Students will engage in classroom discussion as well as generate scholarly writing suitable for publication. (3)

IAE-845 Pedagogy and Information Assurance
Learners are introduced to the fundamentals of teaching information assurance. Learners gain experience in course and syllabus development. The development and integration of online labs as an academic component is explored. Learners examine the professional development and training that supports IA. (3) Enrollment by permission of the Dean.

IAE-865 Special Topics in Human Resource Management

Learners examine human resource theories and practices in the context of the complex environment of information assurance. (3)

IAE-871 Software Assurance Assessment

This course covers the fundamentals of establishing a required level of software and system assurance, applying methods and determining measures to assess whether the required level of assurance has been achieved. Topics include assessment methods; defining product measures, process measures and other performance indicators; measurement processes and frameworks; performance indicators for business survivability and continuity; and comparing selected measures to determine whether the software/system meets

its required level of assurance. These fundamentals are applied to newly developed software and systems as well as during the acquisition of software and services. (3)

IAE-872 Software Assurance Development

This course covers the fundamentals of incorporating assurance practices, methods, and technologies into software development and acquisition life-cycle processes and models. With this foundation, the course provides students with rigorous methods for eliciting software and system assurance requirements, using threat identification, characterization, and modeling; assurance risk assessment, and misuse/abuse cases. Students will also learn how to evaluate methods and environments for creating software and systems that meet their functionality and security requirements. (3)

IAE-873 Software Assurance Management

This course covers the fundamentals of software and system assurance management, including making the business case for assurance; planning and managing development projects that include assurance practices; compliance with laws, regulations, standards and policies related to assurance; and risk assessment, identification, analysis, mitigation and monitoring for assurance. The focus is on how to manage business and technical requirements. (3)

IAE-874 Assured Software lytics

This course covers methods for assuring the security and functionality of existing software and services, whether legacy, internally developed, or externally acquired, with emphasis on detection of vulnerabilities and malicious content. It also discusses assurance considerations for system architectures, networks and databases in their role as underlying enablers of software operations. Methods for structuring and reverse engineering of existing software are covered, as are techniques for acquiring and assuring software and services through suppliers, service-oriented architectures and cloud computing environments. (3)

IAE-875 IA Implementation

Learner focus is on deployment of information assurance technologies in the organization. Relevant literature and real world deployment is examined. (3)

IAE-880 Special Topics in Information Assurance

This course provides students the opportunity to examine in-depth issues relevant to information assurance. This course may result in a publishable paper in the IA field. (3)

IAE-881 Special Topics II in Information Assurance

This course provides students the opportunity to examine in-depth issues relevant to information assurance. This course may result in a publishable paper in the IA field. (3)

IAE-882 Special Topics III in Information Assurance

This course provides students the opportunity to examine in-depth issues relevant to information assurance. This course may result in a publishable paper in the IA field. (3)

IAE-883 Special Topics IV in Information Assurance

This course provides students the opportunity to examine in-depth issues relevant to information assurance. This course may result in a publishable paper in the IA field. (3)

IAE-884 Special Topics V in Information Assurance

This course provides students the opportunity to examine in-depth issues relevant to information assurance. Students must request a faculty member who is a topic specific expert to facilitate the course. This course may result in a publishable paper in the IA field. (3)

IAE-885 Software Assurance Assessment

This course covers the fundamentals of establishing a required level of software and system assurance and applying methods and determining measures to assess whether the required level of assurance has been achieved. Topics include assessment methods; defining product and process measures and other performance indicators; measurement processes and frameworks; performance indicators for business survivability and continuity; and comparing selected measures to determine whether the software/system meets its required level of assurance. These fundamentals are applied to newly developed software and systems as well as during the acquisition of software and services. (3)

IAH-301 Honors Comp Computer & Network Security

Building on IAE-201, this course provides NSF Cyber Transfer Student Program (CTSP) scholars with detailed and hands-on knowledge of computer and network security. The course emphasizes current topics such as network security, compliance and operational security, threats and vulnerabilities, application security, access control, as well as cryptography. Additionally, underlying theory and concepts are presented in order to extend learners' understanding of computer and network security. Weekly laboratory exercises are utilized to reinforce practical, real-world security techniques. CTSP Scholars are expected to conduct a focused research project and presentation at the end of the course. Classes are a mixture of lecture, current event discussions, and laboratory

exercise review and will prepare learners for the CompTIA Security+ certification. This course is taught each fall semester for each new cohort of NSF Cyber Transfer Student Program (CTSP) scholars. Prerequisite: IAE-201 (3-0-3)

IE-701 Principles of Design Engineering Computer Networks

Networking and the Internet have introduced us to a new set of devices and protocols that link personal computers to servers, and servers to servers. This course explores all the hardware and software that drives local and Internet computing. Special emphasis on connectivity and throughput is explored. (3)

IE-703 Thin and Fat Client Deployment with SOA

Client/Server has been extended to multi-tiered environments, distributed communications via CORBA,COM/DCOM, service-oriented architecture (SOA) and Cloud computing models. To examine this shift and to understand the technologies involved, this course focuses on how these models are used to enable thin-and fat-clients as well as Web-based clients on desktops, servers and PDAs. This class will examine the mechanisms employed to bring legacy as well as modern computing to the information economy. (3)

IE-705 Comparison of Operating Systems and Web Servers

This course explores the operating software underlying Internet and intranet computing. The similarities and differences between operating systems and web servers are investigated with a view to choosing the best technology and optimization practices. Topics include NT, 2000 Server, Advanced Server, Windows CE, Unix and versions, Linux, IIS, Apache, third party, and public domain. (3)

IE-707 Network Architecture Convergence Using Wireless

This course investigates the techniques used by successful network engineers to create converged network architectures and provide optimum information access to their users. The course will provide an in-depth study of the current and contemplated mobile technologies that can facilitate network convergence. Students will test these mobile technologies and their applications via the virtual laboratory concept using OpNet, the most advanced network modeling software currently available. Technical information on specific equipment and software will be provided as instruction supplemental to the textbook, and case studies will be used throughout the course. (3)

IE-709 Comparison of Object-Oriented and Scripting Languages

For the first time in two decades, software developers now have to be proficient in multiple programming languages to deploy thin client or fat client Internet-based applications. Choosing the right set of languages has a dramatic impact on application performance and e-commerce. This course is designed to compare and contrast the various language tools for crafting Internet-based and Web-based applications. (3)

IE-712 Design of Cloud Networks and Services

This course will help students understand the design and architecture of networks and network services that enable the delivery of business-grade cloud services. Students will understand how virtualized data-center infrastructure lays the groundwork for cloud-based services, automated self-service portals, how to classify cloud services and deployment models, and understand the actors in the cloud ecosystem. Students will review the elements, requirements, challenges, and opportunities associated with network services in the cloud, optimize data centers via network segmentation, virtualization-aware networks, virtual network services, and service overlays, and systematically secure cloud services. Students will learn about the crucial role of organizations such as Federal Risk and Authorization Management Program (FedRAMP), National Institute of Standards and Technology (NIST), Cloud Security Alliance (CSA), and the International Standards Organization (ISO) in creating standards. Students will be challenged with cutting edge hands on labs from leading cloud vendors and a major cloud project. Students will also learn about containerization and micro services. This course is appropriate for Computer Science, Engineering and Cyber Security majors. Prerequisite: instructor permission. (3)

IE-713 Multimedia and Web Casting

The Internet and increased bandwidth management technologies has brought us a new venue to communicate with each other in either full duplex, half-duplex, or simplex modalities. Dot Com companies present us with radio stations, on demand streaming audio and video, and live casting of audio and video. To understand the integration, deployment, and optimization of these technologies, this course compares technical aspects, market positioning, and strengths, and weaknesses of various media products in the market. (3)

IE-715 Identifying and Integrating Component Collaboration Technologies

Software and hardware companies have utilized a component approach to product development in order to address the requirement that Internet and Intranet communications applications operate in a on-demand mode. This is the technical underpinning of the "any where, any time" mantra of the Internet. However, these components do not always integrate easily. This course identifies the various component technologies, standards, and issues with integration to provide on-demand communication capabilities. (3)

IE-717 Invention and the Use Intellectual Property

The Internet's ability to share ideas between millions of people instantaneously, and the ability of Internet users to improve upon those ideas and share them with everyone on the Internet instantaneously, has challenged intellectual property's status quo. This course examines the legal and regulatory limits of an e-business's ability to exploit intellectual value in the new paradigm. In addition, the latest changes to intellectual property law and regulation as a result of Internet commerce will be examined. (3)

IE-719 Capstone Course

The capstone course is in graduate seminar format. Students will integrate the prior course work and personal experiences into a major paper or a project. (3)

IE-730 SCADA Networks and Industrial Control Systems

Industrial Control Systems (ICS) have been in existence for decades in the United States. These systems are relatively unknown to the general public and were designed to control our critical infrastructure such as utilities (electricity, nuclear power, and water treatment plant). Until recently, these systems were connected to company networks by privately owned IT networks based on private line technology. Public utility companies have begun to connect ICS networks to public networks such as the Internet as they transition to TCP/IP based networks. This trend is accomplishing the much needed modernization of the nation's IT networks supporting the critical infrastructure and setting the groundwork for developing the federally mandated Smart Grid. The ICS network transition to public networks has many benefits and risks. SCADA software runs chemical plants and factories, transmission systems and electric power plants. Prerequisite: IE 701 (3)

MA-005 Basic Mathematics

Designed for students needing math skills for MA-110, MA-112 and MA-114. Topics include operations on signed numbers and fractions, products and factoring, exponents and roots, graphs, and solutions of first degree and quadratic equations. Credits from this course are not applicable toward a degree. (3-0-3)

MA-006 Basic Business Math

This course is designed for students needing math skills for MA-110. Topics include operations on signed numbers and fractions, percentages, products, compounding and quadratic equations. (3-0-3)

MA-110 Business Mathematics I

A general introduction to the mathematics used in the U.S. business. Focus is on developing the mathematical and critical thinking skills needed to solve math problems encountered in typical business situations. This course will help prepare the student for courses in Statistics and Accounting. Topics include 1) the essentials of business mathematics; and 2) accounting mathematics. Prerequisite: placement test score. (3-0-3)

MA-111 Business Mathematics II

A continued introduction to the mathematics used in of U.S. business. Builds on the mathematical and critical thinking skills developed in MA 110 to address the topics of 1) retail mathematics and 2) introductory financial mathematics. This course will help prepare the student for courses in Marketing and Finance. (3-0-3)

MA-112 Intermediate Algebra

Designed for students needing mathematical skills and concepts for MA-114 and MA-216. In this course students are introduced to equations and inequalities and learn the language of algebra and related functions, including polynomial, rational, exponential and logarithmic functions. Other topics include solving equations, inequalities and systems of linear equations; performing operations with real numbers, complex numbers and functions; constructing and analyzing graphs of functions; and using mathematical modeling to solve application problems. Prerequisite: MA-005 or placement test score. (3-0-3)

MA-114 Algebra and Trigonometry

Designed for students needing mathematical skills and concepts for MA-216; topics in this course are as follows. Algebra: basic operations on real and complex numbers, fractions, exponents and radicals. Determinates. Solution of linear, fractional, quadratic and system equations. Trigonometry: definition and identities, angular measurements, solving triangles, vectors, graphs and logarithms. Prerequisite: MA-112 or placement test score. (4-0-4)

MA-124 Discrete Mathematics

Logic sets and sequences; algorithms, divisibility and matrices; proof, induction and recursion; counting methods and probability; relations, closure and equivalence relations, graphs and trees; Boolean algebra. Prerequisite: MA-112, MA-114 or placement test score. (3-0-3)

MA-128 Introduction to Statistics

Probability: definitions, theorems, permutations and combinations. Binomial, hypergeometric, Poisson and normal distributions. Sampling distribution and central limit theorem, estimation and hypothesis testing. Prerequisite:MA-110 or MA-111 or MA-112. (3-0-3)

MA-230 Introduction to MATLAB

Intended for students with little or no experience with the Software. Introduction to MATLAB is a short course covering its basic operations and features. In addition, we will work through applications in engineering, physics and mathematics, provide a grounding for developing tools for your own projects. Topics include Import/export data, Create and manipulate variables, Program and run scripts (M-files) Use graphics tools to display data. Use the built in help features. Perquisites: CT-115. MA-114 Corequisites: MA-261, PH-261/201 (3-0-3)

MA-261 Calculus I

Lines, circles, ellipses. Functions and limits, differentiation, power rule, higher-order derivatives, product, quotient and chain rules, implicit differentiation, applications. Integration: definite integrals; indeterminate forms; exponential, logarithmic, trigonometric and hyperbolic functions; differentiation and integration, graphing. Prerequisite: MA-114. (4-0-4)

MA-262 Calculus II

Methods of integration: completing the square, substitution, partial fractions, integration by parts, trigonometric integrals, power series, parametric equations. Partial derivatives. Directional derivatives. Introduction to multiple integrals. Prerequisite: MA-261. (4-0-4)

MA-263 Calculus III

Multivariable and vector calculus. Integrals in two and three dimensional coordinate systems. Cylindrical and spherical coordinates. Vector functions and their derivatives. Gradients, divergence and curl. Stokes theorem, Green's theorem, Gauss's theorem. Prerequisite: MA-262. (4-0-4)

MA-300 Mathematical Methods for Engineering

This course provides a basic understanding of MATLAB software for engineering, such as the basic matrix, matrix manipulation, college algebra and trigonometric concepts. In addition MATLAB techniques for solving problems by means of calculus and differential equations are introduced. Successful completion of this course will enable students to begin the study of more advanced topics such as the statics and dynamics classes taken by most engineering majors. Prerequisites: MA-230 and MA-261. (3-0-3)

MA-325 Mathematics of Cryptography

This course gives an introduction to the mathematics of cryptography. A survey of cryptography from Roman times up to today's current techniques. Cryptographic content for the course includes classical ciphers and their decryption (shift, affine and Vigenere ciphers), key exchange protocols (main example: Diffie-Hellman), public key ciphers (main example: RSA), block ciphers, modes of operation, hash functions and digital signatures. Mathematical formulations of security goals will be discussed as a method for determining weaknesses in designs. Prerequisites: MA-124 and CS-130 or CS-150. (3-0-3)

MA-340 Ordinary Differential Equations

Methods of solving first order equations with applications to mechanics and rate problems. Solutions of second order equations by undetermined coefficients and variations of parameters. Applications to circuits. Introduction to systems of equations and operational and numerical methods. Prerequisite: MA-262. (3-0-3)

MA-345 Probability and Statistics for Engineers

Sets and methods of counting. Probability density functions, expected values and correlations. Binomial, Poisson, exponential and normal distribution. Central limit theorem and statistical estimation. Introduction to stochastic processes. Applications to noise and reliability. Prerequisite: MA-262. (3-0-3)

MA-355 Numerical Analysis

Number systems, floating-point arithmetic and error analysis. Taylor, interpolating and mini-max polynomials. Integration and differentiation. Methods of solving equations, systems of linear equations. Prerequisite: MA-262, and CT-115 or CS-130. (2-2-4)

MA-360 Laplace and Fourier Analysis

Definition of transform: Laplace transform of algebraic, exponential and trigonometric functions; basic theorems including shifting, initial and final-value theorems; unit-step, periodic and delta functions; methods of inverting transforms; solutions of differential equations by transform methods. Fourier series and coefficients; expansion of functions in Fourier series; complex Fourier coefficients; Parseval's Theorem; Fourier transform and its properties. Prerequisite: MA-340. (3-0-3)

MA-524 Discrete Mathematics

Logic sets and sequences; algorithms, divisibility and matrices; proof, induction and recursion; counting methods and probability; relations, closure and equivalence relations, graphs and trees; Boolean algebra. (3)

MA-525 Statistics Using Excel

This course provides an understanding of basic statistical principles and tests and their application using Excel. Topics include collecting and organizing data, theorems, descriptive and inferential statistics, probability, discrete and normal distributions, sampling distributions, central limit theorem, estimation and hypothesis testing and regression analysis. Prerequisite: undergraduate statistics course or work experience. (3)

MBA-501 Professional Writing Practicum

This course is designed to provide masters level students with the necessary writing skills to be successful writers in a professional environment. (3)

MBA-510 Analytics and Decision Analysis

Course focus is predominantly on prescriptive analytics with some parts focused on predictive analytics. Topics include operations research techniques and their application to decision making such as mathematical optimization, networks modeling, stochastic modeling, and multi-objective modeling. Other topics such as PERT, CPM, computer simulation, decision analysis using decision trees and quantitative value functions, and heuristic methods are covered, as well as use of contemporary computer software for problem solving. In particular, the course will extensively use MS Excel for solving the decision-making problems. Case-study approach to problem solving is used. Recommended prerequisite: Undergraduate statistics or SM-525. (3)

MBA-515 Applied Stats & Vis for Analytics

An Introduces multivariate regression and random forests for modeling data. Addresses data access, variable selection and model diagnostics. Introduces foundations for visual thinking. Reviews common statistical graphics such as dot plots, box plots, q-q plots. Addresses more advanced methods such as scatterplot matrices enhanced by smoothed or density contours, and search tools for finding graphics with suggestive patterns. Course will introduce R software for analysis. A final project will involve visualization of a real data set. Prerequisite: MBA-510. (3)

MBA-520 Big Data Warehousing & Analytic Sys

This course will equip the student with the necessary skills to solve complex problems and design solutions using Big Data. The student will be able to gain an understanding of how to design databases to manage large volumes of data from multiple sources, and how that data can be analyzed and translated into meaningful results. The student will be introduced to the field of Analytics, gain an understanding of Enterprise Data Warehousing models, be introduced to Data Mining techniques and tools used for mining the data warehouse, and build specific Data Marts. The student will be introduced to predictive analysis, and will be expected to develop models to extract data, perform trend analysis, establish patterns, and make projections. Prerequisites: Ability to use Structured Query Language with a basic relational database system; ability to read pseudo code, and understand basic data structures like arrays; and, an understanding of algebra and basic probability and statistics would be helpful, though not required. Prerequisite: MBA-510. (3)

MBA-540 Web Analytics

The course covers concepts and techniques for retrieving, exploring, visualizing, and analyzing social network and social media data, website usage, and clickstream data. Students learn to use key metrics to assess goals and return on investment, perform social network analysis to identify important social actors, subgroups, and network properties in social media. Students will earn specialized skills in Advanced Excel, Python, JavaScript (D3.js, Leaflet.js), HTML/CSS, API Interactions, Social Media Mining, SQL, Tableau, Advanced Statistics, Machine Learning, R, Git/GitHub, and more. Prerequisite: MBA-510 (3)

MBA-600 Fundamentals of Prof Management

A bridge course designed for students without a degree in business, this course addresses foundations of accounting, finance, statistics, and economics. Students are provided a broad overview of each of these topics for later application in the MBA program. This course is waived for students with an undergraduate degree in business management or business administration. (3)

MBA-601 Special Topics in Business Admin

Research into business administration subjects. Student primarily works in a guided study format with a mentor. Permission required from the instructor and academic dean. This course may be repeated with different projects. (1-4)

MBA-615 Financial Management

Provides an understanding of the business decision framework in the context of the economic environment in which decisions are made. Covers topics in capital investment policy, financing and capital structures, dividend policy, financial state-

ment analysis, forecasting, and working capital management. It is preferable to complete MBA 620 before MBA 615. Prerequisite: MBA 600 or undergraduate degree in business. (3)

MBA-616 Financial & Contract Management
This course is an introduction to financial and contract management for technical managers. Topics include financial management accounting (including elementary accounting principles, assets, liabilities, and stockholders' equity), direct and indirect costs, revenues, profits, indices to financial position, use of financial reports, return on investment, net present value, internal rate of return, and financial management (including cash and funds flow statements). An introduction to the principles of contract formation is presented, highlighting the distinctive characteristics of contracting with the federal government as well as the team concept for effective contracting. The role of the program manager as the key team members is a prime focus. Subcontract management, competitive negotiation techniques, contract financing, and cost reimbursement are also included. Case studies supplement theoretical discussions. (3)

MBA-620 Managerial Accounting
The course examines the use of accounting data in corporate planning and control. The aim is student proficiency in the analysis and design of control systems in order to make decisions that allow management attention to be focused on long-term strategic issues. Covers internal and external auditing systems, financial reporting, and tax planning. Prerequisite: MBA-600 or undergraduate degree in business. (3)

MBA-625 Org Behavior in Tech Environment
Technology has created amazing new opportunities for businesses and organizations. Mobile smartphones, tablets, all-in-one desktops and sophisticated software are just some of the radical changes that have revolutionized the workplace. Although the explosive technology growth has increased productivity and advancement, it has also created changes in worker requirements, employee expectations and workplace changes. This course analyzes organizational behavior in a technical environment. Cases are analyzed to develop skills in applying theories to common managerial problems in technology driven organizations. Students completing this course may not enroll in SM-513 for additional credit. (3)

MBA-627 Impact of Emerging Tech on Mgmt
This course will focus on emerging technologies that influence management. Students will learn leading edge skills to understand the technologies and innovations that are increasingly changing the business and public administration landscape. The course will put students at the forefront of new technology to produce value for their future business, employers, and customers. (3)

MBA-630 Marketing Process and Strategy
Explains key marketing concepts and their significance in domestic and international activities. Analyzes marketing problems and efforts regarding the organization's product and services, pricing activities, channel selection, and promotion strategies. Emphasis is on development and implementation of marketing plans and programs. (3)

MBA-631 Technical Personnel Management
This course reviews the problems of personnel management in a technical organization. Topics include environmental requirements for effective and innovative technical efforts, direction and motivation, leadership behavior, recruitment of technical staff, orientation and training programs, personnel placement and reassignment, assignment of work, salary administration, personnel evaluation and counseling, professional growth and promotion, technical obsolescence and retraining, equal opportunity programs, employee grievances, and handling of conflict situations. Students explore typical personnel management situations that arise in a technical organization. (3)

MBA-635 Technology-Enabled Operations
This course will prepare you to contribute effectively in today's technology-enabled workplace by understanding how to leverage processes, systems, and data to create business value. We'll examine business operations in traditional companies, between firms, and in digital businesses. We will consider the perspectives and needs of both start-ups and established organizations. (3)

MBA-640 Managerial Economics
Application of relevant economic theory to business problems. Examines general principles that can be applied to the business decision-making process in the presence of risk and uncertainty. Analysis of demand, costs, productivity, pricing policies, market structure, and government policies toward business within various marketing structures. Prerequisite: undergraduate degree in business. (3)

MBA-646 Federal Contract Project Management
This course provides an overview of the theory and practice of managing a project in an organizational setting. Fundamentals concepts are covered to provide a solid understanding and foundation of managing each phase of the project life cycle,

adhering to organizational and cost constraints, setting goals for stakeholders, and utilizing best practices to complete the project on time and within budget. Project management is examined in the realm of various technology fields. (3)

MBA-647 Methods of IT Project Mgmt
Methods of IT Project Management focuses on IT project management and is built around the Project Management Body of Knowledge (PMBOK). You will learn how IT projects differ from other kinds of projects and how the methods and techniques of project management must be modified/adapted for IT projects. In addition, you will gain an increased understanding of what managers do (or should be doing) and why managers ask you to do the things that they do. The course presents methods, tools, and techniques that can be used to effectively manage IT projects, both large and small. Prerequisite MBA-646 or equivalent. (3)

MBA-648 Project Mgmt/Competitive Advantage
Project Management takes decision-making and a business-oriented approach to the management of projects which is reinforced throughout the course with current examples of project management in action. Project management is central to operations within the context of a variety of successful organizations, whether publicly held, private or not-for-profit. Prerequisite: MBA-646 or equivalent. (3)

MBA-650 Strategic Management
Examines the objectives, elements and framework of analysis for strategic management. Case studies will be used as the primary tool of learning and analysis. Working well with others, synthesizing information, applying sound business judgment, and communicating crisply are key skills for this class. This class should be taken as the last core class prior to the capstone project. (3)

MBA-657 Transformational Leadership & Innov
Leadership is the process of influencing others to achieve results and this course examines leadership concepts applied to managing people, organizations and strategic processes. Leadership perspectives and philosophies of organization development, functions and systems are examined. Finally, students will examine how they can provide innovative leadership based on both leadership theory and practice. Students will be expected to apply the various leadership skills and techniques to address challenges and opportunities they face through the term project. (3)

MBA-658 Legal, Political & Ethical
As the comprehensive business law course, areas of law critical to the success of technology managers and entrepreneurs are examined. Topics include contract issues, torts and product liability, business crimes, intellectual property, cyber law, cybercrimes, the law and structure of business organizations, employment, and bankruptcy. The legal issues are also explored in the context of a rapidly evolving global cyber environment, changing technology and business practices. (3)

MBA-659 Leadership & Managing Human Capital
This course examines the concept of leading an increasingly diverse and global workforce. Emphasis is placed on creating a work environment adaptable to the new challenges of the 21st century. This course is based on the understanding that human capital is critical to creating competitive advantage. Course material is examined from a systems perspective. Theory and practice will be explored by comparing and contrasting effective use of leadership in both the private and public sectors. (3)

MBA-660 Special Projects in MBA
Research into business administration and related subjects. Student primarily works in a guided study format with a mentor. Permission required from the instructor and academic dean. This course may be repeated with different projects to a maximum of 9 credits. (3)

MBA-665 Entrepreneurship
Course focuses on all aspects of starting a new business. Emphasis is on the critical role of recognizing and creating opportunities. Topics include attributes of entrepreneurs and entrepreneurial careers, evaluating opportunities, writing business plans, and financing the venture. (3)

MBA- 672 Mathematics of Cryptography
Cryptography is indispensable for providing confidentiality of information in computer systems. This course explains the inner workings of cryptographic primitives and how to correctly use them. Students will learn how to reason about the security of cryptographic constructions and how to apply this knowledge to real-world applications. Students will examine many deployed protocols and analyze mistakes in existing systems. The course discusses public-key techniques that let two or more parties generate a shared secret key. Students will cover the relevant number theory and discuss public-key encryption and basic key-exchange. Students are expected to have knowledge of Calculus I and a scripting language such as python. Prerequisite: IAE 685 and CS-620 or permission of department chair. (3)

MBA-700 Capstone Project
Students complete a research project in the field of major concentration. The research is super-

vised by a faculty member and must be defended by the student in an oral examination. Internships under the supervision of an academic advisor are an option. This course is to be taken last or next to last as the student applies accumulated knowledge of both core and concentration classes to this effort. (3)

MBA-701 Federal Acquisitions & Contracting
This course covers the fundamentals of Federal acquisitions and contracting and will provide a comprehensive understanding of the acquisition environment. Students will develop professional skills for making business decisions and advising other acquisition team members to successfully meet customers' needs. Participation in small group simulation exercises will prepare students to provide contracting support within the overarching business relationships of government and industry. Prerequisite: MBA-646 or equivalent. (3)

MBA-702 Mergers and Acquisitions
This course surveys the drivers of success in mergers and acquisitions (M & A) and develops your skills in the design and evaluation of these transactions. The M & A transactions will cover the foundation for a wide range of mergers and acquisition fields including corporate development, investment banking, consulting and advising senior management. (3)

MBA-703 Software Acquisitions
This course covers the acquisition of open systems and commercial off-the-shelf (COTS) products, an increasingly vital element of corporate and government software development. Properly managed software acquisition offers potential for significant time and cost savings over a system's lifetime. The transition from proprietary, custom-built systems to systems based on standards and commercial products is not easy, however. Managers and their staff must understand the risks and opportunities associated with this acquisition approach. (3)

MBA-705 Org Chg & Info Sys Implementation
Information systems represent a critical resource to organizations; yet, there are many unknowns about how to successfully design and implement those systems and many firms today continue to struggle with the deployment process. This seminar explores issues associated with the implementation of information systems in organizations - including requirements analysis, project management, outsourcing, and virtual teams -using a variety of theoretical or conceptual lenses such as control and coordination, organizational change, and trust. The emphasis of this course is on understanding Information Systems implementation from an organizational perspective. (3)

MEC-155 Intro to Materials Science
Origin and behavior of materials. Classifications of materials. Physical metallurgy-mechanical and physical properties, crystalline structure, imperfections in solids, phase diagrams, failure mechanisms in materials, hardening and tempering, isothermal diagrams. Involves hands-on experiences through lab sessions in the use of metallurgical and mechanical testing equipment. Lecture and laboratory. Prerequisites: CH-120. (3-0-3)

MEC-210 Engineering Mechanics - Statics
Fundamental concepts and conditions of static equilibrium; their application to systems of forces and couples acting on rigid bodies; and the calculation of centers of gravity, centroids, and moments of inertia. Prerequisites: MA-261. Corequisite: PH-261. (3-0-3)

MEC-215 Intro to Engineering Design CAD
Introduction to computer-aided design (CAD) for product design, modeling, and prototyping. Individual use and team-based environment to design and prototype a functional and manufacturable marketable product. Application to design, manufacturing, and analysis using geometric tolerancing and dimensioning. Two hours lecture and three hours laboratory. (2-3-3)

MEC-220 Principles of Mechatronics
This course will introduce you to Mechatronics as a multidisciplinary engineering discipline that includes electronics, electrical, mechanical, computer systems engineering, together with information technology. Theory lectures will introduce the core components of mechatronic systems: electrical and electronic components and circuits, sensors and actuators. In laboratory work, you will work on putting theory into practice in the context of a challenging project that is at the core of a national design and build competition. This course significantly develops the generic skills of teamwork, planning, leadership, and communication. Conventional lectures will be given on the theoretical aspects of these graduate capabilities. You will then apply these skills in the completion of specific learning activities such as design project, report, testing and prototyping. The dry run testing of the prototype Mechatronics mechanisms will provide an opportunity for you to receive feedback. Prerequisites: EL-150 and MEC-215. (3-0-3)

MEC-310 Engineering Mechanics - Dynamics
Kinematics of particles in rectilinear and curvilinear motions. Kinetics of particles, Newton's second law, energy and momentum methods. Systems of particles, Kinematics and plane motion of rigid bodies, forces and accelerations, energy and

momentum methods. Introduction to mechanical vibrations. Prerequisites: MEC-210 and MA-262. (3-0-3)

MEC-330 Fluid Mechanics Fluid Mech
Continuum, velocity field, fluid statics, manometers, basic conservation laws for systems and control volumes, dimensional analysis. Euler and Bernoulli equations, viscous flows, boundary layers, flow in channels and around submerged bodies, one-dimensional gas dynamics, turbo¬ machinery. Applications in hydraulic, pneumatic, and fluidics discussed. Two hours lecture and three hours laboratory. Prerequisites: MEC-310 and MA-262.

MEC-370 Electronics and Instrumentation
Introduces use and analysis of electronic circuits and input mechanism of various sensors, design of analog signal conditioning systems based on the system requirement, as well as understanding the theory and the art of modern instrumentation and measurements (I&M) systems. Topics include BJT and MOSFET circuit model and analysis; operational amplifier; instrumentation amplifier; survey of sensor input mechanisms; analog signal conditioning and sensor application; measurement system architecture; errors in measurement; standard used in measurement. Two hours lecture and three hours laboratory. Prerequisite: EL-200. (2-3-3)

MEC-375 Engineering Safety
Safety and health in the manufacturing, construction, and utilities industries, including pertinent laws, codes, regulations, standards, and product liability considerations. Organizational and administrative principles and practices for safety management and safety engineering, accident investigation, safety education, and safety enforcement. (3-0-3)

MEC-410 Kinematics & Dynamics of Machinery
The kinematics and dynamics of machinery and its applications to mechatronic systems. Analysis of motion translation/rotation in machinery, energy of machine mechanisms. Involves projects, seminars, and workshops regarding graphical, analytical, and numerical techniques for dynamic analysis and synthesis of machines. Two hours lecture and three hours laboratory. Prerequisite: MEC-310. (2-3-3)

MEC-455 Mechatronic System Design
Presents specifics in the mechanical design of mechatronic systems. Includes problem analysis, conceptualization, design/material selection, and performance analysis. Addresses mechanical subsystems, bill of materials, and economic analysis of the system. Two hours lecture and three hours laboratory. Prerequisites: MEC-330 and MEC-410. (2-3-3)

MEC-462 Automation Systems Design
Capstone design project. Design and analysis of a complete mechatronic system using controllers, sensors, and actuators. Advance systems programming with current industrial network programs and GUIs. Implementation of project and process management principles as well as professional documentation and presentation. Two hours lecture and three hours laboratory. Prerequisites: EE-285 and MEC-455. (2-3-3)

NT-100 Computer Architecture & Construction
Basic introduction to the design and construction of a current model PC including operating systems and some diagnostic software. Students build, configure, test and troubleshoot PCs in the laboratory. This material can be used as a basis for studying for the CompTIA A+ exam. (1-4-3)

NT-150 Computer Networking
This course is a continuation of NT-100 with major emphasis on local network equipment, network software and addressing schemes. Students build, configure, test and troubleshoot a network in the laboratory. Routers and switches are included. This material can be used as a basis for studying for the CompTIA Network + exam. (1-4-3)

NT-250 Microsoft Infrastructure and Design MS
This course will address the design processes for Microsoft infrastructure technologies and services. These technologies include Windows server, workstation, and active directory to name a few. Students will also implement VPNs, firewalls, IDSs, PKI, and AAA servers to protect the infrastructure will be discussed. Students will be challenged in a lab environment with unique infrastructure technology scenarios to design and implement to both meet customer requirements and satisfy security policies to protect sensitive customer data. Prerequisite: NT 100, 150 or Permission (4)

NT-350 Virtualized Networks and Data Center
Cloud computing services allow users to lease computing resources from large scale data centers operated by service providers. Using cloud services, users can deploy a wide variety of applications dynamically and on-demand. Most cloud service providers use machine virtualization to provide flexible and cost-effective resource sharing. Organizations must take the proper steps to transition to virtualized services by first consolidating their server farms, then virtualize infrastructure such as servers and work stations and databases. This course will use a intensive hands on approach to teach students to plan, design and

build such a virtualized infrastructure to meet the needs of the organization on a cost effective, efficient and secure manner. Prerequisite: NT 100, 150, 250 or Permission (4)

OP-301 Fiber-Optic Communications

Lightwave propagation in fiber optics, including modal conditions, numerical aperture, attenuation and signal distortion in step-index and graded-index fibers. Connectors, splices and analysis of coupling losses. Operating principles and characteristics of optical sources and detectors. Transmitter and receiver circuits for analog and digital communication. Design consideration for practical optical communication links using power budget and rise-time analysis. Discussion and comparison of latest multiplexing and coupling techniques used in optical networks. Contains labs. Prerequisites: EL-261 and MA-261. (2-2-3)

PH-201 General Physics I

Non calculus-based physics intended for credit in engineering technology courses. Use PH-261 for electrical, computer and software engineering courses. Mechanics: units, conversion factors: vector diagrams, translational equilibrium, friction, torque and rotational equilibrium: uniformly accelerated motion, projectiles: Newton's Law, work energy and power: kinetic and potential energy, conservation of energy: impulse and momentum. Heat: temperature scales, thermal properties of matter, heat and temperature change, heat and change of phase, physics of heat transfer; applications. Prerequisite: MA-114. Fall-evening only; Spring-daytime only. (2-2-3)

PH-202 General Physics II

Non-calculus based physics intended for credit in engineering technology courses. Use PH-262 for electrical, computer and software engineering courses. Light and sound: wave motion, nature of light, reflection and mirrors, refraction, prisms, dispersion lenses; simple harmonic motion; sound transmission, resonance, interference. Doppler Effect. Electricity and magnetism: Static electricity, electric fields, magnetic fields, electric potential, capacitance; electricity in motion; magnetic induction; electromagnetic relations. Alternating currents. Prerequisite: PH-201. (2-2-3)

PH-253 Energy and the Environment

This course covers fundamentals of energy generation (conversion), current diversity of energy resources from fossil fuels to renewable and alternative sources, and environmental impact of the generation and use of energy. Topics include the availability, economics and environmental consequences of energy generation, distribution and consumption from oil, coal, gas, hydrogen, nuclear, wind, solar, geothermal, hydro, biomass and other alternative sources currently under development and study by the scientific and engineering communities. Efficient use of energy in the domestic, transportation and industrial sectors will be discussed. This course may be used as a general, technical, science or engineering elective. Prerequisite: PH-201 (3-0-3)

PH-261 Engineering Physics I

Calculus based physics. Displacement, velocity and acceleration, equations of motion, Newton's laws of motion and their applications, gravitation, work and energy, impulse and momentum, conservation laws, rotational motion, rotational dynamics, equilibrium, elasticity, periodic motion. Prerequisite: MA-261. Corequisite: MA-262. Fall-evening only; spring-daytime only. Students completing this course may not enroll in PH-201 for additional credit. (3-2-4)

PH-262 Engineering Physics II

Calculus based physics. A continuation of PH-261. Topics include wave motion, vibration and sound, electricity and magnetism, Coulomb's Law, electrical fields, induction. Prerequisite: PH-261. (3-2-4)

PH-263 Engineering Physics III

Calculus based introduction to light, lens and diffraction. Photon and their interaction with matter. Wave-particle duality. Basic quantum discoveries leading the Bohr atom and atomic spectra. Interaction of electrons and photons with matter with special emphasis on the design of detectors and electronic devices that use quantum effects. Prerequisite PH-262. (3-2-4)

PH-400 Einstein's Theory of Relativity

Introduction to Einstein's Special and General Theory of Relativity. Topics covered: the physics of Lorentz contraction, time dilation, the "twin paradox" and energy, momentum in Special Relativity; mass in Relativity, Schwarzschild metric, Black Holes and Cosmology, behavior of light and applications to Global Positioning Systems. Prerequisites: PH-263 and MA-340 or permission of instructor. (3-0-3)

PH-463 Quantum Physics

"Fundamentals of quantum physics: wave – particle duality, the Heisenberg uncertainty principle. Schrodinger's wave equation and solutions. WKB approximation, and time-dependent perturbation theory methods. Interaction of matter with radiation. Application to atomic and molecular spectra. Lasers and quantum computing. Prerequisites: MA-262 and PH-262, or permission of instructor. (3-0-3)

PHL-813 Professional Ethics & Leadership
This course examines the role of ethics in society. Cultural diversity, legal behaviors and the impact of moral behaviors on private and public organizations are presented in case studies. The various roles and impacts of unethical behaviors by system developers, users, managers, executives and consultants will be analyzed and the positive and negative impacts discussed as they pertain to the overall trustworthiness. (3)

PHL-880 Special Topics in Management
This course provides students the opportunity to examine in-depth issues relevant to Management and Decision Sciences. It is expected that students will produce a publishable paper.(3)

PHL-900 Mgmt. Theory in a Global Economy
This course provides an overview of seminal management theories and their relevance, applicability, and/or divergence from current business practice. The focus of the course is on understanding the application of management theories in the context of organizational sustainability in a global economy. (3)

ROB-100 Introduction to Robotics
This introductory course is a hands-on introduction to the key concepts and tools underpinning robotic systems in use and development today. Intended to give students the tools to understand robotic systems, to explore robotics for their own purposes, and to pursue advanced study in the field. The course will cover the fundamentals of manipulators, sensors, actuators, end effectors and product design for automation, kinematics, control, programming of manipulators, along with an introduction to pattern recognition and computer vision. Prerequisite: none. (3-0-3)

ROB-200 Robotics Systems Eng. & Analysis
This course examines methods of specifying, designing, analyzing and testing robotics systems. The principles and processes of robotics systems engineering are introduced and applied to the development of robotic devices. The focus is on a robotic system engineered to perform complex behavior. Robotic systems embed computing elements, integrate sensors and actuators, operate in a reliable and robust fashion, and demand rigorous engineering from conception through production. The course is organized as a progression through the systems engineering process of conceptualization, specification, design, and prototyping with consideration of verification and validation. Students completing this course will engineer a robotic system through its compete design and initial prototype. Prerequisites: ROB-100, EL-100 and EL-150 (3-0-3)

ROB-300 Industrial Robotics
This course will cover the principles and techniques involved in industrial robotics. Emphasis will be placed on industrial robot applications, analysis of robot manipulators, components of industrial robots, robot programming and control. Students will explore the use of robotics and machine learning in the efficiency of industrial processes. Students will model, design, plan, program, select, and implement industrial robot systems. Prerequisites: ROB-200, EE-210, EE-220, and EL-215. (3-0-3)

ROB-382 Robotic Systems
An introduction to the design and control of autonomous robots. Mechanical considerations and detection and navigational ability. Students will develop algorithms and use machine learning techniques to generate programs to control electromechanical systems to perform tasks. The class incorporates team-based projects and laboratories. Prerequisites: EL-262, ROB-300. (3-0-3)

RSC-805 IA Standards and Frameworks
This course covers Information Assurance (IA) umbrella standards and frameworks for cyber security and the broad areas of knowledge considered important for practicing professionals in information assurance. Students will acquire the means to identify a body of core knowledge and skills that all programs should contain as well as the ability to work with models of scope and assurance standards practices. With this foundation, the course provides students with rigorous methods for eliciting information assurance requirements using identification, characterization, categorization and modeling. Prerequisite: RSC-801or RSC-802. (3)

RSC-810 Prof. Research Theory & Practice
Students will examine the research process in the context of quantitative and qualitative methods. Students will develop a purpose statement, problem statement, and research question. (3)

RSC-811 Prof. Research Theory & Practice Research Theory
This course is designed to provide students an overview of a broad range of qualitative and quantitative methodologies applicable to doctoral level research. The course will examine the research process, including problem statements, developing dissertation research questions, conducting a literature review, and ethical implications in research. Students begin examining topics for Chapter 1 of the dissertation. Prerequisite: DSM-910

RSC-812 Prof Research Theory & Practice II

This course takes the foundational research designs established in IAE-860 and provides students with practical applications of research design in chapters one and three of the dissertation. Students will generate significant portions of the writing in these areas. Prerequisite: RSC-810 (3)

RSC-813 Professional Ethics and Leadership
This course examines the role of ethics. Cultural diversity, legal behaviors and the impacts of moral behaviors on business, corporations and agencies are presented in case studies. The various roles and impacts of unethical behaviors by system users, managers, executives and consultants will be analyzed and the positive and negative impacts discussed as they pertain to the overall trustworthiness. IRB requirements as it relates to research and human subjects will be examined in this course. Prerequisite: RSC-801 or RSC-802. (3)

RSC-815 Prob. Solve Quantitative Methods
The objective of this course is to provide students with the necessary knowledge to design and implement quantitative data analysis as part of scholarly research. The focus is on crafting research questions, hypotheses and proper data collection schemes. Students will explore a range of data analysis techniques useful for testing hypothesis and answering research questions. Research topics include: survey design, correlational design, casual-comparative design and experimental designs. Statistics topics include: types of data, parametric versus non-parametric classes of tests, descriptive statistics and inferential statistics. Prior experience with statistics is not required. (3)

RSC-820 Situation Awareness Analysis (Residency)
Students will generate a purpose statement, problem statement, and research question within their selected dissertation topic area. Corequisite: RSC-810. (3)

RSC-821 Contemporary Research in Mgmt.
Specialized contemporary topics in management, managing information systems, and decision analytics are presented for doctoral students. Qualifying exam will be administered at this residency. Prerequisite: RSC-811 (3) RESIDENCY

RSC-825 Applied Research in IA Research in IA
Building on RSC-810 and RSC-820, students will engage in formal research in order to develop the background of their topic problem statement and to locate seminal research for the topic. Prerequisite: RSC-820. (3) RSC-826 Applied Research in Mgmt & Dec Sci
This course is a continuation of RSC 811 and RSC 821. It is devoted to enhancing student understanding of dissertation research practices, with the intent of completing an initial draft of Chapter 1 of the doctoral dissertation. Prerequisite: RSC-811 and RSC-821. (3)

RSC-860 Research Design
This course will expose the student to the overall research design process through the analysis of knowledge claims, strategies of inquiry, and the development phases of the research project. We will examine how to consider the philosophical worldviews and how they are applied to the quantitative, qualitative, and mixed methods research methodologies. In addition, this course will provide the student with a brief introduction to questionnaire design.

RSC-899 Doctoral Dissertation Research
This course allows those students who have completed all relevant coursework in their Doctoral program to maintain continuous enrollment in good standing. This course does not apply toward degree requirements and may not be used to establish full or part time status for financial aid. Course may be repeated as needed. Prerequisite: Permission of Dean. (1)

SE-301 Software Engineering
Introduction to software design. Software performance, modularity, portability and reliability. Students apply engineering principles to create software solutions to specified problems. Software testing and CASE tools introduced. Emphasis on UML and object-oriented code. Prerequisite: CS-220. Offered during fall semester only. (2-2-3)

SE-321 Human Computer Interaction
Students learn user-centered design of computer systems with the goal of high usability. Emphasis is on designing systems that are efficient, easy-to-use, enjoyable and effective. Explores the selection of interaction style, hardware, and the use of color, font, text and images. Explores design implications due to user characteristics such as age, dexterity, experience and disabilities. Students learn requirements gathering, prototype building and user testing. A group project is assigned. Prerequisite:Engineering degrees CS-130 or CS-150. Offered during Spring semester only. (3-0-3)

SE-351 Software Testing
Covers the techniques and concepts required for software testing. Topics covered include software testing at the unit, module, subsystem and system levels; coverage criteria, manual and automated techniques for test validation and data generation;

formal testing processes and standards (with an emphasis on CMMI); rational tools suite; inspections; black box vs. white box testing; functional testing; and testability analysis. Prerequisites: CS-225 or CS-230 or CS-200. (2-2-3)

SE-457 Senior Design Project I
Students/teams select a project, develop an understanding of the project scope that includes research and documentation of related work, prepare a feasibility study, develop project requirements (constraints) and engineering, software, and/or security specifications, propose solutions and multiple designs, analyze proposed designs, and select a final proposed design, and prepare and present a preliminary design review (PDR). Students are expected to apply proper systems engineering and project management to their work. Additional components may be required in some projects. Students/teams submit a final report at the end of the semester. Pre-requisite: Senior standing. (3-0-3)

SE-458 Senior Design Project II
Students/teams build and test their selected designs (completed in 457). Each student team delivers a tested prototype and defends its project in front of a panel of experts. Students/teams submit a final report that includes description of the design, realization, and test processes as well as test results, discussion, and conclusion. Failure to deliver a completed design and a working prototype that meets engineering, software, and/or security specifications by the end of the semester may result in failing the course. *Note: Course must be completed with a grade of "C" or higher to meet undergraduate graduation requirements. Prerequsite: SE-457 (3-0-3)

SM-513 Systems Management & Organization
Basic concepts applied to managing large-scale systems. Perspectives and philosophies of organization, functions and processes of systems management and organizational leadership. Students completing this course may not enroll in MBA-625 for additional credit. (3)

SM-517 Psychological Factors in Sys Mgmt
Human characteristics and their bearing on systems management critical review of theory and research on personality, motivation, values, stress, leadership skills and power bases. (3)

SM-518 Principles of Systems
Systems theories, methodologies, thinking and practice; hard and soft systems approaches; multidisciplinary approaches to organizational problem solving, feedback loops and system change. (3)

SM-525 Statistics Using Excel
This course provides an understanding of basic statistical principles and tests and their application using Excel. Topics include collecting and organizing data, theorems, descriptive and inferential statistics, probability, discrete and normal distributions, sampling distributions, central limit theorem, estimation and hypothesis testing and regression analysis. Prerequisite: undergraduate statistics course or work experience. (3)

SM-563 Managing Information Systems
This course provides the student with an understanding of principles, practices, methodologies, and terminology used in planning, designing, implementing, operating, and managing information systems in government and industry. The overall approach is to examine the technology and roles of information systems within the organization, concentrating on how information systems are designed and how they operate. Knowledge of computer concepts will be provided to students new to this field. Prerequisite: SM-513. (3)

SM-567 Business Data Comm & Networking
This course is designed to develop skills and proficiency in information systems which use telecommunications facilities, computer networks, data communications, distributed processing, interactive systems, and the planning, design and analysis of telecommunications-based information systems for systems management. This course was formerly entitled Telecommunications and Computer Networks." Prerequisite: SM-563. (3)

SM-569 Decision Support and Expert Systems
This course helps the student understand techniques, terminology, principles, concepts and methodologies for using computers in decision making in business, aerospace, and government. The overall approach examines the nature and process of decision making, using a framework of Decision Support Systems (DSS) and Expert Systems, and explores specific computer applications in a variety of management decision situations applying learned techniques in a project. Prerequisite: SM 567, Corequisite: SM-525. (3)

SM-570 Business Analytics
T Introduces students to the key business, computational, and data competencies needed by business analysts to fulfill the information needs of decision makers at all levels of an organization. Business analytics (BA) refers to the skills, technologies, applications and practices for continuous iterative exploration and investigation of past business performance to gain insight and drive business planning. Analytics can also be used as input for human decisions or it may drive fully automated decision support (ADS) tools. The

course will provide usable information for the students on how "big data" can be used to help decision makers improve organizational competitiveness. BA makes extensive use of large data sets, statistical and quantitative analysis, explanatory and predictive modeling, and fact-based management to drive decision-making. Students also gain experience with different software tools used for data analysis and reporting. In the course students will focus on developing new insights and understanding of business performance based on data and statistical methods. Course deliverables will include in-depth case analyses, exams, and a course project and presentation to the class. Prerequisite: SM-569. (3)

SM-587 Law & Regulation of E-Commerce
The course is an examination of the complex political, legal and regulatory compliance issues influencing electronic commerce. This course will attempt to make sense of the status quo ante of electronic law and regulation to enable students to conduct business online. The future landscape, based upon developments in technology, applications, proposed legislation and administrative rule making, is discussed. (3)

SM-600 Special Topics in ITSM
Research into systems management subjects. Student primarily works in a guided study format with a mentor. Permission required from the instructor and academic dean. This course may be repeated with different projects. (1-4)

SM-615 Applied Statistics and Visualization
Introduces multivariate regression and random forests for modeling data. Addresses data access, variable selection and model diagnostics. Introduces foundations for visual thinking. Reviews common statistical graphics such as dot plots, box plots, q-q plots. Addresses more advanced methods such as scatterplot matrices enhanced by smoothed or density contours, and search tools for finding graphics with suggestive patterns. Course will introduce R software for analysis. A final project will involve visualization of a real data set. Prerequisite: Undergraduate statistics. (3-0-3)

SM-620 Big Data Warehousing and Analytic Systems
This course will equip the student with the necessary skills to solve complex problems and design solutions using Big Data. The student will be able to gain an understanding of how to design databases to manage large volumes of data from multiple sources, and how that data can be analyzed and translated into meaningful results. The student will be introduced to the field of Analytics, gain an understanding of Enterprise Data Warehousing models, be introduced to Data Mining techniques and tools used for mining the data warehouse, and build specific Data Marts. The student will be introduced to predictive analysis, and will be expected to develop models to extract data, perform trend analysis, establish patterns, and make projections. Prerequisites: Ability to use Structured Query Language with a basic relational database system; ability to read pseudocode, and understand basic data structures like arrays; and, an understanding of algebra and basic probability and statistics would be helpful, though not required. (3-0-3)

SP-358 Internship Program I
This is an elective course intended to provide students an alternate educational experience in industry and government that complements and strengthens their classroom education. Internship positions must be related to the students major and be creative and analytical in nature, for a minimum of eight weeks. The intern is under the supervision or mentorship of an experienced professional. Prerequisites: junior or senior status. Cumulative GPA 2.8+ and 3.0+ in major. Approval of appropriate dean required. (3-0-3)

SP-359 Internship Program II
This is the second of two elective courses intended to provide students an alternate educational experience in industry and government that complements and strengthens their classroom education. Prerequisites: junior or senior status. Cumulative GPA 2.8+ and 3.0+ in major. Approval of appropriate dean required. (3-0-3)

SP-400 Special Topics in Business and Technology
Students are provided the opportunity to examine topics of special interest in the field of business, management and technology. The student works in a guided study format with a mentor. Permission is required from the instructor and the academic dean. This course may be repeated with different projects. (3-0-3)

SS-171 Introduction to Psychology
This course is a fundamental study of human behavior exploring such topics as learning and cognition, memory, intelligence, motivation and emotion, consciousness, personality, and abnormal behavior. A discussion of the scientific character of psychology and the research methodology employed in the discipline will be included. Perquisite or Corequisite: EN-001 or EN-101. (3-0-3)

SS-175 Introduction to Sociology
A survey of the basic concepts and principles of sociology; culture, human nature, personality and the self, socialization, society, group behavior, norms and deviance, and institutions. The topic of social problems will be addressed by an in-depth

examination of a contemporary issue. A primary text and newspapers, magazines and journals will be used for this unit in addition to the textbook. Prerequisite: EN-101. (3-0-3)

SS-181 Human Development
This course provides a comprehensive and integrated review of human development from a psychological perspective. The lifespan model provides a coherent time-line approach for students to study, observe, and reflect on personal life developments as well as how relationships with individuals, families, and communities are integral to our development as humans. Perquisite or Corequisite: EN-101. (3-0-3)

SS-220 Critical Thinking
This course explores the process of thinking critically and guides students in thinking more clearly, insightfully and effectively. Concrete examples from personal experience and contemporary issues help students develop the abilities to solve problems, analyze arguments and issues, as well as make informed decisions in their academic career and personal lives. Readings, structured writing assignments and ongoing discussions help students develop sophisticated thinking abilities. Prerequisite: EN-102 (3-0-3)

SS-272 Group Dynamics
Focuses on interpersonal relations and skills development; cross-cultural relations and communication; organizational climate and culture and their relationship to and impact on individuals and groups; personality traits and team building; and characteristics and functions of groups in high-tech organizations both in the United States and abroad. Corequisite: EN-102. (3-0-3)

SS-275 History of Modern Culture
This course offers students a review and survey of world history and how it affected culture from 1946 to present through the use of the Internet. Students will learn the important historical events during this time period and how they impacted society, culture and politics. Students will learn major historical events, their geographical location and their world impact. Students will select a subject and throughout the semester be able to discuss their subject as it relates to the time period covered. Students will be required to do oral and written presentations covering 1946 to modern times. Corequisite: EN-101. (3-0-3)

SS-280 Culture Through Literature
This is a survey course that is designed to give students an overview of diversity in literature and its effect on social trend and culture traditions during the 20th century and beyond. Students will read and research literature from minority U.S. authors and how their writings affected both their respective minority communities as well as the effect their writing had on culture & society as a whole. Students will be required to read assigned books, make an oral presentation and conduct research dealing with a diverse author and their literature. (3-0-3)

SS-301 History of Technology
This is a survey course designed to give students an overall view of the development and effect of technology on American economic trends, social trends and cultural traditions through critical analysis. The focus is on the early twentieth century to the present day. Prerequisite: EN-102. (3-0-3)

SS-351 Ethics
This course is designed to help students improve their ability to make ethical decisions. This is done by providing a framework that enables the student to identify, analyze, and resolve ethical issues that arise when making decisions. Case analysis is a primary tool of this course.Prerequisite: EN-102. (3-0-3)

SS-400 Social Science: Special Topics
Research into social sciences. Student primarily works in a guided study format with a mentor. Permission required from the instructor and academic dean. (3-0-3)

TC-110 Intro to Telecommunications
Telecommunications defined and its effects on our daily lives. Structure of the telecommunications industry. Brief history. Basic terminology. Type of analog and digital communications systems. Data communications and networking. Introduction to local area networks, and wide area networks. Microwave and cellular systems. Satellite systems. Internet and its structure, World Wide Web, website technology and terminology. (2-2-3)

TC-312 Voice Over IP
This course offers students a hands-on approach for learning how Voice Over IP works, how it's planned and how it's implemented. The students will be expected to complete a series of labs on equipment and simulators to build shared data and voice networks. Students will work with specialized high performance networking equipment such as phones and switches that primarily support three functions. Students will configure VLAN networks to support the VOIP infrastructure. The commercial software such as Cisco Communication Manager Express (CME) and Cisco Unified Communication Manager (CUCM) will be used.

TC-319 Network Infrastructure Security
This course focuses on how to secure network infrastructures through hands on labs, since many

attacks are geared to degrade, compromise and even disable network infrastructures. Some of the tasks covered will be the securing of network switches and routers, their configurations and secure deployment, encryption of traffic and deployment of VPN. In addition, the labs will help students be competent in configuring firewalls such as ASA routers. Prerequisite CT-240. (1-3-3)

TC-359 Network Modeling and Design
A continuation of TC-309 where students are expected to design model, simulate and analyze networks to meet real-world situations. Networks are designed and tested for traffic handling capabilities and robustness. Alternate network solutions are proposed and tested. Virtual simulation software is used throughout course. Prerequisites: CT-240 and MA-128 (1-3-3)

TC-400 Special Projects in Telecom
Guided study. This course is a project course in which students research a problem in the field of telecommunications under the guidance of a professor or member of the academic staff. Students are required to produce a final written and oral presentation of their effort. Prerequisite: Permission of instructor. (0-6-3)

TC-401 Advanced Topics in Telecommunications Layered protocol models. Ethernet, TCP/IP with mathematical throughput analysis. SMTP, POP, HTTP analyzed using Ethereal. Number theory, encryption and authentication. The RSA algorithm. Routing algorithms (RIP, OSPF). Optimal capacity assignment. Laboratory exercises performed using actual constructed networks (Windows/ Linux) and virtual networks (in VMWare). Prerequisites: CT-152 and MA-128 or equivalent. (2-2-3)

TC-401 Advanced Topics in Telecommunications Layered protocol models. Ethernet, TCP/IP with mathematical throughput analysis. SMTP, POP, HTTP analyzed using Ethereal. Number theory, encryption and authentication. The RSA algorithm. Routing algorithms (RIP, OSPF). Optimal capacity assignment. Laboratory exercises performed using actual constructed networks (Windows/ Linux) and virtual networks (in VMWare). Prerequisites: CT-152 and MA-128 or equivalent. (2-2-3)

TEC-700 Prj. 1: Fund of Grad Research & Design
Project I will introduce the fundamentals of graduate research and design. The project will focus on graduate level writing, APA style, and the fundamentals of scientific inquiry. The project will cover the areas of technology research, ethics of research, the stages of the research process, conceptualization and operationalization of research questions, data collection techniques, analytics, an introduction to qualitative and quantitative methods and measurement, a discussion of program evaluation research, and research proposal development. Prerequisite: None. (6)

TEC-710 Prj. 2: Ethics & Phil. of Rsc and Design
Project II will address the ethics of conducting scholarly research. The discussion of research ethics will include, but not be limited to, informed consent, protecting anonymity of participants, and ethical participant protocols. Discussions will address the limits of researchers' obligations, along with providing a detailed look at the process of applying for Institutional Review Board approval. This project will provide students with an overview of the range of data collection methods available to individuals undertaking research and to enable the student to consider the implications, application strengths and weaknesses of the various data collection methods. The module will also provide insight into the ways that such methods may be applied effectively and ethically in research. Prerequisite: None. (6)

TEC-720 Prj. 3: Qual. & Quant. Research Design
Project III introduces the main research designs used in qualitative research. In addition to covering conceptual and epistemological issues associated with qualitative research design, the course introduces a range of qualitative research techniques. The strengths and limitations of various qualitative designs are explored with emphasis on issues of reliability, validity and representativeness. This project also introduces the main research designs used in quantitative research. In addition to covering conceptual and epistemological issues associated with quantitative research, the course introduces a range of techniques used in quantitative research. The strengths and limitations of various quantitative designs are explored with emphasis on issues of reliability, validity and representativeness. Prerequisite: TEC-700 and TEC-710. (6)

TEC-730 Prj. 4: Applied Stat, Anl, Dec & Vis
Project IV Project IV covers the basic concepts of probability, common distributions, statistical methods, data analysis, developing a critical approach to the analysis of contingency tables, examining the basic ideas and methods of generalized linear models, linking logit and log-linear methods with generalized linear models, and developing basic facility in the analysis of discrete data using SAS, R, and Python. The project will also cover operations research techniques and their application to decision making such as mathematical optimization, networks modeling, stochastic modeling, and multi-objective modeling. Other topics covered include computer simulation, decision analysis using decision trees, and quantitative value func-

tions. The project will culminate with visualization techniques. Students will learn different means of combating information overload as well as visual encoding as a method to supplant cognitive calculations with simpler perceptual inferences, improve comprehension, memory, and decision making. Prerequisite: TEC-700 and TEC-710. (6)

TEC-740 Prj. 5: Capstone Project
Project V is the Capstone project. This project provides an opportunity for students to undertake an extensive piece of academic writing based on an original research conducted by the student. The research will be supervised by a faculty member and must be defended through oral examination. The thesis is a medium to demonstrate the student's understanding of research methods as applied to a topic of the student's selection. Students may also use this class to begin the prospectus for doctoral studies. Prerequisite: TECH 700, TECH 710, TECH 720, and TECH 730. (6)

TEC-800 Writing the Doctoral Proposal I
Project I. The student and the student's Committee will work to produce a proposal for research that is comprehensive in detail and planning. The proposal will address the research topic, scope and aims, objectives and a timing plan. Further, the skill set of the student will be evaluated by the committee and recommendations may be made to the PhD Review Board to address deficiencies. Prerequisite: Admittance to Track II. (6)

TEC-810 Writing the Doctoral Proposal II
Project II. The student will work to complete research milestones related to chapter one of their research according to the proposal and research plan. The prospective chapter will be reviewed by the student's Committee for approval prior to advancing to the next phase in the program. Prerequisite: TEC-800. (6)

TEC-820 Writing the Doctoral Proposal III
Project III. The student will undertake a robust and comprehensive literature review, equivalent in scope and aim to a dissertation chapter two, within the boundaries of the proposal and research plan. The prospective chapter will be reviewed by the student's Committee for approval prior to advancing to the next phase in the program. Prerequisite: TEC-810. (6)

TEC-830 Writing the Doctoral Proposal IV
Project IV. Students will complete the research milestones associated with chapter three of the research. Further, students will finalize Institutional Review Board and Academic Review Board documentation. All research materials will be reviewed by the student's Committee and, upon reaching approval consensus, the committee will notify the PhD Review Board of the student advancing to proposal oral defense status. Prerequisite: TEC-820. (6)

TEC-840 Doctoral Proposal Oral Defense
Project V. Upon approval from the Institutional Review Board, Academic Review Board, and PhD Review Board, the student will prepare a presentation for oral defense of the research proposal, research plan, and initial chapters of the dissertation. The PhD Review Board and Dissertation Committee will evaluate both the student's proposal oral defense as well as the student's potential to complete the next phases of original research. Prerequisite: TEC-830. (6)

TEC-900 Doctoral Research Preparation I
Project VI. After receiving the necessary approvals, the student will conduct data collection and analysis activities consistent with the research plan. A complete and substantive presentation of the research results will be produced, equivalent to a dissertation chapter four. The student's Committee will review and approve related research materials. Prerequisite: TEC-840. (6)

TEC-910 Doctoral Research Preparation II
Project VII. The student will compose a draft research document in the appropriate form consisting of five chapters and submit the draft to the student's Committee. The student's Committee will review and approve related research materials. The student will make any required changes. Prerequisite: TEC-900. (6)

TEC-920 Doctoral Research Preparation III
Project VIII. The student will finalize the research document consisting of five chapters. The student's Committee will submit chapters four and five to university reviewers for approval. During Project VIII, the student is required to make the recommended changes and re-submit to the student's Committee; the student's Committee will re-submit to the university reviewers for final approval. Prerequisite: TEC-910. (6)

TEC-930 Doctoral Research Preparation IV
Project IX. The student will finalize the research document consisting of five chapters and will submit the document to the student's Committee. Upon review and approval, the student's Committee will notify the PhD Review Board of the student's readiness for oral defense. The student will be responsible for preparing the oral defense and submitting for approval. Prerequisite: TEC-920. (6)

TEC-950 Doctoral Preparation Oral Defense
Project X. Upon approval from the PhD Review Board, the student will prepare and deliver an oral presentation summarizing the body of research

and defend such through oral examination. The student's committee and PhD Review Board will confer to determine if the student has provided a sufficient and necessary oral defense of the research. Prerequisite: TEC-930. (6)

UAS-101 Intro to Unmanned and Autonomous Systems
This course presents an introduction to Unmanned and Autonomous Systems operations. This includes a historical perspective and background information of this system including its: modeling and control fundamentals, ground based systems, visual and electro-optical aspects of navigation, obstacle and terrain avoidance systems, modular on-board processing systems, and current applications. This course also exposes students to the significant regulations impacting unmanned systems operations. Prerequisite: None. (3-0-3)

UAS-102 Mechanics of Unmanned & Auto Systems
This course will provide the student an understanding of the component systems common to most Unmanned and Autonomous Systems with an emphasis on effective integration and operations. The course focuses on the core technologies and includes examinations of the control systems, power plants (motors), servos/actuators, power sources, and communication technologies utilized in unmanned systems. Prerequisite: None. (3-0-3)

UAS-110 Air Traffic Control Communications
This course presents an overview of the history of air traffic control, air traffic control tower procedures, radar systems, radar separation, radio communications and techniques, flight plan clearances, traffic management and emergency procedures and priority handling survey. Prerequisite: UAS-101, UAS-102. (3-0-3)

UAS-120 UAS Operator Certification
The course will develop the student's knowledge and skills that are needed to safely exercise the privileges and responsibilities of a Private Pilot. Course content includes instruction in aerodynamics, aircraft systems, FAA regulations, U.S. Airspace System, weight and balance, aircraft performance, aviation weather, flight publications, radio navigation, cross-country planning and navigation, basic flight physiology, and flight safety. The student must complete the appropriate flight lessons to satisfactorily complete the course. This course will develop the student's knowledge and skill needed to manage and operate small unmanned aircraft systems. Course content includes Federal Aviation Regulations, airspace authorization criteria, and operational approval requirements. Mission employment skills will be acquired through both classroom and hands-on flight activities. Flight activities will include launch and recovery operations, emergency procedures, plus mission planning and execution. Students must complete the appropriate UAS flight lessons to satisfactorily complete the course. Prerequisite: None (3-0-3)

UAS-130 UAS Safety Management Systems
This course presents an overview of related unmanned and autonomous safety topics, including current safety issues, the role of federal agencies, accident statistics, causes of accidents, human factors, crew resource management skills, and accident prevention. Prerequisite: UAS-101 and UAS-102. (3-0-3)

UAS-140 UAS Operations
This course provides an overview of the principles used in the design and operation of unmanned and autonomous systems (UAS) to support applications in air, ground, water, and space environments. The platform, sensors, power plant, control, and communications systems that are required in unmanned and autonomous systems will be explored with respect to function and interaction. The student will conduct a detailed examination of the components of unmanned systems and the critical parts played in operations. Topics include component capabilities, limitations, selection, overall system design concepts, criticality to system function, and applications in the civilian, commercial, and military fields. Prerequisite: None. (3-0-3)

UAS-150 UAS Crew Planning
This course is an introduction to the concepts and principles of crew resource management (CRM) in unmanned systems. Topics include human performance in crews, communication, decision making, situational awareness, workload management, team building, and human-machine interaction. The relationships of CRM principles will be explored in air, land, and water type vehicles. Additionally, contrasts of manned and unmanned systems and the essential coordination of unmanned and autonomous systems teams will be explored in-depth. Prerequisite: UAS-140. (3-0-3)

UAS-201 UAS System Sensors
This course covers payload systems capable of being installed on air (UAV), ground (UGV), and water-based vehicles (UMV). The student will gain an understanding of various sensory payloads and appropriate applications that may be used on multiple platform types. The student will learn to select sensors depending upon mission requirements, platform capabilities, data types, and environmental impacts. An introduction will be made to tools for data analysis after capture

and storage. Prerequisite: UAS-101, UAS-102. (3-0-3)

UAS-202 UAS Ground Vehicles
This course provides the principles and concepts of unmanned and autonomous vehicles used for ground applications. Students will explore the problems of perception, navigation, communications, control, sensors and payloads, and fundamentals of locomotion in the environments found on the land. The capabilities and limitations will be examined and the student will be able to select the appropriate platform types and sensors to meet application requirements. Current trends such as driverless cars, autonomous buses and trains, and agricultural vehicles will be highlighted with the most successful systems and their technologies. Prerequisite: UAS-140. (3-0-3)

UAS-210 UAS Design
This course provides the principles and concepts essential to the design and operation of unmanned and autonomous systems (UAS) and their subsystems. Communications, components, and networking are explored as the infrastructure to ensure system and subsystem interoperability. Students will examine technologies dealing with facets of mobile computing platforms, machine-learning, network protocols and communication systems to support intra-system and inter-system coordination. Topics include system requirements, constraints, dependability, regulations, communications, cybersecurity, avionics and sensors. Prerequisite: UAS-140. (3-0-3)

UAS-220 Intro to Processing Rem Sensed Data
Students are introduced to basic theory, history, and practical applications of remote sensing technology, with an emphasis on high spatial resolution multispectral aerial imagery collected using unmanned aircraft systems. Other topics include geographic information systems, aerial image interpretation, sensor resolution, orthomosaicing, georegistration, vegetation indices, and image classification. Prerequisite: UAS—201. (3-0-3)

UAS-230 Unmanned Surface and Underwater Vehicles
This course provides the principles and concepts of unmanned and autonomous vehicles used for water applications where unique challenges for mobile robotic systems are encountered. Students will explore the problems of perception, navigation, communications, control, sensory payloads, and fundamentals of propulsion in the water environment. The capabilities and limitations will be examined and the student will be able to select the appropriate platform types and sensors to meet application requirements. Applications explored include both surface and underwater functions in the civilian, commercial and military fields. Prerequisite: UAS-140. (3-0-3)

UAS-240 Unmanned Space Vehicles
This course provides the principles and concepts of unmanned and autonomous vehicles used for space applications. The challenges of space as an environment, navigation, time, and distance will be included as essential elements of overall space exploration via unmanned and autonomous systems. Students will explore the problems of perception, space navigation, communications, control, sensors and payloads, time delay, and fundamentals of propulsion and motion in space. Capabilities and limitations of multiple platform types will be examined and the student will be able to select the appropriate platform types and payloads to meet mission and application requirements. Applications explored include earth orbital, interplanetary, solar system, and planetary/celestial body exploration. Prerequisite: UAS-150, UAS-220. (3-0-3)

UAS-250 Unmanned Vehicle Environments
This course presents the challenges to unmanned and autonomous systems (UAS) encountered in their operational capacities. The student is exposed to the aspects of extreme environments where the vehicles and communications must operate in all conditions. The presence of adverse factors and disturbances could disrupt the function of the communications and controllers and lead to significant degradation of performance, causing instability and possible damages. Students learn to match platform capabilities, communications abilities, and payloads with the mission requirements to meet the demands of a variety of environments. The students develop an understanding of extreme or uncertain environments, the limitations inflicted on UAS systems, and possible methods to overcome them. Prerequisite: UAS-140. (3-0-3)

UAS-310 Unmanned Vehicle Missions
This course exposes the student to the concepts and principles of mission planning for leaders, operators, communicators, and data analysts involved in unmanned and autonomous systems (UAS). The student will gain an understanding of the processes in the missions of UAS including planning, execution, acquisition, processing, analysis, and dissemination. This course also addresses the suitability of unmanned technologies to support common missions such as law enforcement, hazardous materials detection, natural disaster assess-

ment, border patrol, agriculture survey, search and rescue, crop improvement, transportation inspections, utility inspections, weather observation, monitoring of renewable energy sources, and others. Prerequisite: UAS-101, UAS-102. (3-0-3)

UAS-320 Unmanned Vehicle Business Decisions
This course provides students an overview of the business aspects of unmanned and autonomous systems (UAS) and methods of making better informed decisions. Students will explore multiple commercial business problems, define requirements, and design solutions based on system capabilities, business need, costs, productivity, regulatory restrictions, safety, and risk. Business cases will be reviewed for aerial, ground, and water UAS. Prerequisite: UAS-120, UAS-310. (3-0-3)

UAS-330 Unmanned Systems Crew Resource Mgmt
Principles of organizational behavior, interpersonal relationship skills, and critical behavioral dynamics used by Unmanned Aircraft Systems (UAS) crews. Information processing, Human Error, Communications Processes, Problem Solving, Workload Management, and Situational Awareness with particular attention given to dealing with teleoperation and automation in UAS application. (3-0-3)

UAS-410 Unmanned Vehicle Laws and Regulations
This course introduces students to laws and regulations related to unmanned and autonomous systems (UAS) operations. The issues of local, state, federal, and international laws and agreements are presented with regard to aerial, ground, water, and space environments. Aspects of vehicle operation, sensor operation, ethics, dominion, jurisdiction, privacy, and security will be highlighted. Prerequisite: UAS-320. (3-0-3)

UAS-420 Data Acquisition and Post-processing
Students build upon the basic image processing skills gained in the previous course, expanding their knowledge of common aerial image data processing tasks using industry-standard software packages. Aerial data collection methodologies are introduced, including consideration of aerial mission flight parameters. Prerequisite: UAS-220. (3-0-3)

UAS-430 UAS Data Visualization and Present
Students build upon the basic image processing skills gained in the previous course, expanding their knowledge of common aerial image data processing tasks using industry-standard software packages. Aerial data collection methodologies are introduced, including consideration of aerial mission flight parameters. Prerequisite: UAS-220. (3-0-3)

UAS-457 Senior Design Project I
Students/teams select a project, develop an understanding of the project scope that includes research and documentation of related work, prepare a feasibility study, develop project requirements (constraints) and engineering, software, and/or security specifications, propose solutions and multiple designs, analyze proposed designs, and select a final proposed design, and prepare and present a preliminary design review (PDR). Students are expected to apply proper systems engineering and project management to their work. Additional components may be required in some projects. Students/teams submit a final report at the end of the semester. Pre-requisite: Senior standing. (3-0-3)

UAS-458 Senior Design Project II
Students/teams build and test their selected designs (completed in 457). Each student team delivers a tested prototype and defends its project in front of a panel of experts. Students/teams submit a final report that includes description of the design, realization, and test processes as well as test results, discussion, and conclusion. Failure to deliver a completed design and a working prototype that meets engineering, software, and/or security specifications by the end of the semester may result in failing the course. *Note: Course must be completed with a grade of "C" or higher to meet undergraduate graduation requirements. Prerequsite: UAS-457 (3-0-3)

UAS-500 UAS Operator Certification
The course will develop the student's knowledge and skills that are needed to safely exercise the privileges and responsibilities of a Private Pilot. Course content includes instruction in aerodynamics, aircraft systems, FAA regulations, U.S. Airspace System, weight and balance, aircraft performance, aviation weather, flight publications, radio navigation, cross-country planning and navigation, basic flight physiology, and flight safety. The student must complete the appropriate flight lessons to satisfactorily complete the course. This course will develop the student's knowledge and skill needed to manage and operate small unmanned aircraft systems. Course content includes Federal Aviation Regulations, airspace authorization criteria, and operational approval requirements. Mission employment skills will be acquired through both classroom and hands-on flight activities. Flight activities will include launch and recovery operations, emergency procedures, plus mission plan-

ning and execution. Students must complete the appropriate UAS flight lessons to satisfactorily to complete the course. Prerequisite: None

UAS-501 Unmanned Vehicle Theory and Practice
This course provides an overview of unmanned and autonomous systems (UAS) and their subsystems as critical elements in their application to civilian, commercial, and military fields. The students will explore case studies in aerial, ground, water and space environments and examine mission requirements, selection standards, limiting factors, and regulatory issues. Emphasis is on the total system including reliability, maintainability, system support, and total system performance toward fulfillment of user needs and results in the operational environment. Prerequisite: None. (3)

UAS-520 Unmanned Vehicles Sensors and Data
This course provides the student with an understanding of the complexities of sensory operations and data processing in unmanned and autonomous systems (UAS). The student will examine multiple sensory devices including their capabilities, acquisition rates,, and constraints as factors of device selection. The issues of data acquisition, formats, storage, processing, and communications within the vehicle, the system, and between multiple systems will be explored. Prerequisite: UAS-510. (3)

UAS-530 User Interface for Design and Eval
This course introduces user interfaces for unmanned and autonomous systems through designing, implementing, and evaluating human-computer interfaces of various types. It focuses on the emerging field of human-robot interaction (HRI) which comprises a multitude of disciplines including: robotics, artificial intelligence, human factors, human computer interaction and cognitive psychology. Topics include: Approaches to human-system interactions for unmanned systems including graphical user interfaces, non-visual feedback (haptic, aural, etc.), gesture-based controls, voice-based controls, telepresence, interaction and architectures, programming languages, metrics, social robotics, emotions, frameworks and relations between perception, actuation and HRI. Includes hands-on experience with one or multiple user interface technologies. The theoretical foundation for designing interfaces is complemented by practical classroom exercises and the design and development of a prototype in a team-based setting using previously learned principles. Prerequisite: UAS-520. (3)

UAS-640 Data Analysis and Visualization
This course is an introduction to key design principles and techniques for interactively visualizing data. Includes the review, design, planning, analysis and statistical interpretation of data to support unmanned and autonomous applications. The major goals of this course are to understand how visual representations can help in the analysis and understanding of complex data, how to design effective visualizations, and how to create interactive visualizations using modern web-based frameworks. Students will build on statistical theory and learn advanced techniques that can be applied to problem solving, research analysis and numerical interpretation of data. In addition, students will learn basic visualization design and evaluation principles, and learn how to acquire, parse, and analyze large datasets. Students will also learn techniques for visualizing multivariate, temporal, text-based, geospatial, hierarchical, and network/graph-based data. Additionally, students will utilize software tools to prototype many of these techniques on existing datasets. Students must have some previous statistics course or experience. Prerequisite: UAS-530. (3)

UAS-650 UAS Laws, Regulations and Policy
This course will survey the rapidly evolving field of the law and public policy governing the use of autonomous systems of all types of Unmanned Aircraft Systems ("UAS") in the national airspace ("NAS"). The course will proceed based on six "modules" addressing various aspects of the new field of UAS and autonomous vehicle Law. These modules are: (1) Emerging FAA Regulatory Framework; (2) Government Use of UAS, autonomous systems, and the Fourth Amendment; (3) State Regulation of Government and Commercial autonomous systems; (4) Tort Liability for autonomous and UAS Operations; (5) Emerging Frameworks for autonomous systems and Privacy; and (6) Overview of Intellectual Property Issues for the unmanned and autonomous industry. Upon successful completion of the course, the student will have a working knowledge of the legal issues relevant to the autonomous vehicle and UAS industry. Prerequisite: UAS-640. (3)

UAS-660 Safety Mgmt Sys & UAS Cybersecurity
Overview of related unmanned and autonomous safety topics, including current safety issues, the role of federal agencies, accident statistics, causes of accidents, human factors, crew resource management skills, and accident prevention. The course discusses the safety requirements, hazard and risk analysis, failure modes and effect analysis, fault tolerance, basics of hardware and software reliability, levels of integrity, nature of faults and redun-

dancy, and issues of verification, validation and certification. Cybersecurity issues pertinent to computer-based infrastructure, mobile robotics, and the information-driven nature of unmanned and autonomous ventures. Topics include threats, assumptions, assurance, confidentiality, integrity, availability, access control matrix and policies, security models, requirements imposed by policies, protection models, covert channels, formal methods for security, intrusion detection, auditing, and other issues associated with dynamic and vehicular systems. Prerequisite: UAS-650 (3)

UAS-660 Safety Mgmt Sys & UAS Cybersecurity
Overview of related unmanned and autonomous safety topics, including current safety issues, the role of federal agencies, accident statistics, causes of accidents, human factors, crew resource management skills, and accident prevention. The course discusses the safety requirements, hazard and risk analysis, failure modes and effect analysis, fault tolerance, basics of hardware and software reliability, levels of integrity, nature of faults and redundancy, and issues of verification, validation and certification. Cybersecurity issues pertinent to computer-based infrastructure, mobile robotics, and the information-driven nature of unmanned and autonomous ventures. Topics include threats, assumptions, assurance, confidentiality, integrity, availability, access control matrix and policies, security models, requirements imposed by policies, protection models, covert channels, formal methods for security, intrusion detection, auditing, and other issues associated with dynamic and vehicular systems. Prerequisite: UAS-650 (3)

UAS-670 UAS Management for Managers
This course provides the student an understanding of planning, scheduling, and managing unmanned and autonomous projects. Course includes roles, responsibilities, administrative procedures, cost control, documentation, quality control, and applications. This course introduces concepts of leadership, organizational and technical management which are approached from a complex systems perspective to explain the behavior of autonomous and semi-autonomous systems. This course addresses the fundamental principles of system management and explores issues related to effective technical planning, scheduling and assessment of technical progress, and identifying the unique challenges of the technical aspects of autonomous systems and the ability to control them. Topics will include techniques for life cycle cost, performance measurement, modern methods of effective project management, quality management, risk management, functional analysis, and communications. Prerequisite: UAS-660. (3)

UAS-710 UAS Capstone Project I
The Capstone Project is the culminating effort of the student's entire learning experience. The student will complete a comprehensive exam that provides significant evidence of experience in unmanned and autonomous systems studies, master's level thesis and research project (with submission of a final report, approval by a thesis committee, and an oral defense of the research work), or a project resulting in fabrication of a prototype and publication of refereed article. Students will work with designated faculty to formulate, develop, and complete the project, thesis, or exam. The completion of the Capstone Course is designed to document significant evidence that all Program Outcomes have been met and provides the student evidence of experience to show to current and prospective employers. The Capstone Course must be taken at the end of the student's degree program. Prerequisite: All Master of Science in Unmanned and Autonomous Systems degree program curriculum. Prerequisite: UAS-670. (3)

UAS-720 UAS Capstone Project II
The Capstone Project is the culminating effort of the student's entire learning experience. The student will complete a comprehensive exam that provides significant evidence of experience in unmanned and autonomous systems studies master's level thesis and research project (with submission of a final report, approval by a thesis committee, and an oral defense of the research work), or a project resulting in fabrication of a prototype and publication of refereed article. Students will work with designated faculty to formulate, develop, and complete the project, thesis, or exam. The completion of the Capstone Course is designed to document significant evidence that all Program Outcomes have been met and provides the student evidence of experience to show to current and prospective employers. The Capstone Course must be taken at the end of the student's degree program. Prerequisite: All Master of Science in Unmanned and Autonomous Systems degree program curriculum. Prerequisite: UAS-710. (3)

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Calendar

Fall Semester 2018

Undergraduate Classes

Semester-long Classes

Sept. 3	Labor Day – university closed
Sept. 4	Classes begin
	Last day for 100% refund
	First tuition installment due
	Library opens
	Cooperative education work period begins
	December graduates notify Office of Registration and Records
Sept. 10	Electronics, physics and chemistry labs open
	Learning Center opens
Sept. 17	Last day for 75% refund
	Last day to add a course
Sept. 24	Last day for 50% refund
Oct. 1	Last day for 25% refund
	Last day to drop without a W
	Second tuition installment due
Oct. 1-8	Financial Aid Disbursement Week/ Pell Census
Oct. 9	Career Conference
Oct. 29	Final tuition installment due
Oct. 31	Registration for spring semester begins for continuing students
Nov. 5	Last day to drop course with W or change to audit
Nov. 21	Classes cancelled -- university closes at 5 pm
Nov. 22-25	Thanksgiving recess -- university closed
Dec. 14	Classes end
	Electronics, physics and chemistry labs close
	Learning Center closes
	All library materials are due
	Last day for cooperative education work
	Last day to withdraw
Dec. 17-21	Final examinations
Dec. 21	Library closes
	Residence halls close at 5 p.m.
	University closes at 5 p.m.
Dec. 24-Jan. 1	Winter recess – university closed

Refer to Capitol Technology University's online calendar at www.CapTechU.edu for an updated calendar.

Graduate Classes

Semester-long Classes

Aug. 24	Final day of registration
Aug. 27	Classes begin
	Last day for 100% refund
	First 50% tuition installment due
Sept. 3	Labor Day – university closed (Online classes will meet asynchronously.)
Sept. 10	Last day for 75% refund
	Last day to add a course
Sept. 17	Last day for 50% refund
Sept. 24	Last day for 25% refund
	Final 50% tuition installment due
Oct. 31	Registration for spring semester begins
Nov. 5	Last day to drop or audit course
Nov. 21	University closes at 5 p.m. (Online classes will meet asynchronously.)
Nov. 22-25	Thanksgiving – university closed (Online classes will meet asynchronously.)
Dec. 7	Last day to withdraw
Dec. 14	Classes end
Dec. 21	University closes at 5 p.m.
Dec. 24-Jan. 1	Winter recess – university closed

Fall – Term I

Aug. 24	Final day of registration
Aug. 27	Classes begin
	Last day for 100% refund
	First 50% tuition installment due
Sep. 3	Labor Day -- college closed (Online classes will meet asynchronously.)
Sep. 4	Last day for 75% refund
	Last day to add a course
Sept. 10	Last day for 50% refund
Sept. 17	Last day for 25% refund
	Last day to drop or audit course
Sept. 24	Final 50% tuition installment due
Oct. 12	Last day to withdraw
Oct. 19	Classes end

Fall – Term II

Oct. 19	Final day of registration
Oct. 22	Classes begin
	Last day for 100% refund
	First 50% tuition installment due
Oct. 29	Last day for 75% refund
	Last day to add a course
Oct. 31	Registration for spring semester begins
Nov. 5	Last day for 50% refund
Nov. 12	Last day for 25% refund
	Last day to drop or audit course
Nov. 19	Final 50% tuition installment due
Nov. 21	University closes at 5 p.m. (Online classes will meet asynchronously.)
Nov. 22-25	Thanksgiving – university closed (Online classes will meet asynchronously.)
Dec. 7	Last day to withdraw
Dec. 14	Classes end
Dec. 21	University closes at 5 p.m.
Dec. 24-Jan. 1	Winter recess – university closed

Refer to Capitol Technology University's online calendar at www.CapTechU.edu for an updated calendar.

Spring Semester 2019

Undergraduate and Graduate Classes

Semester-long Classes

Jan. 2	University opens
Jan. 2-4	Registration for part-time students
Jan. 4	Residence hall check-in for new students
	Orientation and registration for new students
	Final day of registration
Jan. 5	Residence hall check-in for returning students
Jan. 7	Classes begin
	Last day for 100% refund
	First tuition installments due – UG
	First 50% tuition installment due - GR
	Library opens
	Cooperative education work period begins
	Graduation applications due for Class of 2019
Jan. 14	Electronics, physics and chemistry labs open
	Student Success Center opens
Jan. 21	Martin Luther King Jr. Day – university closed. (All classes will meet asynchronously)
Jan. 22	Last day for 75% refund
	Last day to add a course
Jan. 28	Last day for 50% refund
Feb. 4	Last day for 25% refund
	Last day to drop course without W grade
	Second tuition installments due – UG
	Final 50% tuition installment due - GR
Feb. 4-11	Financial Aid Disbursement Week/ Pell Census
Mar. 1	Career Conference
Mar. 4	Final tuition installment due - UG
Mar. 11-15	Spring reading days (All classes will meet asynchronously)
Mar. 18	Classes resume
	Last day to drop course with W or change to audit
Apr. 3	Registration for summer semester begins for continuing students
Apr. 10	Pre-registration for fall semester begins for continuing students
April 19	Classes end
	Last day to withdraw
	Electronics, physics and chemistry labs close
	Learning Center closes
	All library materials are due
	Last day for cooperative education work
Apr. 22-26	Final examinations
Apr. 26	Library closes
Apr. 26	Residence halls close at 7 p.m.
May 4	Commencement

Spring – Term 1

Jan. 2	University opens
Jan. 4	Final day of registration
Jan. 7	Classes begin
	Last day for 100% refund
	First tuition installment due – UG & GR
	Graduation applications due for Class of 2019
Jan. 14	Last day for 75% refund
	Last day to add a course
Jan. 21	Martin Luther King Jr. Day – university closed. (All classes will meet asynchronously)
Jan. 22	Last day for 50% refund
Jan. 28	Last day for 25% refund
	Last day to drop or audit course
Feb. 4	Final tuition installment due UG & GR

Refer to Capitol Technology University's online calendar at www.CapTechU.edu for an updated calendar.

Feb. 22	Last day to withdraw
Mar. 1	Classes end

Spring – Term II

Mar. 1	Final day of registration
Mar. 4	Classes begin Last day for 100% refund First tuition installment due – UG & GR
Mar. 11	Last day for 75% refund Last day to add a course
Mar. 11-15	Spring reading days (All classes will meet asynchronously)
Mar. 18	Last day for 50% refund
Mar. 25	Last day for 25% refund Last day to drop or audit a course
Apr. 1	Final tuition installment due – UG & GR
Apr. 3	Registration for summer semester begins for continuing students
Apr. 10	Pre-registration for fall semester begins for continuing students
April 19	Last day to withdraw
April 26	Classes end
May 4	Commencement

Refer to Capitol Technology University's online calendar at www.CapTechU.edu for an updated calendar.

Summer Semester 2019
Undergraduate and Graduate Classes

Semester-long Classes

May 3	Final day of registration
	Cooperative education work period begins
May 4	Commencement
May 5	Residence Hall check-in
May 6	Classes begin
	Last day for 100% refund
	First tuition installments due - UG
	First 50% tuition installment due - GR
	Library opens
May 13	Electronics, physics and chemistry labs open
May 20	Last day for 75% refund
	Last day to add a course
May 27	Memorial Day – university closed (All classes meet asynchronously)
May 28	Last day for 50% refund
June 3	Last day for 25% refund
	Last day to drop course without W grade
	Second tuition installments due – UG
	Final 50% tuition installment due - GR
June 3-10	Financial Aid Disbursement Week/ Pell Census
July 1	Final tuition installment due - UG
July 4	Independence Day – university closed (All classes meet asynchronously)
July 8	Last day to drop course with W or change to audit
July 22-26	Summer reading days (All classes will meet asynchronously)
Aug. 16	Classes end
	Electronics, physics and chemistry labs close
	All library materials are due
	Last day to withdraw from courses
Aug. 19-23	Final examinations
Aug. 23	Library closes
Aug. 24	Residence halls close at 7 p.m.

Summer – Term I

May 3	Final day of registration
May 4	Commencement
May 6	Classes begin
	Last day for 100% refund
	First tuition installment due – UG & GR
May 13	Last day for 75% refund
	Last day to add a course
May 20	Last day for 50% refund
May 27	Memorial Day – university closed (All classes will meet asynch)
May 28	Last day for 25% refund
	Last day to drop or audit course
June 3	Final tuition installment due – UG & GR
June 21	Last day to withdraw
June 28	Classes end

Summer – Term II

June 28	Final day of registration
July 1	Classes begin
	Last day for 100% refund
	First tuition installment due – UG & GR
July 4	Independence Day – university closed (All classes will meet asynchronously)
July 8	Last day for 75% refund
	Last day to add a course
July 11	First class for live 8 week Thursday classes
July 12	Thursday classes meet
July 15	Last day for 50% refund
July 22	Last day for 25% refund
	Last day to drop or audit course
July 22-26	Summer reading days (All classes will meet asynchronously)
July 29	Final tuition installment due – UG & GR
Aug. 16	Last day to withdraw
Aug. 23	Classes end

Refer to Capitol Technology University's online calendar at www.CapTechU.edu for an updated calendar.

Fall Semester 2019
Undergraduate and Graduate Classes

Semester-long Classes

Aug. 26-27	Registration for part-time students
Aug. 28	Residence Hall check-in for new students
Aug. 28-30	Orientation, registration
Aug. 30	Final day of registration
Aug. 31	Residence hall check-in for returning students
Sept. 2.	Labor Day – University Closed
Sept. 3	Classes begin
	Last day for 100% refund
	First tuition installment due – UG
	First 50% tuition installment due - GR
	Library opens
	Cooperative education work period begins
Sept. 9	Electronics, physics and chemistry labs open
	Learning Center opens
Sept. 13	Monday classes meet
Sept. 16	Last day for 75% refund
	Last day to add a course
Sept. 23	Last day for 50% refund
Sept. 30	Last day for 25% refund
	Last day to drop without a W
	Second tuition installments due – UG
	Final 50% tuition installment due - GR
Sept. 30 - Oct. 7	Financial Aid Disbursement Week/Pell Census
Oct. 11	Career Conference
Oct. 28	Final tuition installment due - UG
Nov. 4	Last day to drop course with W or change to audit
Oct. 30	Registration for spring semester begins for continuing students
Nov. 25-29	Fall reading days (All classes will meet asynchronously)
Nov. 28-29	Thanksgiving – University Closed
Dec. 13	Classes end
	Electronics, physics and chemistry labs close
	Learning Center closes
	All library materials are due
	Last day for cooperative education work
	Last day to withdraw
Dec. 16-20	Final examinations
Dec. 20	Library closes
	Residence halls close at 5 p.m.
Dec. 23	University closes at 5 p.m.
Dec. 24-Jan. 1	University Closed

Fall – Term I

Aug. 30	Final day of registration
Sept. 2.	Labor Day – University Closed
Sept. 3	Classes begin
	Last day for 100% refund
	First tuition installment due – UG & GR
Sep. 9	Last day for 75% refund
	Last day to add a course
Sept. 13	Monday classes meet
Sept. 16	Last day for 50% refund
Sept. 23	Last day for 25% refund
	Last day to drop without a W
	Last day to drop or audit course
Sept. 30	Final tuition installment due – UG & GR
Oct. 18	Last day to withdraw
Oct. 25	Classes end

Fall – Term II

Oct. 25	Final day of registration
Oct. 28	Classes begin
	Last day for 100% refund

Refer to Capitol Technology University's online calendar at www.CapTechU.edu for an updated calendar.

Spring Semester 2020
Undergraduate and Graduate Classes

Semester-long Classes

	First tuition installment due – UG & GR
Oct. 29	Registration for spring semester begins for continuing students
Nov. 4	Last day for 75% refund
	Last day to add a course
Nov. 11	Last day for 50% refund
Nov. 18	Last day for 25% refund
	Last day to drop or audit course
Nov. 25	Final tuition installment due – UG & GR
Nov. 25-29	Fall reading days (All classes will meet asynchronously)
Nov. 28-29	Thanksgiving – University Closed
Dec. 13	Last day to withdraw
Dec. 20	Classes end
Dec. 24-Jan. 1	University Closed

Jan. 2	University opens
Jan. 2-3	Registration for part-time students
Jan. 3	Residence hall check-in for new students. Orientation and registration for new students. Final day of registration,
Jan. 4	Residence hall check-in for returning students
Jan. 6	Classes begin
	Last day for 100% refund
	First tuition installments due – UG
	First 50% tuition installment due - GR
	Library opens
	Cooperative education work period begins
	Graduation applications due for Class of 2020
Jan. 13	Electronics, physics and chemistry labs open
	Learning Center opens
Jan. 20	Martin Luther King Jr. Day – university closed. (All classes will meet asynchronously)
Jan. 21	Last day for 75% refund
	Last day to add a course
Jan. 27	Last day for 50% refund
Feb. 3	Last day for 25% refund
	Last day to drop course without W grade
	Second tuition installments due - UG
	Final 50% tuition installment due - GR
Feb. 3-10	Financial Aid Disbursement Week/Pell Census
Mar. 2	Final tuition installment due - UG
Mar. 2	Career Conference
Mar. 9-13	Spring reading days (All classes will meet asynchronously)

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Mar. 16	Classes resume
Last day to drop course with W or change to audit	
Apr. 1	Registration for summer semester begins for continuing students
Apr. 8	Pre-registration for fall semester begins for continuing students
April 17	Classes end
	Last day to withdraw
	Electronics, physics and chemistry labs close
	Learning Center closes
	All library materials are due
	Last day for cooperative education work
Apr. 20-24	Final examinations
Apr. 24	Library closes
Apr. 24	Residence halls close at 7 p.m.
May 2	Commencement

Spring – Term 1

Jan. 2	University opens
Jan. 3	Final day of registration
Jan. 6	Classes begin
	Last day for 100% refund
	First tuition installment due – UG & GR
	Graduation applications due for Class of 2020
Jan. 13	Last day for 75% refund
	Last day to add a course
Jan. 20	Martin Luther King Jr. Day – university closed. (All classes will meet asynchronously)
Jan. 21	Last day for 50% refund
Jan. 27	Last day for 25% refund
	Last day to drop or audit course
Feb. 3	Final tuition installment due – UG & GR
Feb. 21	Last day to withdraw
Feb. 28	Classes end

Spring – Term II

Feb. 28	Final day of registration
Mar. 2	Classes begin
	Last day for 100% refund
	First tuition installment due – UG & GR
Mar. 9	Last day for 75% refund
	Last day to add a course
Mar. 9-13	Spring reading days (All classes will meet asynchronously)
Mar. 16	Last day for 50% refund
Mar. 23	Last day for 25% refund
	Last day to drop or audit a course
Mar. 30	Final tuition installment due – UG & GR
Apr. 1	Registration for summer semester begins for continuing students
Apr. 8	Pre-registration for fall semester begins for continuing students
April 17	Last day to withdraw
April 24	Classes end
May 2	Commencement

Refer to Capitol Technology University's online calendar at www.CapTechU.edu for an updated calendar.

Summer Semester 2020
Undergraduate and Graduate Classes

Semester-long Classes

May 1	Final day of registration
May 2	Commencement
May 4	Classes begin
	Last day for 100% refund
	First tuition installments due – UG
	First 50% tuition installment due - GR
	Cooperative education work period begins
	Library opens
May 11	Electronics, physics and chemistry labs open
May 18	Last day for 75% refund
	Last day to add a course
May 25	Memorial Day – university closed (All classes meet asynchronously)
May 26	Last day for 50% refund
June 1	Last day for 25% refund
	Last day to drop course without W grade
	Second tuition installments due – UG
	Final 50% tuition installment due - GR
June 1-8	Financial Aid Disbursement Week/ Pell Census
July 3	Independence Day observed – university closed (All classes meet asynchronously)
July 6	Last day to drop course with W or change to audit
June 29	Final tuition installment due – UG
July 27-31	Summer reading days (All classes will meet asynchronously)
Aug. 14	Classes end
	Electronics, physics and chemistry labs close
	All library materials are due
	Last day to withdraw from courses
Aug. 17-21	Final examinations
Aug. 21	Library closes
Aug. 22	Residence halls close at 7 p.m.

Summer – Term I

May 1	Final day of registration
May 2	Commencement
May 4	Classes begin
	Last day for 100% refund
	First tuition installment due – UG & GR
May 11	Last day for 75% refund
	Last day to add a course
May 18	Last day for 50% refund
May 25	Memorial Day – university closed (All classes will meet asynchronously)
May 26	Last day for 25% refund
	Last day to drop or audit course
June 1	Final tuition installment due – UG & GR
June 19	Last day to withdraw
June 26	Classes end

Summer – Term II

June 26	Final day of registration
June 29	Classes begin
	Last day for 100% refund
	First tuition installment due – UG & GR
July 3	Independence Day observed – university closed (All classes will meet asynchronously)
July 6	Last day for 75% refund
	Last day to add a course
July 13	Last day for 50% refund
July 20	Last day for 25% refund
	Last day to drop or audit course
Aug. 3	Final tuition installment due – UG & GR
July 27-31	Summer reading days (All classes will meet asynchronously)
Aug. 14	Last day to withdraw
Aug. 21	Classes end

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Refer to Capitol Technology University's online calendar at www.CapTechU.edu for an updated calendar.

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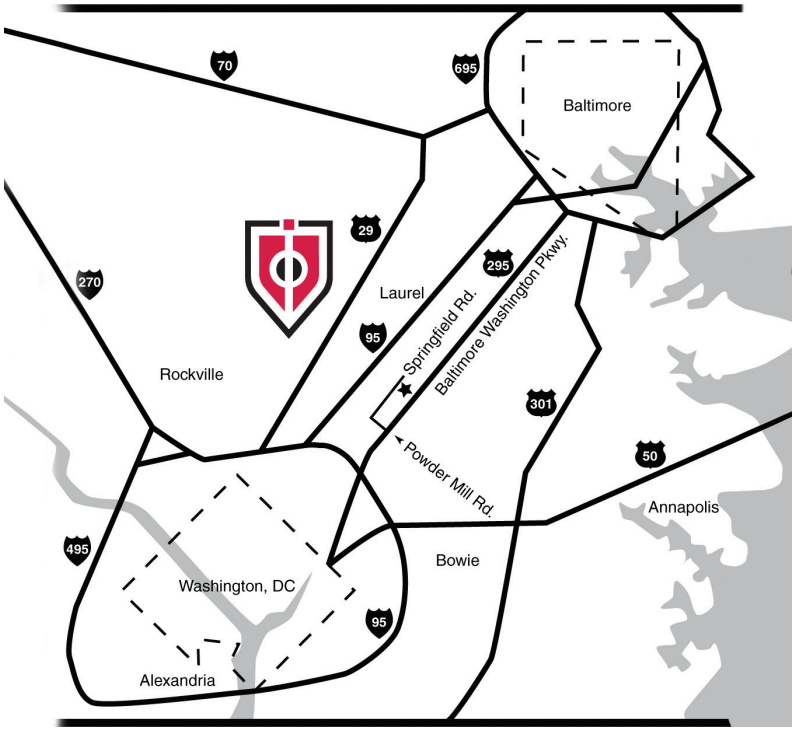
Map and Directions



Directions from Washington, DC and points south of Laurel, MD:

Take the Baltimore/Washington Parkway (Exit 22, north off I-95) to the Beltsville Powder Mill Road exit. Turn left on Powder Mill Road and take the first right onto Springfield Road. Follow Springfield Road one mile. Capitol Technology University is on the right.

Directions from Baltimore, MD and points north of Laurel, MD:

Take the Baltimore/Washington Parkway (Exit 7, south off I-695) to the Beltsville Powder Mill Road exit. Turn right on Powder Mill Road and take the first right onto Springfield Road. Follow Springfield Road one mile. Capitol Technology University is on the right.

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