Graduate and Professional Development Programs

School of Extended Graduate Studies

Digest
of Resident On-Site and Distance Learning Programs

SUMMER 2003 / FALL 2004

Florida Institute of Technology
Main Campus • Melbourne, Florida

General Information and Descriptions of FLORIDA INSTITUTE OF TECHNOLOGY Extended Graduate Studies Programs

The John H. Evans Library, Melbourne campus, houses 106,000 books, 202,000 government documents and an extensive collection of technical journals, including nearly 7,000 current print and electronic subscriptions.

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Florida Institute of Technology Mission Statement

Florida Institute of Technology is an independent technological university that provides quality education, furthers knowledge through basic and applied research, and serves the diverse needs of our local, state, national and international constituencies.

In support of this mission, we are committed to:

- *creating an organizational culture that values and encourages intellectual curiosity, a sense of belonging and shared purpose among faculty, students and staff, and pursuit of excellence in all endeavors;*
- *recruiting and developing faculty who are internationally recognized as educators, scholars and researchers;*
- *achieving recognition as an effective, innovative, technology-focused educational and research institution;*
- *recruiting and retaining a high-quality, highly selective and culturally diverse student body;*
- *continued improvement in the quality of campus life for members of the university community;*
- *providing personal and career growth opportunities for both traditional and nontraditional students and members of the faculty and staff.*

School of Extended Graduate Studies
Mission Statement

The mission of the School of Extended Graduate Studies at Florida Institute of Technology is to prepare adult students, wherever they may be located, for rewarding and productive professional careers in a work environment that is increasingly global in scope, driven by rapidly changing technology and focused on quality. In pursuit of our mission, we seek to provide our students with the finest possible graduate and professional development education using the most appropriate delivery technology. We offer an education that is reflective of current best practices and that is taught by instructors who are fully qualified academically and by virtue of professional practice.

SEGS Statement of Values and Beliefs

We, the faculty and staff of the School of Extended Graduate Studies, believe that learning is a lifelong process that need not be constrained by time or place. We believe that learning is a cooperative process involving the joint responsibility of both students and teachers. We believe that knowledge resides in many places and in many forms, and it is the purpose of a university to acquire and disseminate this knowledge as widely and as completely as possible. Finally, we believe in the fundamental importance of the following traditional values as the basic underpinnings of our educational processes:

> *The Worth of Individuals, Self-discipline, Academic Integrity and Honesty, Respect for People, Property and the Environment, Adherence to Laws and Properly Exercised Authority*

We welcome all individuals who seek to improve themselves through graduate education to join us and to actively support our stated values and beliefs.

R. L. Marshall

Ronald L. Marshall, Ph.D.
Dean, School of Extended Graduate Studies

EXTENDED GRADUATE STUDIES PROGRAMS

Section I General Information

INTRODUCTION

This *Digest* represents a flexible program of the current curriculum, education plans, offerings and requirements that may be altered from time to time to carry out the purposes and objectives of the university. The provisions of the *Digest* do not constitute an offer for a contract that may be accepted by students through registration and enrollment in the university. The university reserves the right to change any provision, offering or requirement, including fees, at any time. It reserves the right to require a student to withdraw at any time (under appropriate procedures) if it is deemed in the best interest of the student and/or university. It also reserves the right to impose probation on any student whose conduct is unsatisfactory. Any admission on the basis of false statements or documents presented by the student is void when the fraud is discovered, and the student is not entitled to any credit for work that he or she may have done at the university. When a student is dismissed or suspended from the university for cause, there will be no refund of tuition and fees paid. If a dismissed student has paid only a part of his or her tuition and fees, the balance due the university will be collected.

Florida Tech's extended graduate studies programs and courses may be approved for payment of Veterans' educational benefits subject to individual state approval authority. Independent study, audit and continuing education courses not taken for academic credit are not approved for payment of veterans' educational benefits.

There will be no refund of tuition, fees, charges or any other payments made to the university in the event the operation of the university is suspended at any time as a result of any act of God, strike, riot, disruption or for any other reasons beyond the control of the university.

Enrollments may be restricted at some sites.

Florida Institute of Technology does not discriminate on the basis of race, color, sex, disability, age, national or ethnic origin in admission of students, administration of its educational policies, scholarship and loan programs, employment policies and athletic or other university-sponsored programs or activities.

Address all inquiries to the Director, Graduate Studies of the Florida Tech site concerned.

THE UNIVERSITY

Florida Institute of Technology is an accredited, coeducational, independently controlled and supported university. It is committed to the pursuit of excellence in teaching and research in the sciences, engineering, technology, management and related disciplines, as well as providing the challenges that motivate students to reach

their full academic and professional potential. Today, over 4,500 students are enrolled, with over 3,000 students at the Melbourne campus and 1,425 at Florida Tech's off-campus graduate centers. All of the off-campus students and about 900 on-campus students are enrolled in graduate programs. Florida Tech offers more than 130 different degree programs in science and engineering, aviation, business, humanities, psychology and communication. Doctoral degrees are offered in 22 disciplines, while master's degrees are offered in more than 60 areas of study.

Because of the moderate size of the student body and the university's dedicated faculty and staff, a student at Florida Tech is recognized as an individual. Acting as individuals or as members of student organizations, students are encouraged to express their opinions on ways in which academic programs and student life might be made better for all. An active student government and student court play a meaningful part in matters affecting student life.

Many students enrolled in graduate school take part in sponsored research programs and make significant contributions to project results. Florida Tech houses a number of research institutes and centers that, in collaboration with academic departments, aid in the students' training.

The university is organized into six academic units: the College of Engineering, College of Science and Liberal Arts, School of Aeronautics, School of Management, School of Psychology and School of Extended Graduate Studies.

The **College of Engineering** includes six departments: chemical engineering, civil engineering, computer sciences, electrical and computer engineering, mechanical and aerospace engineering, and marine and environmental systems. Programs offered in addition to those included in the department names are biological oceanography, chemical oceanography, coastal zone management, computer information systems, engineering management, environmental resource management, environmental science, geological oceanography, marine environmental studies, meteorology, ocean engineering, physical oceanography, software development and software engineering.

The **College of Science and Liberal Arts** is composed of the departments of biological sciences, chemistry, mathematical sciences, physics and space sciences, science education (including computer education and mathematics education), and humanities and communication. Bachelor's degrees are offered in all of these areas and in applied mathematics, biochemistry and interdisciplinary science. Master's degrees are offered in applied mathematics, biological sciences, chemistry, computer education, environmental education, mathematics education, operations research, physics, technical and professional communication, managerial communication, science education and space sciences. The Specialist in Education degree is offered by the science education department. Doctoral degrees are offered in applied mathematics, biological sciences, chemistry, mathematics education, operations research, physics, science education and space sciences. In addition to these degree programs, the college also includes the Division of Languages and Linguistics within the humanities department, and the military science program (Army ROTC) through interdisciplinary science.

SEGS Programs and Locations

Note: For DL = Distance Learning program information visit our Web site www.segs.fit.edu

DEGREES OFFERED	LOCATIONS	
Legend: R = Resident Classes, On site DL = Distance Learning (Online) Classes NA = Not Available (this location)	Aberdeen Proving Ground, MD	Fort Lee, VA
PROFESSIONAL MASTER OF BUSINESS		
ADMINISTRATION (PMBA)	R-DL	DL
Acquisition and Contract Management	R-DL	DL
eBusiness	R-DL	DL
Human Resources Management	R-DL	DL
Information Systems	R-DL	DL
MASTER OF PUBLIC ADMINISTRATION (MPA)	DL	DL
MASTER OF SCIENCE (MS)		
ACQUISITION AND CONTRACT MANAGEMENT	R-DL	R-DL
AEROSPACE ENGINEERING	NA	NA
COMPUTER INFORMATION SYSTEMS	NA	NA
COMPUTER SCIENCE	NA	NA
ELECTRICAL ENGINEERING	NA	NA
ENGINEERING MANAGEMENT	R	NA
HUMAN RESOURCES MANAGEMENT	R-DL	DL
LOGISTICS MANAGEMENT	DL	R-DL
MANAGEMENT	R-DL	R-DL
Acquisition and Contract Management	R-DL	R-DL
eBusiness	R-DL	DL
Human Resources Management	DL	DL
Information Systems	R-DL	R-DL
Logistics Management	R-DL	R-DL
Transportation Management	DL	DL
MATERIEL ACQUISITION MANAGEMENT	DL	R-DL
MECHANICAL ENGINEERING	NA	NA
OPERATIONS RESEARCH	R-DL	R-DL
PROJECT MANAGEMENT	R-DL	DL
Information Systems	R-DL	DL
Operations Research	R-DL	DL
SOFTWARE ENGINEERING	NA	NA
SPACE SYSTEMS	NA	NA
SPACE SYSTEMS MANAGEMENT	NA	NA
SYSTEMS MANAGEMENT	R-DL	DL
Information Systems	R-DL	DL
Operations Research	R-DL	DL

LOCATIONS							
Hampton Rds., Fort Eustis/ Norfolk, VA	NCR, Alexandria, VA	Northeast NJ/PA	Orlando, FL	Patuxent River, MD	Redstone Arsenal, AL	Spaceport/ PAFB, FL KSC, FL	Virtual Center
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The university offers four-year and two-year Army ROTC programs to interested, qualified students. Students may qualify for a reserve commission in the U.S. Army through normal completion of both the college basic and advanced cadet programs or may enter directly into the advanced program after completing their basic program requirements before entering the university.

The **School of Aeronautics** offers bachelor's degrees in aeronautical science, aviation management and aviation meteorology, with flight options available in each program, and aviation computer science; a master's degree in aviation with two options—airport development and management, and aviation science; and a master's degree in aviation human factors. The school consists of two divisions—aviation studies, which is responsible for all academic instruction and student advising; and flight training, which conducts the flight operations courses. Classroom instruction in pilot training is conducted on campus, while all flight training is conducted under the supervision of the flight training department in university-owned facilities located at the Melbourne International Airport.

The **School of Management** offers both bachelor's and master's degrees in business administration. School of Management students are prepared to compete in a global, technologically-driven business environment by integrating personalized and applied business instruction into a focused, high-quality academic learning experience.

The **School of Psychology** offers a bachelor's degree in psychology. The master's degree is offered in applied behavioral analysis and industrial/organizational psychology, and doctoral degrees in clinical psychology and industrial/organizational psychology.

The School of Extended Graduate Studies began in August 1972 as "Off-Campus Programs" when 42 students enrolled in a master's degree program in electrical engineering at the Naval Air Test Center, Patuxent River, Maryland. From that modest beginning, the Graduate Programs have grown to more than 1,425 students per year enrolled in 30 degree programs. Extended Graduate Studies Programs that benefit employees of industry were added in 1976 when several in-plant courses started with several firms and the municipal government in St. Petersburg, Florida, and with Martin Marietta Aerospace in Orlando, Florida.

Florida Tech's Extended Graduate Studies Programs are conducted in a very traditional manner with admission and graduation standards the same as those required on campus. Each graduate center is staffed with at least one full-time terminally degreed faculty member. Most courses offered are taught by instructors possessing terminal degrees. Curricula and course content are tailored to meet the needs of the students and their employers, while maintaining the highest possible academic quality and integrity. Class times and locations are selected for the convenience of the students. The conduct of administration is made as effective and efficient as possible by on-site staff and the School of Extended Graduate Studies in Melbourne, which was established for that sole purpose. Since the 1972 beginning, more than 12,000 Florida Tech master's degrees have been conferred on off-campus candidates representing the military services, federal and local government employees and a wide variety of businesses and industries.

Degree programs available in **Distance Learning** can be found on our Web site at www.segs.fit.edu.

HISTORY

Founded in 1958 as Brevard Engineering Institute by Dr. Jerome P. Keuper, Florida Institute of Technology initially offered continuing education opportunities to scientists, engineers and technicians working at what is now NASA's John F. Kennedy Space Center. The new school grew quickly, in many ways paralleling the rapid development of space technology that was taking place at Cape Canaveral. In 1966 the name was changed to Florida Institute of Technology to acknowledge its growing identity as a scientific and technological university, the only such independent institution in the Southeast.

From its inception, Florida Tech has shown its commitment to graduate education. An article in the *New York Times* in 1962 described Brevard Engineering College as "the only space engineering college in the country…Its graduate course offers engineers the opportunity to obtain a master's degree and keep up with the advancement taking place daily at the Cape." Originally, all graduate students attended classes on a part-time basis, but at present approximately one-half of the on-campus graduate students attend class and carry out research full time.

The university moved to its current Melbourne campus in 1961, and construction began immediately on administration and classroom buildings to augment existing buildings that had been used by the former University of Melbourne. From that beginning, growth of the campus has been continual through the years.

More than 35,000 degrees have been earned by students at Florida Institute of Technology. As the institution advances and the alumni ranks multiply, the university remains dedicated to developing concerned scientists, engineers and business leaders who will make positive contributions to our society.

ACCREDITATION AND MEMBERSHIPS

Florida Institute of Technology is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools (1866 Southern Lane, Decatur, GA 30033-4097; (404) 679-4501) to award the associate of science, bachelor of arts, bachelor of science, master of science, master of business administration, master of public administration, educational specialist, doctor of psychology and doctor of philosophy degrees.

The university is approved by the Office of Education of the U.S. Department of Education.

The university is a member of the Independent Colleges and Universities of Florida, the American Council on Education, the College Entrance Examination Board and the American Society for Engineering Education.

OPERATION AND CONTROL

Florida Institute of Technology was granted a charter as a nonprofit corporation by the state of Florida in December 1958. The corporate charter established the school as an independent institution of higher learning with academic programs leading to undergraduate and graduate degrees. The charter ensures that the university will be

coeducational in character and that admission will be open to all qualified applicants regardless of race, creed, age, sex, color or disability. Under the corporate charter, control of the university is vested in a self-perpetuating board of trustees. Members of the board are selected on the basis of outstanding ability, integrity and personal interest in the development and preservation of the university.

FINANCIAL SUPPORT

The university is supported by tuition and fees, research grants and contracts, and assistance from foundations, industry and the local community. Careful attention to sound business policies has placed the institution on a sound financial basis year after year.

TAX EXEMPTION

Florida Institute of Technology was ruled tax-exempt under Section 501(c)(3) of the Internal Revenue Code of the U.S. Treasury Department in January 1960. The university was classified in October 1970 as an organization that is not a private foundation as defined in Section 509(a) of the IRC. Gifts to the university are thus tax deductible.

RELEASE OF STUDENT INFORMATION

The Federal Right to Privacy Act of 1974 (FERPA) as Amended established a set of regulations governing access to and the release of personal and academic information contained in student education records. FERPA applies to the education records of persons who are or have been in attendance in postsecondary institutions, including students in cooperative or correspondence study programs. FERPA does not apply to records of applicants for admission who have been denied acceptance or, if accepted, do not attend an institution.

Education records are all records that contain information directly related to a student and are maintained by an educational agency or institution, or a party acting for the institution. Exceptions to education records include Sole Possession Records, Law Enforcement Unit Records, Employment Records, Health Records and Alumni Records. Rights under FERPA are not given to students enrolled in one component of an institution who seek to be admitted in another component of the institution.

FERPA gives students who have reached the age of 18 or who attend a postsecondary institution the following rights:

1. The right to inspect their education records within 45 days of the day the university receives a request for access. Student should submit to the Registrar, dean, head of the academic unit or other appropriate officials, written requests that identify the record(s) they wish to inspect. The university official will make arrangements for access and notify the student of the time and place where the records may be inspected. If the records are not maintained by the university official to whom the request was submitted, that official shall advise the student of the correct official to whom the request should be made.

2. The right to request amendment of the student's education records the student believes are inaccurate or misleading. A student should write the university official responsible for the record, clearly identify the part of the record they want changed and why it is felt to be inaccurate or misleading.

FERPA was not intended to provide a process to be used to question substantive judgments that are correctly recorded. The rights of challenge are not intended to allow students to contest, for example, a grade in a course because they felt a higher grade should have been assigned.

If the university decides not to amend the record as requested by the student, the university will notify the student of the decision and advise the student of his or her right to a hearing regarding the request for amendment. Additional information regarding the hearing procedures will be provided to the student when notified of the right to a hearing.

3. The right to consent to disclosure of personally indentifiable information contained in the student's educational records, except to the extent that FERPA authorizes disclosure without consent. One exception that permits disclosure without consent is disclosure to school officials with legitimate educational interests. A school official is a person employed by the university in an administrative, supervisory, academic or research, or support staff position (including law enforcement unit personnel and health staff); a person or company with whom the university has contracted (such as an attorney, auditor or collection agent); to officials of another school upon request, in which a student seeks or intends to enroll; a person serving on the board of trustees; or a student serving on an official committee, such as a disciplinary or grievance committee, or assisting a school official in performing his or her tasks. A school official has a legitimate educational interest in the official needs to review an educational record in order to fulfill his or her professional responsibility.

   Disclosure is defined as permitting access to or the release, transfer or other communication of education records of the student or the personally identifiable information contained therein to any party orally, in writing, by electronic means or by any other means. Disclosure of confidential information to a school official having a legitimate educational interest does not constitute authorization to share that information with a third party without the student's written permission.

   FERPA allows release of the following directory information to the public without student consent: student's name, address, telephone number, date and place of birth, major field(s) of study, E-mail address, class schedules, participation in officially recognized activities and sports, weight and height of athletic team members, dates of attendance, degrees and awards/honors received and the most recent educational institution attended other than Florida Tech.

   Students may prevent the release of directory information by completing a Request to Prevent Disclosure of Directory Information Form, available in the Office of the Registrar.

   Student consent is required for the release of personally identifiable information such as semester grades, academic record, current academic standing and social security number. The law allows disclosure of this information to certain government agencies/officials, sponsoring agencies, parents/guardians of dependent students and to selected university personnel determined to have a legitimate educational interest in such records.

Students may consent to release personally identifiable information to others by completing the Authorization for Release of Student Information Form, available in the Office of the Registrar.

Information about the provisions of the Family Educational Rights and Privacy Act of 1974 as Amended, and the full text of the law, may be obtained from the Registrar.

4. The right to file a complaint with the U.S. Department of Education concerning alleged failures by Florida Tech to comply with the requirements of FERPA. The name and address of the office that administers FERPA is

   Family Compliance Office
   U.S. Department of Education
   400 Maryland Ave., SW
   Washington, DC 20202-4605

Section II Extended Graduate Studies Programs

PURPOSE

Florida Institute of Technology's Extended Graduate Studies Programs are tailored to meet the educational needs of local residents, employees of industry and business, active duty military personnel and their families, and U.S. Government civilian employees in management and engineering. Enrollment in some programs in certain locations must be restricted to specified categories of individuals because of state requirements, laws pertaining to veterans' benefits or local conditions.

GRADUATE DEGREE PROGRAMS

Courses are open to those seeking a graduate degree, as well as those wishing to take selected subjects for professional development. Degree requirements can be met by a combination of Florida Tech courses, transfer credits from other accredited institutions and transfer credits from certain military schools for those courses designated by Florida Tech. Information on the specific military courses accepted is available from the Director, Graduate Studies.

Management courses used to support School of Extended Graduate Studies' master's programs are identified by the prefix MGT. These courses are taught both on the main campus and at the extended graduate centers based upon enrollment demand. A description of the MGT courses appears in the "Course Descriptions" section of this *Digest* and is published separately in the official catalog for each graduate center.

PART-TIME STUDENTS

The normal course load for a part-time student is two courses per semester, each requiring one class attendance each week. This allows completion of a degree program in less than two years; less if transfer credits are accepted. Although a degree program may be extended beyond two years, the cumulative work including transfer credits may not span an elapsed time of more than seven years.

DEGREE COMPLETION PROGRAMS

With approval of the Department of the Army, a cooperative degree program is conducted at Ft. Lee, Virginia, in conjunction with the Logistics Executive Development Course (LEDC) presented by the U.S. Army Logistics Management College. While attending that course, students also take certain Florida Tech classes. The credits for these classes plus the transfer credits awarded for satisfactory completion of the Army course itself are sufficient to allow the student to complete a degree program in two or three additional semesters, when authorized to attend Florida Tech classes on a full-time basis. The entire program can be completed at Ft. Lee.

Similarly, Florida Tech awards transfer credits for certain classes taken as part of the regular course at the Command and General Staff College, Ft. Leavenworth, Kansas. This permits qualified students to be sent under Army orders to an appropriate Florida Tech site, including the main campus in Melbourne, Florida, to complete a graduate-degree program.

Section III Graduate Admission

Admission to graduate study is granted to highly qualified applicants. Successful applicants for the master's degree will have received a bachelor's degree from a regionally accredited institution, or its equivalent internationally, in a program that provides suitable preparation in the applicant's chosen field. The academic record of the applicant must indicate probable success in the desired program. As a general rule, an undergraduate cumulative grade point average (GPA) of at least 3.0 is required for regular admission. Individual academic units may have higher minimum standards. Only in unusual cases, in which clear and substantive evidence justifies such action, will students be admitted who do not meet this standard.

Evaluation of the applicant's record is made by the applicant's desired academic unit. In the case of a special student described below, the evaluation will be made by the Graduate Program office. Admission requires the approval of the Graduate Program office and the head of the appropriate academic unit. For those cases in which the student has acceptable undergraduate achievement but has course deficiencies, the major academic unit will specify those Florida Tech courses that, if taken, will remove the deficiencies.

APPLICATION

Applications for admission can be obtained from and submitted to the local Florida Tech Graduate Center. The application must be accompanied by payment of the nonrefundable application fee.

One officially certified copy of all undergraduate and graduate (if applicable) transcripts must be sent directly from the student's institution to the graduate center, for forwarding to the School of Extended Graduate Studies. One additional certified copy of all transcripts may be requested for center use.

Transcripts from foreign universities must be accompanied by a certified English translation.

REAPPLICATION

Admission to the Graduate School is valid for two years from the semester of acceptance or from the last semester the student is enrolled in graduate study. Individuals wishing to begin or resume graduate work after a two-year lapse are required to reapply for admission. Individuals who leave Florida Tech and attend another university must reapply for admission and submit grade transcripts regardless of the length of time since last attending Florida Tech (see "Readmission Policy").

READMISSION POLICY

A student who has been away from the university for four or more consecutive semesters (excluding summer terms) or who has attended another institution during an absence from the university must apply for readmission. If readmission is approved, degree requirements for the peer group at the time of readmission must be met.

A student is not considered to be absent from the university during a period of study at another institution if a Request to Study at Another Institution was submitted and approved prior to enrollment for the other institution's courses. While still currently enrolled, a student may also request a leave of absence from the vice president for academic affairs. If the request is approved, the student can resume full-time study at Florida Tech under the previous program without applying for readmission, but may be required to meet the graduation requirements established for the new peer group.

A student who has been away for less than four semesters and who has not attended any other college or university may register for class without filing an application for readmission.

REGISTRATION PRIOR TO ADMISSION

Under certain circumstances, applicants to graduate programs can avoid delaying their education by registering for courses, for one semester only, while their applications are being processed, provided they are citizens or permanent residents of the United States.

Students who register prior to admission are not eligible to receive federal student financial aid until they are admitted to the university. Such registration requires a preliminary review of written documentation from the degree-granting institution (not necessarily official) showing previous academic courses taken, grades received and degrees awarded. The review should be carried out by the academic unit head or his or her designee. Permission to register pending formal acceptance requires a decision that there is a high probability of eventual acceptance into the program applied for and that registration prior to acceptance is in the best interest of both the academic unit and the student.

In the event that applicants are denied admission while enrolled in graduate courses, they will be given the option of either withdrawing with full tuition refund or completing the courses underway. If the applicant completes one or more graduate courses prior to being denied admission or completes a course for any other reason, he or she will not be given the option of withdrawing or receiving a tuition refund after completing the course.

Any exceptions to this policy require the written approval of the Dean.

EVALUATION

The applicant will be notified of the decision regarding his or her admission only after the officially certified transcripts and application for admission have been received and reviewed. Evaluation of the applicant's record is made by appropriate faculty at the main campus. In the case of a Special Student, defined below, the evaluation will be made by the Dean. Admission requires approval of the academic unit head and the Dean. In cases where the student has acceptable undergraduate achievement, but has course deficiencies, the cognizant academic unit will specify those Florida Tech courses that, if taken, will remove the deficiencies. Students who have more than 18 semester hours of deficiencies will not be admitted to graduate studies but may remove the deficiencies while enrolled as a special undergraduate student.

The GMAT is required for admission to the Professional M.B.A and M.B.A. In all other programs, the GMAT, GRE General Test and/or GRE Subject Tests, as well as letters of reference, may be required for admission in the case of any students whose previous academic achievement is deemed to be marginal. Official test scores must not be over five years old. Test results may take up to six weeks to be reported by the educational testing service.

INTERNATIONAL APPLICANTS

International applicants will not be admitted to a Florida Tech off-campus program as full-time students. Immigration forms (I-20) will not be issued by Florida Tech to off-campus students.

Transcripts from foreign universities must be accompanied by a certified English translation.

The Graduate Management Admissions Test (GMAT) is required of any applicant relying on a degree from a foreign (non-U.S.) university for admission to a School of Management degree program. Test scores must not be more than five years old.

Any student whose native language is not English will be required to submit TOEFL scores between 450–547. An exception to this rule is made for the student who has earned a bachelor's or master's degree from an American university in which English is the principal language of instruction.

International applicants must be admitted to the Graduate School before commencing classes.

CLASSIFICATION OF GRADUATE STUDENTS

Assignment to one of the following classifications will be made at the time of admission to the graduate school:

Regular Student A student whose undergraduate grade point average is 3.0 or greater out of a possible 4.0 and who meets all other criteria for admission to a particular program is classified as a regular student.

Provisional Student A student whose undergraduate grade point average is less than 3.0 out of a possible 4.0 or equivalent, or whose academic unit identifies course deficiencies that are considered excessive, is classified as a provisional student. After completing nine credit hours, a provisional student with a grade point average of 3.0 or greater will be reclassified as a regular graduate student. A provisional student who has a grade point average of less than 3.0 after completing nine credit hours, or earns a D or F grade in any academic course will be placed on academic probation. Provisional students cannot be admitted to doctoral programs.

Special Student Special student classifications exist at both the undergraduate and graduate levels and are used for students who, for various reasons, are not enrolled in degree-seeking programs. Specific instances include

1. a student taking course work for credit to apply at another institution;

2. a student taking courses to fill specific professional or vocational needs; or

3. a prospective M.S. or M.B.A. student with generally acceptable undergraduate achievements but with subject matter deficiencies (usually as a result of changing fields) that, in the judgment of the academic unit, preclude immediate acceptance into the degree program.

In the last mentioned case, the student will normally have the option of pursuing an undergraduate degree in the desired discipline or making up the deficiencies while enrolled as a special student. The student will then be considered for admission to the appropriate graduate degree program once sufficient additional work has been done to form an adequate basis for a decision by the academic unit.

The customary classification of special students will be as undergraduate students, regardless of the existence of previous bachelor's degrees. A student may, however, be classified as a special graduate student. In such a case, designation and continuation of graduate student status will be at the discretion of the cognizant academic unit, or the Director, Graduate Programs, in the case of students who are not seeking eventual admission to a graduate degree program.

CONTINUING EDUCATION

Continuing Education Units

The Continuing Education Unit (CEU) is a nationally recognized unit of measure that indicates successful participation in a qualified program of continuing education. The CEU is defined as 10 contact hours of participation in an organized educational experience under responsible sponsorship, capable direction and qualified instruction.

Students enrolled for CEUs at Florida Tech are required to do all homework, outside reading assignments, term papers or special assignments required of graduate-credit students and to attend at least 90 percent of the class sessions, but they are not required to take midterm or final examinations. Students can switch from CEU to graduate credit or vice-versa prior to the end of the first week of classes.

Enrollment Restriction

A continuing education student may not enroll in any graduate course, either for graduate credit or for CEUs, without the written approval of the head of the academic unit offering the course or an authorized representative. With the exception of graduate courses that have no listed prerequisites, this approval is based on a review of the student's previous preparation and qualifications, and even in the case of registration for CEUs, there should be a reasonable expectation that the student is capable of doing all homework, outside reading assignments, term papers and special assignments required of students taking the course for graduate credit.

A student who has been dismissed from a graduate degree program may enroll as a continuing education student to take graduate courses for CEUs subject to the same requirements for approval as any other continuing education student. A change of major from the former degree program to "0100" continuing education is necessary prior to any further enrollment. Under no circumstances will a dismissed student be allowed to take courses for graduate credit while enrolled as a continuing education student.

Admission to Degree Programs
A continuing education student may seek admission to a degree program through the normal admission process. If a continuing education student subsequently decides to pursue either an undergraduate or graduate degree at Florida Tech and is accepted into the degree program, a maximum of 12 semester credit hours earned as a CE student may be applied toward the degree, provided the course work is academically appropriate.

REQUEST TO STUDY AT ANOTHER INSTITUTION

With special permission, a student who has matriculated at Florida Tech may take a course at another institution and have it apply to his or her degree program. A copy of the policy establishing the conditions and limitations that apply to taking a course at another institution may be obtained from the student's graduate center. A Request to Study at Another Institution form must be signed by the student and faculty adviser, and submitted with any other requisite approvals to the Registrar's office prior to taking the course(s). A minimum grade of C or above must be earned for transfer into a bachelor's program and B or above is necessary for transfer into a graduate program.

AUDITING A COURSE

A student may audit a course with the permission of the adviser and payment of an audit fee. An auditor does not receive a grade; an AU is recorded on the transcript in place of the grade if the auditor has, in general, maintained a satisfactory course attendance (usually 75 percent class attendance) and completed the appropriate assignments. If the student does not meet requirements, a final grade of F may be awarded. No changes in registration from credit to audit or from audit to credit will be permitted after the first week of classes.

CORRESPONDENCE COURSES

The university does not offer courses by correspondence, nor does the university grant credit for courses completed by correspondence.

LIBRARY INFORMATION NETWORK (LINK)

To access Florida Tech's Library Information Network (LINK) and its many valuable resources and features, go to the Florida Tech homepage (www.fit.edu) "Library" option or directly to ww.lib.fit.edu. Some databases and services will require the remote user to input an identification (ID) number and an Evans Library four-digit Personal Identification Number (PIN).

Section IV Tuition and Fees Payment Policy

It is the policy of Florida Institute of Technology that all expenses, including tuition and fees, are due and are to be paid by each off-campus student at the time of registration unless specifically exempted. Students may be registered and attend classes without payment at the time of registration if

1. the student is sponsored by his employer who will make payments directly to the university, and the employer has furnished a letter to the local Florida Tech office accepting unconditional liability for all charges not paid by the student, regardless of whether or not the student completes the course or achieves a minimum grade for the course;

2. the student has a scholarship, loan, or grant covering 100 percent of all costs that will be paid directly to the university by a sponsor who has notified the local Florida Tech office in advance, in writing, of the student's eligibility and acceptance; or

3. a Deferred Payment Contract may be accepted from a student for reimbursement in the amount of the course tuition. This privilege will be withheld from students who do not make payment within the time specified.

Registration is made final only upon satisfaction of all charges. The university reserves the right to deny admission or to drop any student who fails to meet his or her financial obligations promptly.

STUDENT ACCOUNTS

An account is established for each student upon receipt of application. The student's name and number are used for account identification and should be included on the face of each payment check to ensure proper credit to the account. Students who pay more than the required amount can have the excess refunded or credited to their accounts.

TUITION

Tuition costs for courses conducted by Florida Tech for School of Extended Graduate Studies students will normally not exceed tuition charges at the Melbourne campus and may be less. Payment will be made to Florida Institute of Technology. Except for credit hours awarded free for designated U.S. military school courses and transfer credits from acceptable colleges and universities, tuition costs will be paid by the individual or, if authorized in writing, by his or her employer. See individual site catalog for a complete breakdown of costs.

TYPICAL REFUND SCHEDULE

Fifteen week terms only: First week—100%, second week—90%, third and fourth weeks—50%, fifth through eighth weeks—25%, thereafter—0%. Does not apply to terms less than 15 weeks in length. Subject to change prior to start of each term.

REFUND POLICY

Florida Tech provides a fair and equitable Refund Policy that meets all applicable federal guidelines governing refunds for tuition, room, board and applicable fees as published in the *Federal Register*. The refund policy is published in the *Schedule of Classes* prior to the start of each term.

Students who believe that individual circumstances warrant exceptions from Florida Tech's Refund Policy, may appeal by submitting in writing, a letter to the graduate center director, outlining any information or circumstances that may be pertinent to the situation.

FEES

All of the charges listed below are nonrefundable.

Summer 2003

Applications	
Master's Degree	$50
Continuing Education	$20
Reapplication	$20
Late Fees	
Late Graduation Petitions	
(Applying after the deadline date,	$30
but before the semester of graduation)	
(Applying late, during the semester of graduation)	$60
Late Payments	$30
Thesis Binding (five copies)	$75
Transcript (per copy)	$ 5
Equivalency or Currency Examination	$80

SATISFACTORY PROGRESS STANDARDS FOR STATE AND FEDERAL AID RECIPIENTS

The academic records of all students admitted to Florida Institute of Technology for the first time shall be considered sufficient to allow them to apply for financial aid. To remain eligible to receive financial aid, continuing students must meet the following Satisfactory Progress Standards instituted by Florida Tech in accordance with federal law. A review for compliance with these standards will be conducted at the end of each semester.

1. Students are expected to achieve and maintain a grade point average (GPA) of 3.0 or higher. This GPA is calculated in accordance with the guidelines contained in this catalog.

2. Graduate students are expected to complete 80 percent of the attempted course work. Students enrolled full time (nine or more credit hours) are expected to complete at least nine credit hours per semester. Students enrolled part time (five to eight hours) are expected to complete at least five credit hours per semester.

3. A master's degree program is expected to be completed within six semesters, or 54 credit hours attempted. Cases will be reviewed on an individual basis when additional time is needed.

OTHER SOURCES

Veterans benefits are administered by the Office of Veterans Affairs, which assists veterans and their dependents who are entitled to VA educational benefits.

Veterans eligible to receive benefits should consult the Office of Veterans Affairs prior to registration and during the regularly scheduled registration days to renew their benefits each semester. A copy of the graduate program plan must be submitted to

the graduate center prior to the completion of 12 credit hours. Enrollment certification will not be submitted to the U.S. Department of Veterans Affairs beyond 12 hours without an approved program plan. Any change to the graduate program plan must be immediately reported to the graduate center. Failure to do so may result in a temporary interruption of VA benefits.

For the purpose of certification of graduate students receiving veterans' education benefits, the following standards will be used

Full-time	9+ hours
3/4-time	6, 7 or 8
1/2-time	5
More than 1/4 time, less than 1/2 time	3, 4
1/4 or less	1, 2

Students receiving veterans' benefits are required to make satisfactory progress in their degree programs. Failure of a graduate student to maintain the minimum cumulative grade point average specified will result in termination of veterans' education benefits.

Semester Hours Completed	**Minimum CGPA**
9–17	2.50
18–23	2.70
24–32	2.90
33 or more	3.00

FEDERAL AND STATE FINANCIAL ASSISTANCE

As a general rule, a graduate student must be enrolled half time (at least five semester hours per term) as a regular student in a degree program and must be a U.S. citizen or an eligible noncitizen to qualify for federal and state financial aid.

The graduate student must also complete a Free Application for Federal Student Aid (FAFSA). Financial aid forms are available through the Florida Tech Graduate Center.

Although applications are accepted throughout the year, an FAFSA must be submitted to the processor for the federal process of need analysis by February 1 to ensure processing before the March 20 priority deadline.

Students must reapply each year and maintain satisfactory academic progress as defined by the Office of Student Financial Assistance to continue receiving federal assistance.

The Federal Stafford Student Loan Program is available to all graduate students who apply for federal assistance and who maintain at least halftime (five credit hours) enrollment in graduate-level courses. Stafford Loans are either subsidized or unsubsidized. A subsidized loan is awarded on the basis of financial need. The federal government pays the interest on a subsidized Stafford Loan until repayment begins and during authorized deferment periods. A student may borrow up to $18,500 each year in Stafford Loans. At least $10,000 of this amount must be in an unsubsidized Stafford Loan. Cumulatively, a graduate student may borrow up to $138,500 in Stafford Loans with no more than $65,000 in subsidized Stafford Loans. The graduate debt limits include any Stafford Loans received for undergraduate study.

Section V Academic Policies

GENERAL ACADEMIC POLICIES

Academic policies are published in the *Graduate Policy Manual,* which is available for reference and photocopying in the Evans Library, in each academic unit office, and in each graduate center. It is also available on the World Wide Web on the Florida Tech home page under academics and research. All graduate students are advised to review the manual early in their graduate careers and to refer to it if in doubt about any aspect of the Graduate School policy.

THE ACADEMIC YEAR

The university operates on the semester basis. Each semester is normally 15 weeks in length, but may vary slightly, without loss of academic time, to meet conditions at off-campus centers. The semesters are designated fall, spring, and summer; however, a site may have to conduct more than one session during a given semester to accommodate students in scheduled military courses and degree completion programs.

CREDIT HOURS

The credit hours for each course are normally represented by the number of class meeting hours per week. Because there may be exceptions to this general rule, the course descriptions should be consulted for the credit hours of specific courses.

COURSE CANCELLATION/SCHEDULE CHANGES

The university reserves the right to cancel classes for which there is insufficient enrollment, to close a class when the enrollment limit in that class is reached and to make any schedule changes as necessary, including a change in time, days, credit or instructor. The university does take the needs of students into account and schedule changes are made only when unavoidable.

FACULTY ADVISER SYSTEM

Each student is assigned a faculty adviser in his or her major academic unit at the beginning of the first semester of attendance. The adviser monitors the student's academic progress toward a degree. A conference is held with each student prior to registration to ensure that courses are scheduled in proper succession, that all relevant academic policies are adhered to, and that the schedule best serves the academic needs of the student. Once arranged, the schedule cannot be changed without the adviser's written permission. The faculty adviser is available throughout the academic year for consultation by appointment, and students are strongly encouraged to seek the counsel of their faculty advisers in other matters beyond registration and schedule changes.

TRANSCRIPTS

All courses taken at Florida Tech are indicated on the student's transcripts.

A request for a transcript must be made in writing to the Office of the Registrar, Records Division along with the appropriate fee enclosed (see "Fees").

GRADING SYSTEM

Graduate work is evaluated by letter grades, with only grades of A, B, C and P being credited toward graduate degrees. Grades of D and F are failing grades in the Graduate School. Failed courses must be repeated at the earliest opportunity, if they are required courses. An elective course in which a D or F is received must be repeated unless the academic unit approves an additional course to be taken in its place.

When Pass/Fail (P/F) grading is used, the total credit hours earned increases without having any effect on the cumulative grade point average (GPA) if a grade of P is earned. Whereas, no credit hours are earned and the GPA is adversely affected in the case of a grade of F, just as with any other F. Pass/Fail grading is used only for certain seminar-format courses and for master's theses.

The basic requirement for receiving any master's degree is a GPA of at least 3.0 on a 4.0 scale where A = 4, B = 3, C = 2, D = 1 and F = 0. The GPA is based on the student's Program Plan and includes all courses shown on the Program Plan as applying toward the master's degree, both graduate-numbered and undergraduate-numbered. Prior to submission of the Program Plan, the GPA will be based on all graduate-numbered courses taken at Florida Tech, with the exception of any that may previously have been used to satisfy the requirements of a bachelor's degree.

In cases where the degree-related GPA referred to above does not include all graduate courses taken at Florida Tech, an overall GPA will also be calculated and reported. Courses used to compute the overall GPA, but not the program GPA, include courses taken as deficiencies, courses unrelated to the student's degree program, courses taken prior to a change of major and courses taken in satisfaction of the requirements of a previously earned graduate degree. Courses related to the degree program that are taken in excess of degree requirements are normally included in the Program Plan. It is not possible to delete a course from a Program Plan once the course has been taken, although an exception is made if the "statute of limitations" is exceeded, at which time it is dropped from the Program Plan and from both the program and overall GPAs. Courses are not otherwise dropped from the overall GPA except by special action of the Graduate Council Committee on Standards following a change of major. If no degree was earned in the first major and the courses are clearly not applicable to the new major, the committee can approve deletion from the overall CGPA.

Grades of S (Satisfactory) and U (Unsatisfactory) are used as progress grades in thesis, dissertation, research and internship, and as final grades in some zero-credit seminar courses. They are similar to grades of P and F except that they carry no credit, and S grades (when used as progress grades) may be replaced at any later time by credit-carrying grade of P. U grades remain on the transcript permanently, but like grades of S they do not affect the grade point average.

Both the overall GPA and the applicable program GPA must be 3.0 or greater for any master's degree to be awarded.

At the close of the term, grades earned during the semester are made available to students on the PAWS system. These grades become a part of the student's official record and are not subject to change without authorization by the head of the academic unit responsible for teaching the course. Grade appeals must be submitted in writing by the student concerned to the Director, Graduate Studies.

PROBATION AND DISMISSAL FOR MASTER'S STUDENTS

A master's student must continue to demonstrate academic proficiency in course work and must show reasonable progress toward the 3.0 grade point average (GPA) required for graduation. Failure to have the minimum GPA specified below will result in academic probation. A student on probationary status will be informed in writing of the conditions of his or her probation. Failure to satisfy the conditions of probation will result in dismissal following the probationary semester.

ACADEMIC STANDARDS FOR MASTER'S STUDENTS

A master's student must continue to demonstrate academic proficiency in course work and must show reasonable progress toward the 3.0 cumulative grade point average (GPA) required for graduation. Failure to have the minimum GPA specified below will result in academic probation. In the case of separate program and overall grade point averages, the current program average must meet the standard for the number of attempted credit hours shown on the current Program Plan, and the overall average must meet the standard for the total credit hours attempted.

Semester Hours Completed	**Minimum CGPA**
9–14	2.60
15–17	2.80
18 or more	3.00

Students who have transferred credits from another institution will be permitted to complete nine semester hours of graduate work at Florida Tech before evaluation of the GPA. After completing nine semester hours at Florida Tech, the student must meet the above standards for total semester hours completed (Florida Tech credits plus transfer credits) by using Florida Tech's GPA.

A graduate student with fewer than nine semester hours of graduate courses, but nine or more credit hours of undergraduate courses taken while enrolled as a graduate student at Florida Tech, must maintain a 3.0 average in these undergraduate courses. Failure to maintain this average will result in probation. Failure to meet probation terms will result in academic dismissal. Upon completing nine credit hours of graduate courses, the graduate GPA will take precedence in probation and dismissal evaluations.

In addition, the following conditions will result in the academic dismissal of a student:

1. Two or more grades of D or F in any courses taken as a graduate student.
2. Judgment by the Graduate Council that the student is not making satisfactory academic progress, or the academic efforts of other students are hampered by the student's presence.

In all cases of academic probation and dismissal, the student will be so notified by the Graduate Program office. The academic dismissal can be waived for educationally sound reasons. A letter of appeal requesting reinstatement should be submitted

to the Graduate Program office. The student will be allowed to continue attending classes pending Graduate Council action on his or her appeal. If the appeal is denied, or if no appeal is submitted within the time period specified in the dismissal letter, the student's registration will be cancelled and further class attendance will not be permitted.

DISMISSAL FOR MISCONDUCT

Student conduct that violates the legal or ethical standards of the university may result in mandatory withdrawal from all classes and denial of permission to register in future terms for either a definite or indefinite period of time. Examples of misconduct that could result in these actions include cheating, plagiarism, knowingly furnishing false information to the university, or forging, altering or misusing university documents or academic credentials.

INCOMPLETE WORK

An I is given when a course cannot be completed because of circumstances beyond the student's control. The I indicates that course work is qualitatively satisfactory and there is reasonable expectancy that completion of the remaining work would result in a passing grade. The instructor must provide a statement of the work to be completed to the head of the academic unit. The student must complete the work at the earliest possible time but prior to the beginning of the seventh week of the following semester, unless an earlier deadline is established at the time the I is recorded and the student is notified of this fact. A waiver of the six-week limitation requires special written permission of the cognizant dean. The I will automatically become an F in the seventh week unless an approved waiver has been filed with the Office of the Registrar.

DROP/WITHDRAWAL POLICY

To add or drop a course, or to withdraw from the university, a student must complete a Change in Registration/Status form. Students withdrawing from the university are asked to complete an exit interview in the student's graduate center.

Failure to attend classes or verbal notification to instructors does not constitute an official drop or withdrawal. Students who drop or withdraw without filing the proper form will receive a failing grade of F. When a student drops a course on or before the last day to do so, as shown in the *Academic Calendar,* the course will not appear on the permanent academic record. After this date, a W will appear on the permanent record for each dropped course. The W is not punitive and is not used in the computation of grade point averages. The last day to drop a course without receiving a failing grade is published in the *Academic Calendar*.

MASTER'S DEGREE REQUIREMENTS

Course Requirements

Course requirements are stated in each master's degree program description. The stated minimum credit hours can include any or all of the following, subject to academic unit approval and specific restrictions stated in the *Graduate Policy Manual:*

1. Up to 12 semester hours of credit transferred from a regionally accredited institution or, in some cases, from a foreign university; or, in the case of a partner institution in a joint-degree or dual-degree program with Florida Tech, up to one-half of the total minimum credit hours.

2. Up to six semester hours of credit for 3000 and 4000 level undergraduate courses taken at Florida Tech while enrolled in the Graduate School. Only 4000-level courses will be considered if the courses are in the student's major field of study.
3. Credit previously used to meet the requirements of another master's degree at Florida Tech may be used to meet up to one-half the credits required for the later degree.
4. Credit in excess of the seven-year "statute of limitations" if grades of A or B were earned, course content has not changed significantly since the course was taken and current mastery of the course material is demonstrated.

Academic credit applied toward the requirements of a bachelor's degree at Florida Tech or elsewhere, may not be used in any graduate program at Florida Tech, regardless of the level of the course.

DEGREE CANDIDACY

Admission to the Graduate School does not imply that courses taken by the student will be credited toward a degree. No commitment in this matter is made until the student is admitted to candidacy for a degree. A master's student becomes a degree candidate by satisfying all of the following requirements:

1. Removal of all course deficiencies specified at the time of admission.
2. Completion of at least nine semester hours of graduate course work in good standing as defined by the academic dismissal regulations of the Office of Graduate Programs.
3. Approval of a Program Plan by the academic unit head.

PROGRAM PLAN

Each master's-level graduate student is required to have an approved Program Plan on file no later than one month prior to the time that nine semester hours of graduate courses have been completed.

Only one Program Plan can be in effect for a student at any given time.

Because of the importance of the Program Plan in establishing a new program GPA following a change of major, no request to change majors will be processed unless accompanied by an approved new Program Plan. This requirement applies whether a degree was earned in the first major or not. An exception is made in the case of a change of major prior to completion of any graduate courses at Florida Tech.

CHANGE OF PROGRAM PLAN

Request for Change of a Program Plan must be submitted through the Director, Graduate Studies, for approval by the academic unit head or his/her designated representative. Students should not deviate from an approved Program Plan prior to obtaining approval of the change.

CHANGE OF MAJOR

A student wishing to change his or her major must complete a Request for Change of Major form and submit it to the Florida Tech Graduate Center. A Program Plan for his or her new major must accompany the request for change.

The academic unit responsible for the new program has the prerogative to accept or reject the student, as well as to designate what courses are germane to the new program. All courses that are determined by the academic unit to be applicable in the new program must be included in the program plan. Because the student is changing programs, the number of courses in the plan may be more than the minimum required for graduation. The student will not be considered as enrolled in the new program until all actions specified above have been completed.

DIRECTED STUDY

Directed study is a means of allowing a student to register for a course during a semester when it is not included in the *Schedule of Classes*. To enroll in a directed-study course, a Request for Directed Study Course form should be initiated and approved according to form instructions. Approval is at the discretion of the dean, academic unit head, or program chair responsible for the course, and normally requires evidence of a compelling need by the student. The student should submit the approval form to the graduate center during early registration. The tuition rate for a directed-study course is the standard undergraduate or graduate rate, plus an additional directed-study fee (see "Fees").

TRANSFER CREDIT

If the courses constitute a logical part of the student's program, up to a maximum of 12 semester hours of transfer credit from regionally accredited institutions may be tranferred to Florida Tech (for one master's degree only), under the following conditions.

1. These courses must be eligible for graduate credit at the institution where they were taken, and not previously applied to any undergraduate degree.
2. They must have been graded courses, and grades of at least B or equivalent must have been earned in each course.
3. They must have been taken not more than six years prior to the student's first enrollment at Florida Tech.
4. All course work (including transfer credit) must be completed within seven years of elapsed time.
5. Subject to approval of Academic Unit head, and the Director, Graduate Programs.

Courses that have been applied toward a graduate degree at another institution may also be considered for transfer credit if they satisfy these criteria. Transfer credit from foreign universities will be considered on a case-by-case basis, subject to the same overall limitations. Transfer credits are not included in the computation of grade point average.

Some courses presented by certain military schools, plus the regular courses of the U.S. Army Command and General Staff College, Ft. Leavenworth, Kansas, have been evaluated by Florida Tech and specific courses found acceptable for transfer to designated degree programs without charge to the student. Up to a maximum of 12 such credit hours may be transferred provided at least a B or its equivalent was earned in each course, and provided the same time limit as for university courses is met. Information concerning the specific courses found acceptable and the Florida Tech equivalents is available from the School of Extended Graduate Studies in Melbourne.

The combined total credit hours transferable from other university courses and from designated military schools may not exceed 12 credit hours.

No transfer credit will be granted for correspondence courses or from college/universities that are not regionally accredited if in the U.S. Military courses must have been taken at an approved school. Off-site military courses do not normally qualify for transfer credit.

Requests for transfer of credits must be filled out on the forms provided and submitted to the Director, Graduate Studies. Transfer requests will not be evaluated until an officially certified transcript is received and until the applicant has been admitted to the Florida Tech Graduate School.

Approval of a request for transfer credits does not indicate acceptance of those credits in a degree program. That action is taken only through approval of a Program Plan.

Where a joint- or dual-degree program exists within another institution, up to one-half of the total credits required in the program may be transferred from the partner institution, provided the courses at that institution are periodically reviewed and monitored by the dean of the appropriate college or school, or other graduate council representative. In each individual joint- or dual-degree program, the total transfer credits will be established prior to announcing the program or admitting students, and may be smaller than half the required credits if circumstances warrant. It is also noted that transfer credits from other institutions are not permitted in the case of a joint- or dual-degree program.

Permission to take a course at another institution for transfer to Florida Tech subsequent to being admitted to the Florida Tech Graduate School must be obtained from the cognizant academic unit head prior to taking the course.

FINAL PROGRAM EXAMINATIONS

A final program examination is required for master's degree programs with the exception of those in the School of Management and the School of Extended Graduate Studies for which there is no on-campus counterpart.

Procedure for the development and grading of operations research (OR) comprehensive exams for off-campus students at Aberdeen, Ft. Lee, and the VGC:

1. The Curriculum Manager of the off-campus OR program will design the comprehensive exam (i.e., determine areas to be tested, number of questions and/or problems, weighting, time limits and other test parameters). Faculty members from the off-campus sites (Aberdeen, Ft. Lee, and the VGC) may submit questions or problems ***with*** associated solutions to the Curriculum Manager of the off-campus OR program for inclusion in the exam. The department head for the operations research program from the main campus will have the final oversight authority for exam design.

2. Comprehensive exams may be administered at the off-campus sites and graded by faculty members at the administering site. However, no grades will be final until both the Curriculum Manager of the off-campus OR program and department head for the operations research program from the main campus review the grading.

3. Off-campus sites shall notify the Curriculum Manager of the off-campus OR program upon learning of an eligible student's intent to sit for the comprehensive exam. Notification shall include:

   - Student name and contact information
   - Anticipated examination date
   - Where exam will be administered (off-campus site)
   - Off-campus site point-of-contact

   Every effort should be made to have comprehensive exams administered and graded no later than one month prior to the end of the intended graduation semester.

4. Completion of the examination report form will require these signatures:

   - **Major Adviser** On this line, the name/signature of a ***full-time*** graduate faculty member who is in the student's program (i.e., operations research) will be entered. This must be the student's Program Chair or another full-time Graduate Faculty member of the student's academic unit designated by the student's Program Chair.
   - **Outside Member** On this line, the name/signature of a ***full-time*** Graduate Faculty member who is "administratively different from the student's program" will be entered. Typically, this will be someone at the off-campus site who meets the above stated criteria.
   - **Other Member** On this line, the name/signature of other committee members who ***must*** be on the Graduate Faculty, but can be other than full time (Adjunct, Visiting, etc.). Typically, this will be the Curriculum Manager of the off-campus OR program.

   Note: Faculty members are listed at: http://www.fit.edu/AcadRes/graduate/facmenu.html.

   By clicking on the SEGS entry, all individuals appointed in SEGS will be listed. However, if there is a date after the name, they are other than **full time**, and therefore **can** be on the committee but **cannot** be the designated "outside member."

5. Only students with an overall GPA of 3.0 at the beginning of the term during which the comprehensive exams are administered are eligible to take the exam.

6. In the event of the student's failing part or parts of the comprehensive exam, the regulations as specified in the Graduate Programs policy manual, section 1.6.5 will apply.

THESIS

Students in certain Extended Graduate Programs are generally expected to undergo the required final program examinations. Permission to follow a thesis in lieu thereof must be requested in writing through the Director, Graduate Studies/faculty adviser to the cognizant academic unit head. If granted, the thesis policies enunciated in the *University Catalog* must be followed.

PETITION TO GRADUATE

All graduating students must file petitions for graduation no later than the dates shown in the *Academic Calendar* of the current catalog; otherwise, the student will be subject to a late fee. Generally, this date is during the first part of the semester preceding the student's final semester. Petitions can be obtained in the Florida Tech Graduate Center. If the student does not graduate at the time anticipated, he/she must re-petition for the appropriate semester. A second payment of the graduation fee is not required, but the student may be required to pay for a replacement diploma, depending on the circumstances.

TIME LIMITATION

A seven-year statute of limitations will be in effect on all work applied toward a master's degree at Florida Tech. That is, all course work, transfer credit and thesis research, including the thesis defense or final program examination, must be completed within a total elapsed time span of not more than seven years.

The academic unit head of the student's college or school may approve a waiver of the statute of limitations for up to six credit hours of course work taken either at Florida Tech or elsewhere, subject to the following conditions.

1. Any course so approved must have been completed within the previous 10 years, and with a grade of at least B.

2. Only those courses where course content has not changed significantly in the intervening years may be approved.

3. The student must provide evidence of current mastery of the course content.

The academic unit head must notify the registrar in writing of the action.

In the case of a waiver request that does not conform to these requirements, or a request involving more than six credit hours, the academic unit head may either deny the request outright or approve it based on accompanying proof of currency by written examination endorsed by Florida Tech faculty with a recommendation for a favorable decision.

All waivers will be valid for a period of seven years. In no case will a time waiver request be honored if the original course grade was less that B.

Courses over the time limit for which the limit has not been waived will not be included in GPA calculations upon receipt of a written request that has been approved by the academic unit head.

SECOND (MULTIPLE) MASTER'S DEGREES

A student seeking a second master's degree from Florida Tech must enroll in the programs sequentially, not simultaneously. Following admission to the first program, the student may at any time thereafter apply for admission to an additional program. If accepted into the new program, actual enrollment in that program will take effect upon completion of the first master's degree.

With approval of the academic unit head, credit for non-thesis or non-degree projects used previously to meet requirements for a master's degree at Florida Tech may be used to meet up to one-half of the credits required for a subsequent master's degree. The academic unit head will decide, on a per-course basis, the applicability of each course to be transferred to the second program. The final program, including those courses transferred, must be approved by the academic unit head of the program in which the student wishes to enroll. However, at least one-half of the course work leading to any master's degree granted by Florida Tech must have been taken at Florida Tech, but never applied to any other degree.

The overall cumulative GPA carried on the transcripts will include all courses for all graduate degrees. A notation will be made of the program GPA compiled for each degree, which will include only courses that were applied to the respective degree. Neither degree will be awarded unless both the program GPA compiled on the basis of only those courses applied to that degree, and the overall cumulative GPA are at least 3.0.

STUDENT–FACULTY COMPLAINT RESOLUTION

Purpose

1. To promote prompt resolution of perceived wrongs and/or injustices that may arise between students and faculty members.

2. To assure that the rights of privacy of all parties are maintained.

3. To develop a higher sense of community among all persons at Florida Tech's off-campus locations.

Complaint Resolution Process

1. Occasions may arise where a student feels that he/she has a legitimate basis for complaint. It is the policy of the university to promptly resolve these complaints. The normal process for resolution of complaints is as follows:

   a. When a student feels that he/she has a complaint, it should be taken by the student directly to the party(s) involved. Those involved should attempt to resolve the matter informally and without the need to establish a record.

   b. If the student and the other party are unable to resolve the matter, or if for any reason the student does not feel at ease in going to the other party, he/she should contact the Director, Graduate Studies at the site for assistance. Very often the Director, Graduate Studies is able to achieve an equitable solution to most problems.

c. If the student would rather not discuss the matter with the Director, Graduate Studies, he/she may contact, by telephone or letter, the Dean, School of Extended Graduate Studies at the main campus in Melbourne, Florida.

d. If for any reason the student chooses not to deal with the individuals listed above, he/she may present their complaint to the Vice President for Academic Affairs, Florida Tech, Melbourne, Florida.

2. To promote prompt and equitable resolution of student grievances, complaints should be made as soon after the incident as possible. Students may seek the help of any of the individuals listed above at any point in the grievance process that they choose. They may also withdraw the complaint at any time. EVERY EFFORT SHOULD BE MADE BY ALL PARTIES CONCERNED TO RESOLVE THE GRIEVANCE WITHIN 90 DAYS.

3. Complaints involving sex discrimination or equal opportunity may be resolved using the procedures outlined above. However, if the student is not at ease with these procedures, or feels these to be ineffective, he/she may seek the aid of the Title IX Coordinator (Director of Human Resources, Mr. Gary Meiseles) at the main campus of Florida Tech in Melbourne, Florida, telephone (321) 674-8100.

DEFINITION

The Title IX Coordinator is the person designated by the university whose function is to ensure that the university is in compliance with federal laws regarding the resolution of allegations regarding sex discrimination. This individual has the added responsibility of ensuring compliance with all federal laws regarding equal opportunity.

COMPLAINT RESOLUTION PROCESS FOR *DISTANCE LEARNING COURSES*

1. Administrative issues (registration matters, how to order books, etc.) should be handled by the student's graduate center, if at all possible.

2. Technical issues (student can't log on, etc.) should be handled by the student's graduate center, if possible; more complicated technical issues (e.g. the student is using a Macintosh computer and has problems, etc.) should be referred to the Information Technologies staff of the Center for Distance Learning (CDL).

3. Instructional issues (lack of faculty feedback, material not presented in an understandable manner) should first be addressed by the student(s) with the instructor. Then, if talking to the instructor does not produce any response (or the student feels that this is not an option), the complaint should be communicated to the director of the Virtual Graduate Center (VGC)/CDL who will communicate this information to the director of the graduate center where the course originates. That graduate center director will discuss the situation with the instructor to see what, if anything, can be done to resolve the complaint. That graduate center director will relay what action(s) is (are) taken to the director of the VGC/CDL, who will relay the outcome(s) to the student(s).

Section VI Virtual Graduate Center

The purpose of the Virtual Graduate Center is to extend the educational opportunity to pursue graduate studies to individuals and groups who are unable to access traditional resident-based graduate programs.

The Virtual Graduate Center offers complete master's degree programs in a total distance learning online environment. There is no requirement for U.S. residency.

Graduate credit certificate programs are also available online. See Section VIII of this catalog for details about available graduate credit certificate programs.

Admission is open to all individuals who possess an undergraduate degree from a university or college that is regionally accredited in the United States. Individuals who possess a degree from other than a U.S. college or university may be admitted subject to conditions for International Student enrollments.

Admission criteria is discussed in Section VII of this catalog. Individuals who do not meet the stated requirements for regular admission may petition to take graduate courses for credit as a continuing education applicant.

Visit our Web site www.segs.fit.edu to obtain information on current course schedules and technical requirements for participation in distance learning online courses.

Distance Learning online course fees are $375 per credit or $1,125 per 3-credit course, effective summer 2003. Directed study fees are $100 per credit hour. Main campus (Melbourne, Fla.) students are charged at main campus tuition rates.

A two-year projection of online courses can be accessed on our homepage www.segs.fit.edu.

FACULTY AT VIRTUAL GRADUATE CENTER

BAILEY, Donald W., Adjunct Instructor. B.A., University of Maryland; M.S., Florida Institute of Technology.

CROSS, William C., Adjunct Instructor. B.A., Kenyon College; M.B.A., Florida Institute of Technology; Ph.D., Nova Southeastern University.

DaSILVA, Paulo A., Adjunct Professor. B.A., National School of Statistical Sciences; B.S., Military Institute of Engineering; M.Sc., Federal University of Rio de Janeiro; Ph.D., Florida Institute of Technology.

DEMENT, Donald F., Adjunct Instructor. B.S., M.A., Ph.D., University of Houston.

DeNEGRIS III, John, Adjunct Instructor. B.S., Indiana University; M.B.A., Orlando College; Ph.D., Walden University.

FERBER, Kenneth S., Adjunct Instructor. LL.B., LL.M. Brooklyn Law School.

HARPER Jr., Ralph L., Adjunct Instructor. B.S.B.A., University of Maryland; M.B.A., new Hampshire College; D.B.A., Nova Southeastern University.

JACQUES, Russell B., Adjunct Instructor. B.S., University of Massachusetts–Boston; M.S., Northeastern University.

KAHL, Alfred L., Adjunct Instructor. B.A., University of Maryland; M.B.A., University of Pittsburgh; Ph.D., University of Florida.

KNERLY, Vicky W., Adjunct Instructor. B.A., Florida International University; M.B.A., Florida Institute of Technology.

PEDRERO, Edward L., Adjunct Instructor. B.A., Florida Institute of Technology; J.D., Loyola University; LL.M., Washington School of Law.

PRICE, Tim E., Adjunct Instructor. B.S., Penn State University; M.B.A., Ph.D., University of South Florida.

THOMPSON, Alexander D., Adjunct Instructor. B.A., J.D., University of Hawaii, Manoa.

WIRTH Jr., Edward D., Adjunct Instructor. A.B., Dartmouth College, M.B.A., Northwestern University; Ph.D., Walden University.

ACADEMIC CALENDAR

FALL 2003 SEMESTER (August 25–December 5)

July 14	Registration begins
Aug. 25	FALL SEMESTER BEGINS
Aug. 29	Last day to file a Petition to Graduate for students who plan to complete their requirements by the end of Spring Semester 2004
Aug. 29	Last day to register, add a class, drop a class with a full tuition refund, or drop a class without receiving a grade of W
Oct. 17	Last day to withdraw from a class with a final grade of W
Nov. 28	Last day of classes
Dec. 1–5	Final Exams

SPRING 2004 SEMESTER (January 5–April 16)

Nov. 17	Registration begins
Jan. 5	SPRING SEMESTER BEGINS
Jan. 9	Last day to file a Petition to Graduate for students who plan to complete their requirements by the end of Spring Semester 2005
Jan. 9	Last day to register, add a class, drop a class with a full tuition refund, or drop a class without receiving a grade of W
Feb. 27	Last day to withdraw from a class with a final grade of W
April 9	Last day of classes
April 12–16	Final Exams

SUMMER 2004 SEMESTER (April 26–August 6)

March 15	Registration begins
April 26	SUMMER SEMESTER BEGINS
April 30	Last day to file a Petition to Graduate for students who plan to complete their requirements by the end of Spring Semester 2004
April 30	Last day to register, add a class, drop a class with a full tuition refund, or drop a class without receiving a grade of W
June 18	Last day to withdraw from a class with a final grade of W
July 30	Last day of classes
Aug. 2–6	Final Exams

FALL 2004 SEMESTER (August 30–December 10)

July 12	Registration begins
Aug. 30	FALL SEMESTER BEGINS
Sep. 3	Last day to file a Petition to Graduate for students who plan to complete their requirements by the end of Spring Semester 2004
Sep. 3	Last day to register, add a class, drop a class with a full tuition refund, or drop a class without receiving a grade of W
Oct. 22	Last day to withdraw from a class with a final grade of W
Dec. 3	Last day of classes
Dec. 6–10	Final Exams

Section VII Degree Programs

**Program is not available via distance learning. Visit our Web site: www.segs.fit.edu.*

PROFESSIONAL MASTER OF BUSINESS ADMINISTRATION (PMBA)

(Code: 8391)

The P.M.B.A. program provides graduates with skills to be adaptable performers in current positions and the competencies for long term career development. This program develops within managers the skills and techniques for team leadership coupled with integrity, social responsibility and a high degree of professionalism. This program is designed to meet the needs of three groups of people:

1. Individuals whose careers have previously focused on specialized areas and who seek to develop a more generalist perspective in anticipation of advancement.
2. Individuals with work experience and business degrees who wish to build upon that foundation for further advancement.
3. Individuals with limited work experience who plan to use the P.M.B.A. as a foundation on which to begin their careers.

ADMISSION REQUIREMENTS

The applicant to the Professional Master of Business Administration program must have a bachelor's degree from an accredited college with an acceptable grade point average and a satisfactory score on the Graduate Management Admission Test (GMAT). General admission requirements and the process for applying are presented in the "Admissions" section of this catalog. Individuals who do not meet the stated requirements for regular admission may petition to take graduate courses for credit as a continuing education applicant.

DEGREE REQUIREMENTS

The Professional Master of Business Administration degree, with or without a concentration, is conferred upon students who have successfully completed 36 credit hours of core and elective courses as listed on the student's approved Graduate Program Plan. Additional prerequisite courses may be required depending on the applicant's undergraduate preparation.

CURRICULUM

All P.M.B.A. options require completion of a common set of nine core courses that are designed to prepare the student for an ever-changing, dynamic organizational environment. The student must complete the prerequisite requirements, if any, before completing nine hours of core courses, or enrolling in a core course for which a prerequisite course is needed.

Prerequisite Courses (noncredit for this program)

Prerequisite courses are required of a student whose undergraduate major is outside the business area or who has not previously completed courses in these prerequisite areas. The exact number of prerequisite courses is dependent upon courses completed during the student's undergraduate studies.

MGT 5000 Financial Accounting *(or two undergraduate accounting courses)*
MGT 5006 Introductory Managerial Statistics
MGT 5021 Business Law
MGT 5022 Analytical Methods of Management
MGT 5132 Basic Economics *(or two undergraduate economics courses)*

Note: In addition, computer literacy is required as a prerequisite. It can be demonstrated by 1) the applicant's undergraduate course work or 2) passing a proficiency exam offered by the School of Extended Graduate Studies, or 3) completing a suitable computer course.

Core Requirements (9 courses) 27
MGT 5001 Managerial Accounting 3
MGT 5002 Corporate Finance 3
MGT 5011 Management Theory and Thought 3
or
MGT 5013 Organizational Behavior 3
MGT 5014 Information Systems 3
MGT 5018 Policy and Strategy for Business 3
MGT 5019 Marketing Management 3
MGT 5071 Decision Theory 3
or
MGT 5007 Intermediate Managerial Statistics 3
MGT 5133 Advanced Analytical Methods for Management 3
MGT 5149 Economics for Business 3

Electives (3 courses) 9

TOTAL CREDITS REQUIRED 36

GENERAL P.M.B.A.

In addition to the nine core courses, students electing the P.M.B.A without a designated concentration are also required to take three elective courses. Electives may be taken with approval of both the faculty adviser and academic unit head from other graduate-level offerings in the School of Extended Graduate Studies.

Concentration in Acquisition and Contract Management

(Code: 8397)

In addition to the nine core courses, students electing the P.M.B.A. with a concentration in acquisition and contract management are also required to take three elective courses. This degree option is for those students who are interested in contracts management.

Core Requirements (9 courses) 27

Electives (3 courses) 9
These electives must be selected from the MGT 52XX (MGT 5211 to MGT 5270) list of Contracts courses.

TOTAL CREDITS REQUIRED 36

Concentration in eBusiness

(Code: 8356)

In addition to the nine core courses, students electing the P.M.B.A. with a concentration in eBusiness are also required to take three elective courses. This degree option is for those students who are interested in eBusiness.

Core Requirements (9 courses) 27

Electives (3 courses) 9
MGT 5160 Introduction to eBusiness 3
MGT 5161 Policy and Organizational Strategies for eBusiness 3
MGT 5162 Survey of Information Technologies for eBusiness 3
MGT 5163 Marketing in an Internet-based Environment 3
MGT 5165 Special Topics in eBusiness 3
MGT 5166 Projects in eBusiness 3

TOTAL CREDITS REQUIRED 36

Concentration in Human Resources Management

(Code: 8400)

In addition to the nine core courses, students electing the P.M.B.A. with a concentration in human resources management are also required to take three elective courses. This degree option is for those students who are interested in human resources management.

Core Requirements (9 courses) 27

Electives (3 courses) 9
MGT 5015 Organizational Planning and Development 3
MGT 5016 Employee Relations 3
MGT 5033 Human Resources Management 3
MGT 5101 Leadership Theory and Effective Management 3
MGT 5105 Interpersonal Relations and Conflict Resolutions 3
MGT 5106 Organizational Communication 3
MGT 5112 Seminar in Contemporary Issues in Human Resources Management 3
MGT 5138 Business Ethics 3

TOTAL CREDITS REQUIRED 36

Concentration in Information Systems

(Code: 8396)

In addition to the nine core courses, students electing the P.M.B.A. with a concentration in information systems are also required to take three elective courses. This degree option is for those students who are interested in information systems management.

Core Requirements (9 courses) 27

Electives (3 courses) 9
MGT 5070 Special Topics in Business 3
MGT 5150 Management of Software Systems 3
MGT 5151 Database Systems Management 3
MGT 5152 Computer Systems Administration 3
MGT 5153 Telecommunications Systems Management 3
MGT 5154 Advanced Management Information Systems 3

TOTAL CREDITS REQUIRED 36

MASTER OF PUBLIC ADMINISTRATION (MPA)

(Code: 8401)

ADMISSIONS REQUIREMENTS

The applicant to the Master of Public Administration program must have a bachelor's degree from a regionally accredited university. The bachelor's degree need not be in public or business administration; however, applicants may be assigned academic prerequisites to complete based upon deficiencies in their undergraduate studies preparation.

The Graduate Record Examination (GRE) or Graduate Management Admission Test (GMAT) may be required for admission evaluation purposes. General admission requirements and the process for applying are discussed in the "Admissions" section of the catalog. Individuals who do not meet the stated requirements for regular admission may petition to take graduate courses for credit as a continuing education applicant.

DEGREE REQUIREMENTS

The M.P.A. degree is conferred upon students who have successfully completed 36 credit hours of graduate work plus other course requirements as listed on the student's approved Graduate Program Plan. Students without adequate undergraduate background will be required to complete all or part of the program prerequisites. Students who do not select an area of concentration may choose elective courses with the approval of both the faculty adviser and the academic unit head.

Program Prerequisites (noncredit for this program)
MTH 1701 College Algebra
MGT 5000 Financial Accounting *(or two undergraduate accounting courses)*
Note: In addition, computer literacy is required as a prerequisite. It can be demonstrated by 1) the applicant's undergraduate course work or 2) passing a proficiency exam offered by the School of Extended Graduate Studies, or 3) completing a suitable computer course.

Required Courses (9 courses) 27
MGT 5001 Managerial Accounting 3
MGT 5003 Public Finance 3
MGT 5006 Introductory Managerial Statistics 3
MGT 5010 Seminar in Research Methodology 3
MGT 5013 Organizational Behavior 3
MGT 5014 Information Systems 3
MGT 5035 Public Administration and Management 3
MGT 5040 Public Program Policy and Evaluation 3
MGT 5132 Basic Economics 3

Electives (3 courses) 9
TOTAL CREDITS REQUIRED 36

Students who do not select an area of concentration may choose electives from other graduate-level offerings in business, or other related disciplines, with the approval from both the faculty adviser and the cognizant academic unit head.

MASTER OF SCIENCE IN ACQUISITION AND CONTRACT MANAGEMENT (MS/ACM)

(Code: 8399)

ADMISSION REQUIREMENTS

The applicant to the Master of Science in Acquisition and Contract Management program must have a bachelor's degree; however, the degree need not be in business administration. Students who are graduates from other fields are encouraged to apply. Students with an undergraduate business degree or courses may be able to waive the program prerequisite requirements in the MS/ACM program based on an evaluation of their undergraduate academic transcripts. Prerequisite courses are required of a student whose undergraduate major is outside the business area or who has not previously completed the courses in these prerequisite areas. The exact number of needed prerequisite courses depends on courses completed during the student's undergraduate studies.

The Graduate Record Examination (GRE) or Graduate Management Admissions Test (GMAT) may be required for admission evaluation purposes. General admission requirements and the process for applying are discussed in the "Admissions" section of this catalog. Individuals who do not meet the stated requirements for regular admission may petition to take graduate courses for credit as a continuing education applicant.

DEGREE REQUIREMENTS

The degree of Master of Science in Acquisition and Contract Management is conferred upon students who have successfully completed 33 credit hours of graduate course work plus other course requirements as listed on the student's approved Graduate Program Plan. Students without adequate undergraduate background will be required to complete all or part of the program prerequisites. Students may choose elective courses from those listed below.

Students with undergraduate credits for courses that they believe are equivalent to the program prerequisites should consult with their adviser concerning waiver of those courses.

Program Prerequisites (noncredit for this program)
MGT 5000 Financial Accounting *(or two undergraduate accounting courses)*
MGT 5132 Basic Economics *(or two undergraduate economics courses)*
Note: In addition, computer literacy is required as a prerequisite. It can be demonstrated by 1) the applicant's undergraduate course work or 2) passing a proficiency exam offered by the School of Extended Graduate Studies, or 3) completing a suitable computer course.

Required Courses (9 courses) 27
MGT 5001 Managerial Accounting 3
MGT 5002 Corporate Finance 3
MGT 5013 Organizational Behavior 3
MGT 5211 Procurement and Contract Management 3
MGT 5213 Contract Changes, Terminations and Disputes 3
MGT 5214 Cost Principles, Effectiveness and Control 3
MGT 5217 Contract and Subcontract Formulation 3
MGT 5218 Contract Negotiations and Incentive Contracts 3
MGT 5220 Contract Management Research Seminar 3

Electives (2 courses) 6
MGT 5017 Program Management 3
MGT 5064 Cost and Economic Analysis 3
MGT 5084 Materiel Acquisition Management 3
MGT 5138 Business Ethics 3
MGT 5212 Advanced Procurement and Contract Management 3
MGT 5240 Business and Legal Aspects of Intellectual Property 3
MGT 5270 Special Topics in Contracts Management 3
MGT 5231 Government Contract Law 3

TOTAL CREDITS REQUIRED 33

Note: The elective may be taken with the approval of both the faculty adviser and the program head from other graduate-level offerings in the School of Extended Graduate Studies, or other schools or academic units.

MASTER OF SCIENCE IN AEROSPACE ENGINEERING (MS/AE)

(Code: 8134)

The Master of Science in Aerospace Engineering may be earned in one of three major areas: aerodynamics and fluid dynamics, aerospace structures and materials, and combustion and propulsion. Because the purpose of each program is to prepare the student for either a challenging professional career in industry or for further graduate study, the programs do not permit narrow specialization. Emphasis is on required course work in several disciplines in which an advanced-degree engineer in a typical industrial position is expected to have knowledge and problem-solving expertise beyond that normally obtained during an undergraduate engineering education.

ADMISSION REQUIREMENTS

An applicant should have an undergraduate major in a field related to aerospace engineering. Applicants whose bachelor's degrees are in other fields will normally be required to take some undergraduate course work in addition to the program described below, as determined by the department head. Applications are also invited from graduates with undergraduate majors in the physical sciences or applied mathematics. In these cases, at least one year of undergraduate course work in aerospace engineering is normally required prior to starting the master of science program. In evaluating an international application, due consideration is given to academic standards in the country where the undergraduate studies have been performed.

Master's applicants should take the Graduate Record Examination (GRE), General Test. General admission requirements and the process for applying are presented in the "Admissions" section of this catalog.

DEGREE REQUIREMENTS

The Master of Science in Aerospace Engineering is offered with both thesis and nonthesis options. Each option requires a minimum of 30 credit hours of course work. Prior to the completion of nine credit hours, the student must submit for approval a master's degree program plan to indicate the path chosen and the specific courses to be taken. For the thesis option, up to six credit hours of thesis work may be included in the 30 credit hours' requirement. The thesis can be primarily analytical, computational or experimental; or it can be some combination of these. In each case, students must demonstrate the ability to read the appropriate engineering literature, to learn independently and to express themselves well technically, both orally and in writing. For the nonthesis option, a student may replace the thesis with additional elective courses and a final comprehensive examination, following approval of a written petition submitted to the department head. Generally students wishing to pursue an academic career are encouraged to choose the thesis option.

CURRICULUM

The program of study leading to the Master of Science in Aerospace Engineering is offered in the three listed areas of specialization. The minimum program requirements consist of nine credit hours of core courses, six credit hours of mathematics and 15 credit hours (which may include six credit hours of thesis) of electives.

The nine credit hours of core courses must be chosen in consultation with the student's adviser from one of the lists below.

Aerodynamics and Fluid Dynamics

MAE 5110 Continuum Mechanics
MAE 5120 Aerodynamics of Wings and Bodies
MAE 5130 Viscous Flows
MAE 5140 Experimental Fluid Dynamics
MAE 5150 Computational Fluid Dynamics
MAE 5180 Turbulent Flows

Aerospace Structures and Materials

MAE 5050 Finite Element Fundamentals
MAE 5410 Elasticity
MAE 5430 Design of Aerospace Structures
MAE 5460 Fracture Mechanics and Fatigue of Materials
MAE 5470 Principles of Composite Materials
MAE 5480 Structural Dynamics

Combustion and Propulsion

MAE 5130 Viscous Flows
MAE 5150 Computational Fluid Dynamics
MAE 5310 Combustion Fundamentals
MAE 5320 Internal Combustion Engines
MAE 5350 Gas Turbines
MAE 5360 Hypersonic Air-breathing Engines

Electives are selected from these course offerings and appropriate courses in mathematics, in consultation with the student's adviser and committee. The topics of emphasis for aerospace engineering in the three areas of specialization include aerodynamics, computational fluid dynamics, experimental fluid dynamics, flow instability theory, combustion, aerospace propulsion and power, and aerospace structures, composite materials, fracture mechanics and fatigue of materials.

MASTER OF SCIENCE IN COMPUTER INFORMATION SYSTEMS (MS/CIS)

(Code: 8072)

The Master of Science in Computer Information Systems is designed for students who seek a terminal degree that prepares them for positions in organizations that design, develop or utilize computer systems. It is for students who do not have an undergraduate degree in computer science but who wish to obtain advanced training in this field. Students with undergraduate degrees in computer science should apply for admission to the Master of Science in Computer Science degree program.

ADMISSION REQUIREMENTS

An applicant for the master's program in computer information systems is not required to have a bachelor's degree in computer science, but should have a mathematical background that includes differential and integral calculus, and those subjects included in the following courses

CSE 5000 Introduction to Programming
CSE 5001 Assembly Language and Organization
MTH 2051 Discrete Mathematics

If the applicant's background is deemed deficient in any of these areas, admission may be granted with the stipulation that deficiencies be made up by taking the necessary extra courses. Students may elect to take MTH 5051, Applied Discrete Mathematics, instead of MTH 2051, for which graduate credit is not awarded. Graduate Record Examination scores (General Test only) are required.

DEGREE REQUIREMENTS

The Master of Science in Computer Information Systems requires a minimum of 30 credit hours, as follows:

CSE	5100	Data Structures and Algorithms	3
CSE	5230	Operating Systems	3
CSE	5250	Programming Languages	3
ECE	5536	Computer Hardware Design	3
		Electives (at least 12 credits in Computer Science)	18

All students who can verify competence in any required course may substitute an appropriate course with permission of the student's adviser and program chair. All electives that apply to the program must be similarly approved. The computer science office maintains a list of approved courses from which electives can be selected.

All students must pass a final program examination. The final program examination is offered each fall and spring semester, and may be taken no earlier than the last semester in which the student is registered for courses. The examination may be retaken in accordance with Graduate School policy.

MASTER OF SCIENCE IN COMPUTER SCIENCE (MS/CS)

(Code: 8071)

This master of science program offers a student the opportunity to pursue advanced studies in various areas of computer science. The program is designed for students with bachelor's degrees in computer science and provides a solid preparation for those who may pursue a doctorate.

ADMISSION REQUIREMENTS

Applicants must have taken courses equivalent to the four required courses in the Master of Science in Computer Information Systems (CIS) degree program, in addition to meeting the admission requirements listed for the CIS program.

If the applicant's background is deemed deficient in any of the listed areas, admission may be granted with the stipulation that deficiencies be made up by taking the necessary extra courses. Graduate Record Examination scores (General Test only) are required.

DEGREE REQUIREMENTS

The Master of Science in Computer Science requires a minimum of 32 credit hours. Students are encouraged to complete and successfully defend a thesis. Students who decide not to write a thesis must pass a comprehensive examination given in the last semester in which the student is registered for courses.

To ensure students are exposed to a variety of areas in computer science, they must pass one course in each of three categories: applied software, foundations, and software and systems, as listed below:

Applied Software

CSE 5260 Database Systems
CSE 5280 Computer Graphics
CSE 5290 Artificial Intelligence

Foundations

CSE 5210 Formal Languages and Automata Theory
CSE 5211 Analysis of Algorithms

Software and Systems

CSE 5231 Computer Networks
CSE 5251 Compiler Theory and Design
SWE 5001 Software Engineering 1

Students are exempted from this breadth requirement only if they can show evidence that they have passed courses equivalent to all of those on the category list. A student can substitute a listed course with another appropriate course only with permission of the student's adviser and department head.

The course requirements are

MTH	5051	Applied Discrete Mathematics	3
		Applied Software	3
		Foundations	3
		Software and Systems	3
CSE	5500	Computer Science Seminar	2
		Electives (at least 6 credits must be in Computer Science, numbered CSE 5600 or higher)	12
CSE	5999	Thesis in Computer Science or Advanced Electives (CSE 5600 or higher)	6

All electives that apply to the program must be approved by the student's adviser. The computer science program office maintains an approved set of courses, including courses in other disciplines, from which electives can be selected. At most, six approved elective credits can be from other disciplines.

MASTER OF SCIENCE IN ELECTRICAL ENGINEERING (MS/EE)

(Code: 8042)

All master of science areas of specialization in electrical engineering can be taken on either a full-time or part-time basis. A two-year projection of course offerings is available on request. Course offerings are arranged to permit the master's program to be completed in three semesters for full-time students and in two calendar years for part-time students.

ADMISSION REQUIREMENTS

The undergraduate backgrounds of applicants for admission to the master's degree (MS/EE) programs vary considerably. For this reason, a variety of master's degree options are available. U.S. applicants should have a bachelor of science or equivalent degree from an electrical engineering program accredited by the Accreditation Board

for Engineering and Technology (ABET). In evaluating an international application, consideration is given to academic standards of the school attended and the content of the courses leading to the degree obtained.

Applicants whose bachelor's degrees are in other engineering fields, mathematics, or the physical sciences may be accepted, but will be required to remedy any deficiencies by satisfactorily completing a number of undergraduate courses in preparation for graduate study in electrical engineering.

DEGREE REQUIREMENTS

The Master of Science in Electrical Engineering is offered with four possible fields of specialization and both thesis and nonthesis paths. Each specialization requires a minimum of 30 credit hours of approved graduate study; however, within each specialization, course choices vary considerably. Prior to the completion of nine credit hours, the student must submit for approval a Master's Degree Program Plan to indicate the path chosen and the specific courses to be taken. Up to six credit hours of thesis work may be included in the 30-credit-hour requirement. A nonthesis candidate must pass a master's final program examination.

CURRICULUM

Listed below are required and elective courses for the master of science specializations.

Electromagnetics Specialization

ECE 5425 Antennas 1 3
ECE 5426 Antennas 2 3
either
ECE 5410 Electrodynamics 1 3
ECE 5411 Electrodynamics 2 3
or
ECE 5418 Field Theory of Guided Waves 1 3
ECE 5419 Field Theory of Guided Waves 2 3
Approved Electives, including up to 6 credits of thesis 18
TOTAL CREDITS REQUIRED 30

Physical Electronics Specialization

This specialization is the combination of two interrelated suboptions—microelectronics and photonics. Recent advances in electronic systems have been largely due to the development of integrated circuits, lasers, optical computing and signal processing, as well as fiberoptic communication and sensing. The study and research of these advanced devices and systems comprise the direction of this program.

Microelectronics Sub-option Requirements

Three courses from the microelectronics course list (must include ECE 5301) 9
One course from the photonics course list (ECE 5350 or ECE 5351 is recommended) 3
Two math electives (see recommended math course list) 6
Approved electives that may include 6 credits of thesis 12
TOTAL CREDITS REQUIRED 30

Photonics Sub-option Requirements

Four courses from the photonics course list (must include ECE 5350 or ECE 5351) 12
One course from the microelectronics course list (ECE 5301 is recommended) 3
Two math electives (see recommended math course list) 6
Approved electives that may include 6 credits of thesis 9
TOTAL CREDITS REQUIRED 30

Microelectronics Course List

ECE 5301 Semiconductor Device Theory
ECE 5310 VLSI Processing
ECE 5311 Microelectronics Fabrication Laboratory
ECE 5333 Analog IC Design
ECE 5335 Advanced IC Design and Simulation

Photonics Course List

ECE 5350 Optical Electronics
ECE 5351 Fiberoptic Communication Systems
ECE 5352 Fiberoptic Sensor Systems
ECE 5353 Optical Computing
ECE 5354 Acoustooptic and Electrooptic Devices
ECE 5355 Electrooptics Laboratory
ECE 5356 Optical Waveguides and Devices
ECE 5418 Field Theory of Guided Waves 1

Mathematics Course List

MTH 5201 Mathematical Methods in Science and Engineering 1
MTH 5202 Mathematical Methods in Science and Engineering 2
MTH 5301 Numerical Analysis
MTH 5315 Numerical Methods for Partial Differential Equations
MTH 5401 Applied Statistical Analysis

Systems and Information Processing Specialization

ECE 5201 Linear Systems 1 3
either
ECE 5234 Communication Theory 3
or
ECE 5223 Digital Communications 3
ECE 5245 Digital Signal Processing 1 3
MTH 5425 Theory of Stochastic Signals 3
Mathematics Elective 3
Approved Electives, including up to 6 credits of thesis 15
TOTAL CREDITS REQUIRED 30

Within this area of specialization, courses may include systems, digital signal and image processing, neural networks and controls. Each student plans a program of study in consultation with a member of the faculty whose professional field is related to the student's interest.

Wireless Systems and Technology Specialization

The explosive growth of cellular phones and systems has prompted the notion that "wireless" is synonymous with pocket phones and pagers. Wireless in the context of this specialization refers to any system or device that relies on electromagnetic-wave propagation to perform one or more of its functions, including such diverse applications as radar, global positioning, location, sensing, etc., as well as the broader class of communications systems such as satellites, point-to-point/multipoint, WLAN, Wireless WAN, etc. This specialization provides students with a solid foundation in the broad array of disciplines that are common and fundamental to these disparate applications, while allowing flexibility to delve into specific application areas of interest. The core curriculum also emphasizes the fundamental theory and principles, system elements and techniques that are common to all these applications. The goal is to ensure that graduates are prepared to make immediate contributions professionally or to pursue more advanced studies in their specific areas of interest.

Wireless Systems Sub-option Requirements

All courses from core curriculum list 15
Three courses from the wireless systems and applications list 9
Approved electives (or 6 credits of thesis) 6
TOTAL CREDITS REQUIRED 30

Microwave Engineering Sub-option Requirements

All course from the core curriculum list 15
Three courses from the microwave engineering list 9
Approved electives (or 6 credits of thesis) 6
TOTAL CREDITS REQUIRED 30

Core Curriculum

ECE 5111 Radio Frequency Propagation
ECE 5201 Linear Systems 1
ECE 5245 Digital Signal Processing 1
ECE 5234 Communication Theory
MTH 5425 Theory of Stochastic Signals

Wireless Systems

ECE 5112 Introduction to Wireless Systems and Applications
ECE 5113 Wireless Local Area Networks
ECE 5114 Radio Location, Sensing and Measurement
ECE 5221 Personal Communications Systems
ECE 5223 Digital Communications
ECE 5233 Satellite Communications
ECE 5238 Error Control Coding
ECE 5246 Digital Signal Processing 2
ECE 5251 Radar Systems

Microwave Engineering

ECE 5115 Modern Wireless System Design
ECE 5356 Optical Waveguides and Devices
ECE 5418 Field Theory of Guided Waves 1
ECE 5425 Antennas 1
ECE 5426 Antennas 2
ECE 5450 Automated RF Measurements
ECE 5451 Microwave Circuit Design

MASTER OF SCIENCE IN ENGINEERING MANAGEMENT (MS/EM)

(Code: 8075)

The Master of Science in Engineering Management has been developed to meet the professional needs of the engineer who, although working in a technical field, finds it necessary to update his or her skills in engineering, as well as acquire knowledge in the management of engineering. Typically, the technical person finds that as he or she advances in the chosen field, the challenges of management increase as part of the overall responsibilities of the position. Many find that their careers would best be served by a program addressing both areas of their job responsibilities. This program is designed for those individuals.

The Master of Science in Engineering Management program is an interdisciplinary program administered by the College of Engineering and offered in cooperation with the School of Extended Graduate Studies. The program faculty includes specialists in engineering management, as well as the coordinators of the specialization areas.

ADMISSION REQUIREMENTS

An applicant for the master's program in engineering management should have a bachelor's degree from an ABET-accredited engineering program. Applicants with bachelor's degrees in physical sciences, computer science and mathematics will also be considered. In evaluating an international application, consideration is given to the academic standards of the school attended and the content of the courses. Letters of recommendation and a statement of educational objectives reflecting the applicant's professional experience and career goals are also encouraged. Applicants should also take the Graduate Record Examination (GRE). General admission requirements and the process for applying are discussed in the "Admissions" section of this catalog.

DEGREE REQUIREMENTS

The master of science degree requires a minimum of 36 credit hours. Courses taken to satisfy admission prerequisites cannot be counted toward the degree requirements. Students without adequate undergraduate courses in accounting, statistics, computer applications and economics will be required to make up these deficiencies. Applicants whose bachelor's degrees are not in engineering will also be required to remedy any additional deficiencies by satisfactorily completing a number of undergraduate courses selected to meet the prerequisites for graduate study in their engineering area of specialization.

CURRICULUM

The program requires six courses in the management area and six courses from the engineering area. At least four courses should be taken from the engineering management (ENM) list and can be applied toward either the management or engineering requirement.

Management

Six courses with a clear focus on management are required. These courses may be from the foundation, core or elective courses, or from courses with a management emphasis from other academic units in the university. Each student meets with the engineering management program director and faculty with expertise in the field of management to select the six-course management sequence. A student must meet any prerequisites needed for a graduate course in management that may be required by the academic unit that offers the course.

Engineering

An engineering specialization is taken by every student based on his or her need for graduate education in technology. A specialization track can be drawn from any of the programs within the College of Engineering or closely allied disciplines such as mathematics or operations research. Each student meets with the engineering management program director and faculty familiar with the area of technical emphasis to form a sequence of five courses. A student must meet any prerequisites needed for a graduate engineering course.

A student may complete an internship with an industrial, government or service organization, or elect to prepare and defend a thesis to account for up to six semester hours of the 36 credits required for graduation. In order to meet graduation requirements, a nonthesis student must present a portfolio of competencies and a summary of the career relevance of his or her academic study.

MASTER OF SCIENCE IN HUMAN RESOURCES MANAGEMENT (MS/HRM)

(Code: 8350)

ADMISSION REQUIREMENTS

The applicant to the Master of Science in Human Resources Management program must have a bachelor's degree; however, the degree need not be in business administration. Students who are graduates from other fields are encouraged to apply. Students with an undergraduate business degree or courses may be able to waive some or all of the program prerequisites in the MS/HRM program based on an evaluation of their undergraduate academic transcripts. Prerequisite courses are required of a student whose undergraduate major is outside the business area or who has not previously completed the courses in these prerequisite areas. The exact number of needed prerequisite courses depends on courses completed during the student's undergraduate studies.

The Graduate Record Examination (GRE) or the Graduate Management Admissions Test (GMAT) may be required for admission evaluation purposes. General admission requirements and the process for applying are discussed in the "Admissions" section of this catalog. Individuals who do not meet the stated requirements for regular admission may petition to take graduate courses for credit as a continuing education applicant.

DEGREE REQUIREMENTS

The degree of Master of Science in Human Resources Management is conferred upon students who have successfully completed 33 credit hours of graduate course work plus other course requirements as listed on the student's approved Graduate Program Plan. Students without adequate undergraduate background will be required to complete all or part of the program prerequisites. Students may choose elective courses from those listed below.

Students with undergraduate credits for courses that they believe are equivalent to the program prerequisites should consult with their adviser concerning waiver of those prerequisites.

Program Prerequisites (noncredit for this program)

MGT 5000 Financial Accounting *(or two undergraduate accounting courses)*
MGT 5132 Basic Economics *(or two undergraduate economics courses)*
MTH 1701 College Algebra

Note: In addition, computer literacy is required as a prerequisite. It can be demonstrated by 1) the applicant's undergraduate course work or 2) passing a proficiency exam offered by the School of Extended Graduate Studies, or 3) completing a suitable computer course.

Required Courses (9 courses) 27

MGT 5001 Managerial Accounting 3
MGT 5002 Corporate Finance 3
MGT 5006 Introductory Managerial Statistics 3
MGT 5013 Organizational Behavior 3
MGT 5014 Information Systems 3
MGT 5015 Organizational Planning and Development 3
MGT 5021 Business Law 3
MGT 5033 Human Resources Management 3
MGT 5138 Business Ethics 3

Electives (2 courses) 6
MGT 5016 Employee Relations 3
MGT 5101 Leadership Theory and Effective Management 3
MGT 5105 Interpersonal Relations and Conflict Resolution 3
MGT 5112 Seminar in Contemporary Issues in Human Resources Management 3
TOTAL CREDITS REQUIRED 33

Note: Electives may be taken with approval of both the faculty adviser and program head from other graduate-level offerings in the School of Extended Graduate Studies or the School of Psychology.

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT (MS/LM)

(Code: 8322)

ADMISSION REQUIREMENTS

The applicant to the Master of Science in Logistics Management program must have a bachelor's degree; however, the degree need not be in business administration. Students who are graduates from other fields are encouraged to apply. Students with an undergraduate business degree or courses may be able to waive the program prerequisite in the MS/LM program based on an evaluation of their undergraduate academic transcripts. Prerequisite courses are required of a student whose undergraduate major is outside the business area or who has not previously completed the courses in these prerequisite areas. The exact number of needed prerequisite courses depends on courses completed during the student's undergraduate studies.

The Graduate Record Examination (GRE) or the Graduate Management Admissions Test (GMAT) may be required for admission evaluation purposes. General admission requirements and the process for applying are discussed in the "Admissions" section of this catalog. Individuals who do not meet the stated requirements for regular admission may petition to take graduate courses for credit as a continuing education applicant.

DEGREE REQUIREMENTS

The degree of Master of Science in Logistics Management is conferred upon students who have successfully completed 33 credit hours of graduate course work plus other course requirements as listed on the student's approved Graduate Program Plan. Students without adequate undergraduate background will be required to complete the program prerequisites. Students may choose elective courses from several of the management or related academic disciplines by securing approval of both their faculty adviser and academic unit head.

Students with undergraduate credits for courses that they believe are equivalent to the program prerequisites should consult with their adviser concerning waiver of those prerequisites.

Program Prerequisites (noncredit for this program)
MGT 5000 Financial Accounting *(or two undergraduate accounting courses)*
MTH 1701 College Algebra
Note: In addition, computer literacy is required as a prerequisite. It can be demonstrated by 1) the applicant's undergraduate course work or 2) passing a proficiency exam offered by the School of Extended Graduate Studies, or 3) completing a suitable computer course.

Required Courses (9 courses) 27
MGT 5002 Corporate Finance 3
MGT 5006 Introductory Managerial Statistics 3
MGT 5014 Management Information Systems 3
MGT 5024 Production and Operations Management 3
MGT 5061 Systems and Logistics Support Management 3
MGT 5062 Logistics Policy 3
MGT 5071 Decision Theory 3
MGT 5100 Distribution Management 3
MGT 5132 Basic Economics 3

Electives (2 courses) 6
MGT 5010 Seminar in Research Methodology* 3
MGT 5017 Program Management 3
MGT 5033 Human Resources Management 3
MGT 5060 Management of Assets 3
MGT 5063 Inventory Control Management 3
MGT 5064 Cost and Economic Analysis 3
MGT 5065 Supply Chain Management 3
MGT 5069 Advanced Supply Chain Management 3
MGT 5079 Traffic Management 3
MGT 5084 Material Acquisition Management 3
MGT 5087 Transportation Management 3
MGT 5500 Integrated Logistics Management 3

TOTAL CREDITS REQUIRED 33

Note: The elective may be taken with approval of both the faculty adviser and program head from other graduate-level offerings in other schools or academic units.

**Note: Students in the LEDC Cooperative Degree program must take MGT 5010 as one of their elective courses.*

MASTER OF SCIENCE IN MANAGEMENT (MS/M)

(Code: 8381)

ADMISSION REQUIREMENTS

The applicant to the Master of Science in Management program must have a bachelor's degree; however, the degree need not be in business administration. Students who are graduates from other fields are encouraged to apply. Students with an undergraduate business degree or courses may be able to waive the program prerequisite in the MSM program based on an evaluation of their undergraduate academic transcripts. Prerequisite courses are required of a student whose undergraduate major is outside the business area or who has not previously completed the courses in these prerequisite areas. The exact number of needed prerequisite courses depends on courses completed during the student's undergraduate studies.

The Graduate Record Examination (GRE) or Graduate Management Admissions Test (GMAT) may be required for admission evaluation purposes. General admission requirements and the process for applying are discussed in the "Admissions" section of this catalog. Individuals who do not meet the stated requirements for regular admission may petition to take graduate courses for credit as a continuing education applicant.

DEGREE REQUIREMENTS

The degree of Master of Science in Management is conferred upon students who have successfully completed 33 credit hours of graduate course work plus other course requirements as listed on the student's approved Graduate Program Plan. Students without adequate undergraduate background will be required to complete all or part of the program prerequisites. Students may choose elective courses with the approval of both the faculty adviser and the program head.

Students with undergraduate credits for courses that they believe are equivalent to the program prerequisites should consult with their adviser concerning waiver of those prerequisites.

Program Prerequisites (noncredit for this program)
MTH 1701 College Algebra
Note: In addition, computer literacy is required as a prerequisite. It can be demonstrated by 1) the applicant's undergraduate course work or 2) passing a proficiency exam offered by the School of Extended Graduate Studies, or 3) completing a suitable computer course.

Required Courses (9 courses) 27
MGT 5000 Financial Accounting 3
MGT 5002 Corporate Finance 3
MGT 5006 Introductory Managerial Statistics 3
MGT 5011 *Management Theory and Thought 3
MGT 5014 Information Systems 3
MGT 5017 Program Management 3
MGT 5019 Marketing 3
MGT 5033 Human Resources Management 3
MGT 5132 Basic Economics 3
**May substitute MGT 5013 or MGT 5015 with adviser's permission.*

Electives (2 courses) 6
These electives can be chosen from those courses offered to emphasize the area of greatest interest and benefit to the student.

TOTAL CREDITS REQUIRED 33

Note: Electives may be taken with approval from both the faculty adviser and the program head from other graduate-level offerings in other schools or academic units.

Concentration in Acquisition and Contract Management (MS/M-ACM)

(Code: 8403)

Program Prerequisites *(See Note 1)*

Required Courses (8 courses) 24
MGT 5000 Financial Accounting 3
MGT 5002 Corporate Finance 3
MGT 5006 Introductory Managerial Statistics 3
MGT 5011 *Management Theory and Thought 3
MGT 5014 Information Systems 3
MGT 5017 Program Management 3
MGT 5033 Human Resources Management 3
MGT 5132 Basic Economics 3
** May substitute MGT 5013 or MGT 5015 with adviser's permission.*

Electives (3 courses selected from concentration) 9
MGT 5070 Special Topics in Business 3
MGT 5084 Materiel Acquisition Management 3
MGT 5211 Procurement and Contract Management 3
MGT 5212 Advanced Procurement and Contract Management 3
MGT 5213 Contract Changes, Terminations and Disputes 3
MGT 5214 Cost Principles, Effectiveness and Control 3
MGT 5217 Contract and Subcontract Formulation 3
MGT 5218 Contract Negotiations and Incentive Contracts 3
MGT 5220 Contract Management Research Seminar 3
MGT 5231 Government Contract Law 3
MGT 5240 Business and Legal Aspects of Intellectual Property 3
MGT 5270 Special Topics in Contract Management 3

TOTAL CREDITS REQUIRED 33

Concentration in eBusiness (MS/M-eBUS)

(Code: 8404)

Program Prerequisites *(See Note 1)*

Required Courses (8 courses) 24
MGT 5000 Financial Accounting 3
MGT 5002 Corporate Finance 3
MGT 5006 Introductory Managerial Statistics 3
MGT 5011 *Management Theory and Thought 3
MGT 5014 Information Systems 3
MGT 5019 Marketing 3
MGT 5033 Human Resources Management 3
MGT 5132 Basic Economics 3
**May substitute MGT 5013 or MGT 5015 with adviser's permission.*

Electives (3 courses selected from concentration) 9
MGT 5160 Introduction to eBusiness 3
MGT 5161 Policy and Organizational Strategies for eBusiness 3
MGT 5162 Survey of Information Technologies for eBusiness 3
MGT 5163 Marketing in an Internet-based Environment 3
MGT 5165 Special Topics in eBusiness 3
MGT 5166 Projects in eBusiness 3

TOTAL CREDITS REQUIRED 33

Concentration in Human Resources Management (MS/M-HRM)

(Code: 8405)

Program Prerequisites *(See Note 1)*

Required Courses (8 courses) 24
MGT 5000 Financial Accounting 3
MGT 5002 Corporate Finance 3
MGT 5006 Introductory Managerial Statistics 3
MGT 5011 *Management Theory and Thought 3
MGT 5014 Information Systems 3
MGT 5017 Program Management 3
MGT 5033 Human Resources Management 3
MGT 5132 Basic Economics 3
**May substitute MGT 5013 or MGT 5015 with adviser's permission.*

Electives (3 courses selected from concentration) 9
MGT 5016 Employee Relations 3
MGT 5070 Special Topics in Business 3
MGT 5101 Leadership Theory and Effective Management 3
MGT 5105 Interpersonal Relations and Conflict Resolution 3
MGT 5112 Seminar in Contemporary Issues in Human Resources Management 3
MGT 5138 Business Ethics 3

TOTAL CREDITS REQUIRED 33

Concentration in Information Systems (MS/M-IS)

(Code: 8406)

Program Prerequisites *(See Note 1)*

Required Courses (8 courses) 24
MGT 5000 Financial Accounting 3
MGT 5002 Corporate Finance 3
MGT 5006 Introductory Managerial Statistics 3
MGT 5011 *Management Theory and Thought 3
MGT 5014 Information Systems 3
MGT 5017 Program Management 3
MGT 5033 Human Resources Management 3
MGT 5132 Basic Economics 3
**May substitute MGT 5013 or MGT 5015 with adviser's permission.*

Electives (3 courses) 9
MGT 5070 Special Topics in Business 3
MGT 5150 Management of Software Systems 3
MGT 5151 Database Systems Management 3
MGT 5152 Computer Systems Administration 3
MGT 5153 Telecommunications Systems Management 3
MGT 5154 Advanced Management Information Systems 3

TOTAL CREDITS REQUIRED 33

Concentration in Logistics Management (MS/M-LM)

(Code: 8407)

Program Prerequisites *(See Note 1)*

Required Courses (8 courses) 24
MGT 5000 Financial Accounting 3
MGT 5002 Corporate Finance 3
MGT 5006 Introductory Managerial Statistics 3
MGT 5011 *Management Theory and Thought 3
MGT 5014 Information Systems 3
MGT 5017 Program Management 3
MGT 5033 Human Resources Management 3
MGT 5132 Basic Economics 3
**May substitute MGT 5013 or MGT 5015 with adviser's permission.*

Electives (3 courses selected from concentration) 9
MGT 5024 Production and Operations Management 3
MGT 5060 Management of Assets 3
MGT 5061 Systems and Logistics Support Management 3
MGT 5062 Logistics Policy 3
MGT 5064 Cost and Economic Analysis 3
MGT 5065 Supply Chain Management 3
MGT 5069 Advanced Supply Chain Management 3
MGT 5066 Systems Analysis and Modeling 3
MGT 5070 Special Topics in Business 3
MGT 5084 Materiel Acquisition Management 3
MGT 5100 Distribution Management 3
MGT 5211 Procurement and Contract Management 3

TOTAL CREDITS REQUIRED 33

Concentration in Transportation Management (MS/M-TM)

(Code: 8408)

Program Prerequisites *(See Note 1)*

Required Courses (8 courses) 24
MGT 5000 Financial Accounting 3
MGT 5002 Corporate Finance 3
MGT 5006 Introductory Managerial Statistics 3
MGT 5011 *Management Theory and Thought 3
MGT 5014 Information Systems 3
MGT 5017 Program Management 3
MGT 5033 Human Resources Management 3
MGT 5132 Basic Economics 3

**May substitute MGT 5013 or MGT 5015 with adviser's permission.*

Electives (3 courses selected from concentration) 9
MGT 5060 Management of Assets 3
MGT 5061 Systems and Logistics Support Management 3
MGT 5079 Traffic Management 3
MGT 5087 Management of Transportation Systems 3
MGT 5101 Leadership Theory and Effective Management 3
MGT 5138 Business Ethics 3

TOTAL CREDITS REQUIRED 33

Note 1: Prerequisite for all MS/M programs is College Algebra (MTH 1701).

MASTER OF SCIENCE IN MATERIEL ACQUISITION MANAGEMENT (MS/MAM)

(Code: 8320)

ADMISSION REQUIREMENTS

The applicant to the Master of Science in Materiel Acquisition Management program must have a bachelor's degree; however, the degree need not be in business administration. Students who are graduates from other fields are encouraged to apply. Students with an undergraduate business degree or courses may be able to waive up to six hours of the program prerequisites in the MS/MAM program based on an evaluation of their undergraduate course work. Prerequisite courses are required of a student whose undergraduate major is outside the business area or who has not previously completed the courses in these prerequisite areas. The exact number of needed prerequisite courses depends on courses completed during the student's undergraduate studies.

The Graduate Record Examination (GRE) or the Graduate Management Admissions Test (GMAT) may be required for admission evaluation purposes. General admission requirements and the process for applying are discussed in the "Admissions" section of this catalog. Individuals who do not meet the stated requirements for regular admission may petition to take graduate courses for credit as a continuing education applicant.

DEGREE REQUIREMENTS

The degree of Master of Science in Materiel Acquisition Management is conferred upon students who have successfully completed 33 credit hours of graduate course work plus other course requirements as listed on the student's approved Graduate Program Plan. Students without adequate undergraduate background will be required to complete all or part of the program prerequisites. Students may choose elective courses from several of the management or related academic disciplines by securing approval of both their faculty adviser and academic unit head.

Students with undergraduate credits for courses that they believe are equivalent to the program prerequisites should consult with their adviser concerning waiver of those prerequisites.

Program Prerequisites (noncredit for this program)
MGT 5000 Financial Accounting *(or two undergraduate accounting courses)*
MTH 1701 College Algebra
Note: In addition, computer literacy is required as a prerequisite. It can be demonstrated by 1) the applicant's undergraduate course work or 2) passing a proficiency exam offered by the School of Extended Graduate Studies, or 3) completing a suitable computer course.

Required Courses (8 courses) 24
MGT 5001 Managerial Accounting 3
MGT 5002 Corporate Finance 3
MGT 5006 Introductory Managerial Statistics 3
MGT 5017 Program Management 3
MGT 5033 Human Resources Management 3
MGT 5132 Basic Economics 3
MGT 5071 Decision Theory 3
or
ORP 5030 Decision Analysis 3

MGT 5084 Materiel Acquisition Management 3
or
MGT 5211 Procurement and Contract Management 3

Electives (3 courses) 9
These electives can be chosen to emphasize the area of greatest interest and benefit to the student.

TOTAL CREDITS REQUIRED 33

Note 1: Electives may be taken with approval of both the faculty adviser and the program head from other graduate-level offerings in other schools or academic units.
Note 2: MGT 5010 Seminar in Research Methodology will be selected as one of the electives for all fully funded U.S. Army officers at the Fort Lee Graduate Center.

MASTER OF SCIENCE IN MECHANICAL ENGINEERING (MS/ME)

(Code: 8131)

The master of science degree may be earned in one of three major areas: dynamic systems, robotics and controls; structures, solid mechanics and materials; or thermal-fluid sciences. The purpose of each program is to prepare the student for either a challenging professional career in industry or for further graduate study.

ADMISSION REQUIREMENTS

The undergraduate backgrounds of applicants for admission to the master's degree (M.S.M.E.) programs vary considerably. For this reason, a variety of master's degree options are available. The applicant should have a bachelor of science or equivalent degree from a mechanical engineering program accredited by the Accreditation Board for Engineering and Technology (ABET). In evaluating an international application, consideration is given to academic standards of the school attended and the content of the courses leading to the degree obtained. Master's applicants are required to take the Graduate Record Examination (General Test).

Applicants whose bachelor's degrees are in other engineering fields, mathematics or physical sciences may be accepted, but will be required to remedy any deficiencies by satisfactorily completing a number of undergraduate courses in preparation for graduate study in mechanical engineering.

DEGREE REQUIREMENTS

The Master of Science in Mechanical Engineering is offered with both thesis and nonthesis options. Each option requires a minimum of 30 credit hours of approved graduate study; however, within each option, course choices vary considerably. Prior to the completion of nine credit hours, the student must submit for approval a Master's Degree Program Plan to indicate the path chosen and the specific courses to be taken. Up to six credit hours of thesis work may be included in the 30 credit hour requirement. The nonthesis option requires that the candidate satisfactorily complete a minimum of 30 credit hours of course work and the master's final program examination.

CURRICULUM

Regardless of which degree path the student chooses, the degree candidate must choose one of three fields of specialization. Listed below are required and elective courses for the master of science specializations.

Structures, Solid Mechanics and Materials Specialization

Three core courses selected in consultation with the student adviser from the list below ... 9

MAE 5050 Finite Element Fundamentals
MAE 5060 Applications in Finite Element Methods
MAE 5410 Elasticity
MAE 5420 Advanced Mechanical Design
MAE 5460 Fracture Mechanics and Fatigue of Materials
MAE 5470 Principles of Composite Materials

Mathematics 6
Approved electives, which may include 6 credit hours of thesis 15
TOTAL CREDITS REQUIRED 30

Specialization in this area focuses on analytical and computational techniques as they apply in design. Each student plans a program of study in consultation with a member of the faculty whose professional field is related to the student's interests.

Thermal-Fluid Sciences Specialization

Three core courses selected in consultation with the student adviser from the list below ... 9

MAE 5130 Viscous Flows
MAE 5210 Conduction Heat Transfer
MAE 5220 Convection Heat Transfer
MAE 5230 Radiation Heat Transfer

Mathematics 6
Approved electives, which may include 6 credit hours of thesis 15
TOTAL CREDITS REQUIRED 30

Specialization in this area focuses on heat transfer, combustion and energy systems. Analytical, computational and experimental techniques are emphasized.

Dynamic Systems, Robotics and Control Specialization

Three core courses selected in consultation with the student adviser from the list below ... 9

MAE 5610 Advanced Dynamics
MAE 5630 Modeling and Simulation of Dynamic Systems
MAE 5650 Robotics
MAE 5660 Robot Control

Mathematics 6
Approved electives, which may include 6 credit hours of thesis 15
TOTAL CREDITS REQUIRED 30

The student's program in this area will be tailored to provide the background and training to pursue a career in a desired and related area of interest. Examples of related areas include design and control of dynamic systems, robotics, vibration, automotive engineering, biomedical engineering, energy and power systems, etc.

MASTER OF SCIENCE IN OPERATIONS RESEARCH (MS/OR)

(Code: 8074)

The Master of Science in Operations Research offers concentrations that emphasize those areas of application most in demand in today's job market. Graduates have skills that include probability and statistics, deterministic and stochastic models, optimization methods, computation and simulation, decision analysis and the ability to effectively communicate with clients and managers. In addition, graduates have a breadth of knowledge that allows them to work in teams, interacting with people who bring different expertise to a problem. All areas involve expertise with standard computer software packages.

ADMISSION REQUIREMENTS

An applicant for the master's program in operations research should have an undergraduate major in a science or engineering discipline that requires a significant amount of mathematics. Business majors with strong quantitative backgrounds are also encouraged to apply. A proficiency in mathematics covering topics in calculus and linear algebra and the use of a high-level programming language such as FORTRAN, Pascal or C must be demonstrated by testing or suitable course work.

General admission requirements and the process for applying are presented in the "Admissions" section of this catalog.

DEGREE REQUIREMENTS

The master of science degree can be pursued with either a thesis or nonthesis option; each requires 33 credit hours. Under the thesis option, up to six credit hours of thesis may be granted in place of electives toward the required 33 hours, and an oral defense is required. The nonthesis option requires a comprehensive examination. Courses taken to satisfy admission prerequisites cannot be counted toward the degree requirements.

CURRICULUM

The program's curriculum is designed to provide breadth with some flexibility to accommodate the diversity of backgrounds typically found in an operations research program. Greater flexibility is provided for the elective courses beyond the core. A student has the choice of developing greater depth in one area of specialization, aiming at eventual research in that area, or continuing to develop breadth across more than one area. By choosing courses in a related field of application, students can prepare for careers in specialty areas such as management science, actuarial science or economic modeling in addition to conventional areas of operations research.

Each student will complete a program plan that satisfies the requirements listed below, subject to approval of the adviser and program chair. Substitutions are sometimes permitted.

Core Requirements (4 courses) 12
MTH 5411 Mathematical Statistics 1 3
ORP 5001 Deterministic Operations Research Models 3
ORP 5002 Stochastic Operations Research Models 3
ORP 5010 Mathematical Programming 3
or
ORP 5003 Operations Research Practice 3

Restricted MTH/ORP Electives (3 courses from the list below) 9
MTH 5051 Applied Discrete Mathematics 3
MTH 5102 Linear Algebra 3
MTH 5401 Applied Statistical Analysis 3
MTH 5412 Mathematical Statistics 2 3
ORP 5020 Theory of Stochastic Processes 3
ORP 5021 Queuing Theory 3

Computation/Computer Science (1 course from the list below) 3
CSE 5100 Data Structures and Algorithms 3
CSE 5210 Formal Languages and Automata Theory 3
CSE 5211 Analysis of Algorithms 3
CSE 5290 Artificial Intelligence 3
CSE 5610 Computational Complexity 3
MTH 5301 Numerical Analysis 3
MTH 5305 Numerical Linear Algebra 3
MTH 5320 Neural Networks 3
ORP 5050 Discrete System Simulation 3

Free Electives 9

Nonthesis Option: Three courses in areas of interest to the student as approved in the student's program plan.

Thesis Option: At least one course plus up to six credits for thesis. The thesis should be an in-depth study of some topic and/or problem in operations research, subject to the approval of the thesis committee.

TOTAL CREDITS REQUIRED 33

MASTER OF SCIENCE IN PROJECT MANAGEMENT (MS/PM)

(Code: 8357)

ADMISSION REQUIREMENTS

The applicant to the Master of Science in Project Management program must have a bachelor's degree; however, the degree need not be in business administration. Students who are graduates from other fields, especially mathematics, science and engineering, are encouraged to apply. Students with an undergraduate business degree or courses may be able to waive up to 12 hours of the program prerequisites in the MS/PM program based on an evaluation of their undergraduate academic transcripts. Prerequisite courses are required of a student whose undergraduate major is outside the business area or who has not previously completed the courses in these prerequisite areas. The exact number of needed prerequisite courses depends on courses completed during the student's undergraduate studies.

The Graduate Record Examination (GRE) or Graduate Management Admissions Test (GMAT) may be required for admission evaluation purposes. General admission requirements and the process for applying are discussed in the "Admissions" section of this catalog. Individuals who do not meet the stated requirements for regular admission may petition to take graduate courses for credit as a continuing education applicant.

DEGREE REQUIREMENTS

The degree of Master of Science in Project Management is conferred upon students who have successfully completed 33 credit hours of graduate course work plus other course requirements as listed on the student's approved Graduate Program Plan. Students without adequate undergraduate background will be required to complete all or part of the program prerequisites. Students may choose elective courses from those listed below.

Students with undergraduate credits for courses that they believe are equivalent to the program prerequisites should consult with their adviser concerning waiver of those prerequisites.

Program Prerequisites (noncredit for this program)
MGT 5022 Analytical Methods of Management
MGT 5132 Basic Economics *(or two undergraduate economics courses)*
Note: In addition, computer literacy is required as a prerequisite. It can be demonstrated by 1) the applicant's undergraduate course work or 2) passing a proficiency exam offered by the School of Extended Graduate Studies, or 3) completing a suitable computer course.

Required Courses (8 courses) 24
MGT 5006 Introductory Statistics 3
MGT 5014 Information Systems 3
MGT 5017 Program Management 3
MGT 5064 Cost and Economic Analysis 3
MGT 5088 Project and Program Risk Management 3
MGT 5089 Multiple Project Management 3
MGT 5090 Practicum for Project Management 3
MGT 5131 Productivity Measurement and Improvement 3

Electives (3 courses) 9
Students without a concentration area may select their three open elective courses from any area of specialization approved by their faculty adviser.

TOTAL CREDITS REQUIRED 33

CONCENTRATIONS

Students may elect to concentrate their studies within an area of specialization. If a concentration area is pursued, the specialization courses will replace the three (open) elective choices. Concentration area courses are approved by the student's faculty adviser from one of the following MS/Project Management specialization areas:

Concentration in Information Systems

(Code: 8358)

Courses (3 courses) 9
MGT 5070 Special Topics in Business 3
MGT 5150 Management of Software Systems 3
MGT 5151 Database Systems Management 3
MGT 5152 Computer Systems Administration 3
MGT 5153 Telecommunications Systems Management 3
MGT 5154 Advanced Management Information Systems 3

Concentration in Operations Research

(Code: 8359)

Courses (3 courses) 9
MTH 5401 Applied Statistical Analysis 3
MTH 5411 Mathematical Statistics 3
ORP 5001 Deterministic Operations Research Models 3
ORP 5002 Stochastic Operations Research Models 3
ORP 5003 Operations Research Practices 3
ORP 5010 Mathematical Programming 3
ORP 5011 Discrete Optimization 3
ORP 5030 Decision Analysis 3
ORP 5040 Quality Assurance 3
ORP 5041 Reliability Analysis 3
ORP 5042 Reliability, Availability and Maintainability 3
ORP 5050 Discrete System Simulation 3

MASTER OF SCIENCE IN SOFTWARE ENGINEERING (MS/SWE)

(Code: 8050)

The master's degree program in software engineering primarily serves working software engineers who want to broaden their perspective while deepening their skills in software development. The program also accepts students who are already competent programmers, whose goal is to prepare for a career in software engineering. Courses in this program are taught at a level that assumes all students have a technical undergraduate degree and significant programming experience.

ADMISSION REQUIREMENTS

An undergraduate degree in computer science or a related discipline is required. Specific skills include experience in at least one programming language, and the content of the following courses:
CSE 2010 Algorithms and Data Structures
MTH 2051 Discrete Mathematics.

At a minimum, applicants must have taken at least two additional computer science classes at a level comparable to 3000 and 4000 level computer science classes in this catalog. Applicants are also required to take the GRE General Test and submit their results for consideration.

DEGREE REQUIREMENTS

The Master of Science in Software Engineering is offered with both thesis and non-thesis degree paths. Each requires a minimum of 30 credit hours of approved graduate study. Prior to the completion of nine credit hours, the student must submit for approval by the student's adviser and department head, a program plan to indicate the specific courses to be taken. Up to six credit hours of thesis work may be included in the 30-credit-hour requirement. The non-thesis path requires successful completion of a comprehensive examination.

CURRICULUM

The degree candidate must take four required courses, four electives, and either a thesis or two additional electives. Successful completion of a master's thesis can be substituted for two of the non-restricted electives. All electives that apply to the program must be approved by the student's adviser.

Required Courses

SWE 5001 Software Engineering 1 3
SWE 5002 Software Engineering 2 3
SWE 5411 Software Testing 1 3
SWE 5621 Software Metrics and Modeling 3

Restricted Elective: Programming

Common to all courses in this restricted elective area is that a substantial program or series of programs must be submitted by the student, and contribute a significant factor in the assessment of the student's work in the course.

A list of courses satisfying this requirement is available from the department. Three courses typical of this list are: CSE 5232 Network Programming, CSE 5250 Programming Languages and CSE 5280 Computer Graphics.

Restricted Elective: Foundations

Courses in this area cover computer science concepts upon which software engineering principles and skills are based. A list of courses suitable for satisfying this requirement is available from the department.

Some typical classes on this list are: CSE 5210 Formal Languages and Automata Theory, CSE 5230 Operating Systems and CSE 5260 Database Systems.

MASTER OF SCIENCE IN SPACE SYSTEMS (MS/SPC)

(Code: 8137)

The graduate space systems (SPC) program provides its graduates with the knowledge and capability to perform in a wide variety of technical and managerial areas, in industry, academia, and government agencies involved in the space program. It is for the student who expects to plan, design, build, integrate, test, launch, operate or manage space systems, subsystems, launch vehicles, spacecraft, payloads or ground systems.

This program is offered at Florida Tech Graduate Centers at NASA Kennedy Space Center and Patrick Air Force Base.

ADMISSION REQUIREMENTS

Admission to the Master of Science in Space Systems (MS/SPC) program requires a bachelor's degree in a recognized field of engineering or physical science from an accredited curriculum. Course work must have included mathematics through differential equations and at least one year of calculus-based physics. In the case of a marginal undergraduate record (GPA less than 3.0), letters of recommendation and results of recent GRE Tests, both General (verbal and quantitative) and Subject (engineering or physics) are required and could be deciding factors. Holders of the Professional Engineer license (or Engineering Intern status for those less than five years past the Baccalaureate) need not take the GRE Subject Test.

General admission requirements and the application process are discussed in the "Admissions" section of this catalog. Individuals who do not meet the stated requirements for regular admission may petition to take graduate courses for credit as a continuing education applicant.

DEGREE REQUIREMENTS

The degree of Master of Science in Space Systems is conferred upon students who have successfully completed 33 credit hours of core and elective courses as listed on the student's Graduate Program Plan. It includes 24 hours of required space systems courses and nine hours of elective courses. Additional prerequisite courses may be required depending on the applicant's undergraduate preparation. With written permission from the Director, Graduate Studies Space Systems, a student may substitute six semester hours of thesis credits in place of six elective credit hours.

Required Courses (8 courses) 24

SPC	5001	Introduction to Space Systems	3
SPC	5002	Introduction to Space Environment	3
SPC	5004	Space Propulsion Systems	3
SPC	5005	Space Power Systems	3
SPC	5006	Space Communications and Data Systems	3
SPC	5013	Space Systems Astrodynamics	3
SPC	5017	Aerospace Remote Sensing Systems	3
SPC	5080	Space Missions (capstone course) *(See Note 1)*	3

Note 1: Four-person student teams compete to develop the best proposal to carry out a specific mission in response to a Request for Proposals issued by the instructor acting as the Source Selection Official. Each team member's grade is partially determined by the team's competitive standing.

Elective Courses (3 courses) *(See Note 2)* 9

MGT	5134	Commercial Enterprise in Space	3
SPC	5009	Space Structures and Materials	3
SPC	5010	Spacecraft Guidance, Navigation and Control	3
SPC	5011	Human Space Systems	3
SPC	5018	Launch and Space Mission Operations	3
SPC	5065	Space Systems for Remote Operations	3
SPC	5066	Spaceflight Human Physiology	3
SPC	5090	Special Topics in Space Systems	3
SPC	5999	Thesis	3

TOTAL CREDITS REQUIRED 33

Note 2: Electives may be selected with the academic program chair's approval from the appropriate graduate-level offerings in the School of Extended Graduate Studies or other schools or academic units (e.g., business, engineering, science).

MASTER OF SCIENCE IN SPACE SYSTEMS MANAGEMENT (MS/SSM)

(Code: 8315)

This program meets the professional needs of technical graduates who are, or are looking forward to, assuming more and more managerial responsibility in some aspect of space systems and need to enhance both managerial and technical skills.

The program is offered at Florida Tech Graduate Centers at NASA Kennedy Space Center and Patrick Air Force Base in Florida.

ADMISSIONS REQUIREMENTS

Admission to the Master of Science in Space Systems Management program requires a bachelor's degree in a recognized field of engineering or physical science from an accredited curriculum. Course work must have included mathematics through differential equations and at least one year of calculus-based physics. Proficiency at the undergraduate level in financial accounting and statistics is also required. In the case of a marginal undergraduate record (GPA less than 3.0), letters of recommendation and results of recent GRE Tests, both General (verbal and quantitative) and Subject (engineering or physics) are required and could be deciding factors. Holders of the Professional Engineer license (or Engineering Intern status for those less than five years past the Baccalaureate) need not take the GRE Subject Test. Individuals who do not meet the stated requirements for regular admission may petition to take graduate courses for credit as a continuing education applicant.

DEGREE REQUIREMENTS

The degree of Master of Science in Space Systems Management is conferred upon students who have successfully completed 36 credit hours of graduate work plus other course requirements as listed on the student's approved Graduate Program Plan. Students without adequate undergraduate background will be required to complete all or part of the program prerequisites listed below.

CURRICULUM

Program Prerequisites 0

Required Courses in Management (6 courses) 18

Six courses with a clear focus on management are required. These course may be from the foundation, core or elective courses offered by the School of Management, via distance learning from the School of Extended Graduate Studies, or from courses with a management emphasis from other academic units at Florida Institute of Technology. Students must submit a program plan to the academic unit head outlining the six management courses to fulfill the curriculum requirement. Also, students must meet all management course prerequisites as stated in the current catalog.

Required Courses in Space Systems (5 courses) 15

SPC 5001 Introduction to Space Systems
SPC 5002 Introduction to Space Environment
SPC 5004 Space Propulsion Systems
SPC 5005 Space Power Systems
SPC 5013 Space Systems Astrodynamics

Elective (1 course) 3
The elective course may be taken with the approval of the academic unit head, from any SPC or SPS graduate level (5000) course in the current catalog.

TOTAL CREDITS REQUIRED 36

MASTER OF SCIENCE IN SYSTEMS MANAGEMENT (MS/SM)

(Code: 8330)

ADMISSION REQUIREMENTS

The applicant to the Master of Science in Systems Management program must have a bachelor's degree; however, the degree need not be in business administration. Students who are graduates from other fields, especially mathematics, science and engineering, are encouraged to apply. Students with an undergraduate business degree or courses may be able to waive up to 12 hours of the program prerequisites in the MS/SM program based on an evaluation of their undergraduate academic transcripts. Prerequisite courses are required of a student whose undergraduate major is outside the business area or who has not previously completed the courses in these prerequisite areas. The exact number of needed prerequisite courses depends on courses completed during the student's undergraduate studies.

The Graduate Record Examination (GRE) or Graduate Management Admissions Test (GMAT) may be required for admission evaluation purposes. General admission requirements and the process for applying are discussed in the "Admissions" section of this catalog. Individuals who do not meet the stated requirements for regular admission may petition to take graduate courses for credit as a continuing education applicant.

DEGREE REQUIREMENTS

The degree of Master of Science in Systems Management is conferred upon students who have successfully completed 33 credit hours of graduate course work plus other course requirements as listed on the student's approved Graduate Program Plan. Students without adequate undergraduate background will be required to complete all or part of the program prerequisites. Students may choose elective courses from those listed below.

Students with undergraduate credits for courses that they believe are equivalent to the program prerequisites should consult with their adviser concerning waiver of those prerequisites.

Program Prerequisites (noncredit for this program)
MGT 5000 Financial Accounting *(or two undergraduate accounting courses)*
MGT 5006 Introductory Managerial Statistics
MGT 5022 Analytical Methods of Management
MGT 5132 Basic Economics *(or two undergraduate economics courses)*
Note: In addition, computer literacy is required as a prerequisite. It can be demonstrated by 1) the applicant's undergraduate course work or 2) passing a proficiency exam offered by the School of Extended Graduate Studies, or 3) completing a suitable computer course.

Required Courses (8 courses) 24
MGT 5002 Corporate Finance 3
MGT 5007 Intermediate Managerial Statistics 3
MGT 5013 Organizational Behavior 3
MGT 5014 Information Systems 3
MGT 5066 Systems Analysis and Modeling 3
MGT 5067 Systems Management 3
MGT 5133 Advanced Analytical Methods for Management 3
MGT 5149 Economics for Business 3

Directed Electives (2 courses) 6
MGT 5017 Program Management 3
MGT 5024 Production and Operations Management 3
MGT 5061 Systems and Logistics Support Management 3
MGT 5062 Logistics Policy 3
MGT 5064 Cost and Economic Analysis 3
MGT 5068 Systems Engineering Management 3
MGT 5084 Materiel Acquisition Management 3
MGT 5137 Management of Engineering and Technology 3
MGT 5143 Advanced Information Systems 3
MGT 5145 Technology and Business Policy 3
MGT 5146 Management of Innovation 3
MGT 5147 Management of Technology Research Seminar 3
MGT 5148 Design and Analysis of Experiments 3

Elective (1 course) 3
An elective can be chosen from those courses offered to emphasize the area of greatest interest and benefit to the student.

TOTAL CREDITS REQUIRED 33

Concentration in Information Systems

(Code: 8402)

Program Prerequisites (noncredit for this program)

Required Courses (8 courses) 24
MGT 5002 Corporate Finance 3
MGT 5007 Intermediate Managerial Statistics 3
MGT 5013 Organizational Behavior 3
MGT 5014 Information Systems 3
MGT 5066 Systems Analysis and Modeling 3
MGT 5067 Systems Management 3
MGT 5133 Advanced Analytical Methods 3
MGT 5149 Economics for Business 3

Directed Electives (3 courses) 9
MGT 5070 Special Topics in Business 3
MGT 5150 Management of Software Systems 3
MGT 5151 Database Systems Management 3
MGT 5152 Computer Systems Administration 3
MGT 5153 Telecommunications Systems Management 3
MGT 5154 Advanced Management Information Systems 3

TOTAL CREDITS REQUIRED 33

Concentration in Operations Research

(Code: 8331)

Program Prerequisites (noncredit for this program)

Required Courses (8 courses) 24

MGT	5002	Corporate Finance	3
MGT	5013	Organizational Behavior	3
MGT	5014	Information Systems	3
MGT	5066	Systems Analysis and Modeling	3
MGT	5067	Systems Management	3
MGT	5149	Economics for Business	3
MTH	5401	Applied Statistical Analysis	3
ORP	5001	Deterministic Operations Research Models	3

Directed Electives (3 courses) 9

MTH	5411	Mathematical Statistics	3
ORP	5002	Stochastic OR Models	3
ORP	5003	Operations Research Practices	3
ORP	5010	Mathematical Programming	3
ORP	5011	Discrete Optimization	3
ORP	5030	Decision Analysis	3
ORP	5040	Quality Assurance	3
ORP	5041	Reliability Analysis	3
ORP	5042	Reliability, Availability and Maintainability	3
ORP	5050	Discrete System Simulation	3

TOTAL CREDITS REQUIRED 33

Note: Electives may be taken with approval of both the faculty adviser and program head from other graduate-level offerings in the School of Extended Graduate Studies or other schools or academic units (e.g., computer science, operations research, psychology). Any other deviation requires specific approval of the program head.

Section VIII Graduate Certificate Programs

ADMISSION

Individuals seeking admission for purposes of attaining a graduate certificate, but not degree seeking, will be evaluated for admission using the same procedures as outlined for continuing education for credit students, with the written approval of the head of the academic center offering the program. Applicants must submit the requisite application for continuing education (Code: 0102), with fee payment made, and be certified by the approving official as being capable of performing to graduate course standards. Specific admission criteria include the following:

- Applicants must have a bachelor's degree from a regionally accredited university.
- An undergraduate GPA of at least 2.5 is generally sufficient for admission for a graduate certificate program. An undergraduate GPA that is less than 2.5 will require that the applicant provide a GMAT, GRE and/or special documentation including letters of reference, résumé, postbaccalaureate credits, certificates of training, etc., to be admitted by exception for a graduate certificate program.

Individuals currently enrolled in a graduate degree program may also qualify for award of a graduate certificate by making a formal request to the local center director, upon satisfaction of the requisite certificate curriculum.

COMPLETION REQUIREMENTS

All courses must be completed with a minimum grade of C. A minimum cumulative grade point average of 3.0 will be required for certificate award. Students will be allowed to attempt seven courses to meet the GPA requirement. If the minimum GPA is not met after seven courses, and the student would like to continue, he/she may appeal to the dean.

TRANSFER CREDIT

A possible three-semester hours of transfer credit will be allowed and is consistent with current university policy regarding transfer credit. The transfer course must be from a regionally accredited university or an approved military equivalent and must have an earned grade of B or better.

Current or past members of the Defense Acquisition, Technology and Logistics (AT&L) workforce, or contractor employees who have attained a minimum level of professional certification in at least one AT&L career area, may be eligible for as many as six hours of transfer credits to be applied toward a Florida Tech Graduate Certificate. Consult with a faculty adviser or academic unit head for further information about current transfer credit policies.

SECOND OR SUBSEQUENT GRADUATE CERTIFICATE AWARDS

A second or subsequent graduate certificate program must consist of no less than three courses not previously used to earn a prior graduate certificate at Florida Tech. Up to two courses from any prior earned graduate certificate at Florida Tech may be applied toward the completion requirements for a second or subsequent graduate certificate award, provided the grade(s) earned was a B or better and the prior course(s) satisfies a required or elective requirement in the second or subsequent graduate certificate program.

CURRICULUM

Graduate Certificate in Business Management

Required Course

MGT 5013 Organizational Behavior 3

Elective Courses (4 required) 12

MGT 5000 Financial Accounting 3
MGT 5001 Managerial Accounting 3
MGT 5002 Corporate Finance 3
MGT 5014 Information Systems 3
MGT 5017 Program Management 3
MGT 5019 Marketing 3
MGT 5024 Production Management 3
MGT 5033 Human Resources Management 3

TOTAL CREDITS REQUIRED 15

Note: An elective course may be substituted with the permission of the Academic Unit Head.

Graduate Certificate in Contract Management

Required Course

MGT 5211 Procurement and Contract Management 3

Elective Courses (4 required) 12

The elective courses may be selected from the following:

MGT 5212 Advanced Procurement and Contract Management 3
MGT 5213 Contract Changes, Terminations and Disputes 3
MGT 5214 Cost Principles, Effectiveness and Control 3
MGT 5217 Contract and Subcontract Formulation 3
MGT 5218 Contract Negotiations and Incentive Contracts 3
MGT 5220 Contract Management Research Seminar 3
MGT 5270 Special Topics in Contract Management 3

TOTAL CREDITS REQUIRED 15

Note: An elective course may be substituted with the permission of the Academic Unit Head.

Graduate Certificate in eBusiness

Required Course

MGT 5160 Introduction to eBusiness 3

Elective Courses (4 required) 12

MGT 5070 Special Topics in Business—eLaw 3
MGT 5161 Policy and Organizational Strategies for eBusiness 3
MGT 5162 Survey of Information Technologies for eBusiness 3
MGT 5163 Marketing in an Internet-based Environment 3
MGT 5165 Special Topics in eBusiness 3
MGT 5166 Projects in eBusiness 3

TOTAL CREDITS REQUIRED 15

Note: An elective course may be substituted with the permission of the Academic Unit Head.

Graduate Certificate in Human Resources Management

Required Course

MGT 5033 Human Resources Management 3

Elective Courses (4 required) 12

MGT 5015 Organizational Planning and Development 3
MGT 5016 Employee Relations 3
MGT 5017 Program Management 3

MGT 5101 Leadership Theory and Effective Management 3
MGT 5105 Interpersonal Relations and Conflict Resolution 3
MGT 5106 Organizational Communication 3
MGT 5112 Seminar in Contemporary Issues in Human Resources Management 3

TOTAL CREDITS REQUIRED 15

Note: An elective course may be substituted with the permission of the Academic Unit Head.

Graduate Certificate in Information Systems Management

Required Course

MGT 5014 Information Systems 3

Elective Courses (4 required) 12

The elective courses can be selected from the following:

MGT 5150 Management of Software Systems 3
MGT 5151 Database Systems Management 3
MGT 5152 Computer Systems Administration 3
MGT 5153 Telecommunications Systems Management 3
MGT 5154 Advanced Management Information Systems 3

TOTAL CREDITS REQUIRED 15

Note: An elective course may be substituted with the permission of the Academic Unit Head.

Graduate Certificate in Logistics

Required Course

MGT 5017 Program Management 3

Elective Courses (4 required) 12

The elective courses can be selected from the following:

MGT 5024 Production and Operations Management 3
MGT 5060 Management of Assets 3
MGT 5061 Systems and Logistics Support Management 3
MGT 5062 Logistics Policy 3
MGT 5063 Inventory Control and Management 3
MGT 5066 Systems Analysis and Modeling 3
MGT 5084 Materiel Acquisition Management 3
MGT 5100 Distribution Management 3
MGT 5211 Procurement and Contract Management 3

TOTAL CREDITS REQUIRED 15

Note: An elective course may be substituted with the permission of the Academic Unit Head.

Graduate Certificate in Materiel Acquisition Management

Required Course

MGT 5084 Materiel Acquisition Management 3

Elective Courses (4 required) 12

MGT 5017 Program Management 3
MGT 5062 Logistics Policy 3
MGT 5067 Systems Management 3
MGT 5068 Systems Engineering Management 3
MGT 5100 Distribution Management 3
MGT 5133 Advanced Analytical Methods for Management 3
MGT 5500 Integrated Logistics Management 3

TOTAL CREDITS REQUIRED 15

Note: An elective course may be substituted with the permission of the Academic Unit Head.

Graduate Certificate in Program Management

Required Course

MGT 5017 Program Management 3

Elective Courses (4 required) 12

MGT 5020 Applied Management Project 3
MGT 5040 Public Program Policy and Evaluation 3
MGT 5062 Logistics Policy 3
MGT 5070 Special Topic (Project Management) 3
MGT 5084 Materiel Acquisition Management 3
MGT 5100 Distribution Management 3
MGT 5137 Management of Engineering Technology 3
MGT 5500 Integrated Logistics Management 3

TOTAL CREDITS REQUIRED 15

Note: An elective course may be substituted with the permission of the Academic Unit Head.

Graduate Certificate in Quality Management

Required Course

MGT 5170 Quality Management 3

Elective Courses (4 required) 12

MGT 5065 Supply Chain Management 3
MGT 5069 Advanced Supply Chain Management 3
MGT 5131 Productivity Measurement and Improvement 3
MGT 5141 Implementing Statistical Process Control 3
MGT 5145 Technology and Business Strategy 3
MGT 5146 Management of Innovation 3
ORP 5040 Quality Assurance 3

TOTAL CREDITS REQUIRED 15

Note: An elective course may be substituted with the permission of the Academic Unit Head.

Graduate Certificate in Systems Management

Required Course

MGT 5067 Systems Management 3

Elective Courses (4 required) 12

MGT 5017 Program Management 3
MGT 5064 Cost and Economic Analysis 3
MGT 5066 Systems Analysis and Modeling 3
MGT 5068 Systems Engineering Management 3
MGT 5084 Materiel Acquisition Management 3
MGT 5087 Management of Transportation Systems 3

TOTAL CREDITS REQUIRED 15

Note: An elective course may be substituted with the permission of the Academic Unit Head.

Graduate Certificate in Transportation Management

Required Course

MGT 5087 Management of Transportation Systems 3

Elective Courses (4 required) 12

MGT 5067 Systems Management 3
MGT 5068 System Engineering Management 3
MGT 5079 Traffic Management 3
MGT 5084 Materiel Acquisition Management 3
MGT 5100 Distribution Management 3

TOTAL CREDITS REQUIRED 15

Note: An elective course may be substituted with the permission of the Academic Unit Head.

Course Descriptions

COMPUTER SCIENCE

CSE 5000 INTRODUCTION TO PROGRAMMING (3 credits). An introduction to the fundamentals of software development. Topics include syntax and semantics of modern programming language and techniques for the design and implementation of simple programs. *(Noncredit for CS and CIS majors.)*

CSE 5001 ASSEMBLY LANGUAGE AND ORGANIZATION (3 credits). Programming and execution model in the classical stored-program von Neumann machine. Assembly language vs. machine language, instruction set of selected processors, addressing modes, shifting and masking, string manipulations, floating point representation, subprograms, hardware and software interrupts. *(Noncredit for CS and CIS majors.)*

CSE 5100 DATA STRUCTURES AND ALGORITHMS (3 credits). Data structures including queues, stacks, lists, sets, hash tables, trees, heaps and graphs are studied. Algorithms manipulating and using these data structures are introduced and analyzed for time and space complexity. *(Prerequisites: CSE 5000, MTH 2051. Noncredit for CS majors.)*

CSE 5210 FORMAL LANGUAGES AND AUTOMATA THEORY (3 credits). Abstract models of computers (finite automata, pushdown automata and Turing machines) and the language classes they recognize or generate (regular, context-free and recursively enumerable) are presented. Applications in compiler design, algorithms and complexity theory are presented. *(Prerequisite: CSE 5100.)*

CSE 5211 ANALYSIS OF ALGORITHMS (3 credits). Time and space complexity of computer algorithms. Algorithm classes, such as divide-and-conquer, greedy, dynamic programming and backtracking; techniques for solving recurrence equa-tions; graph algorithms; searching and sorting; and deterministic and nondeterministic polynomial time problem classes. *(Prerequisite: CSE 5100.)*

CSE 5220 COMPUTER ARCHITECTURE (3 credits). History, organization, operation and performance evaluation of computer systems. Design of RISC and CISC instruction sets, arithmetic units, datapath and microprogrammed control, pipeline computers, hierarchical memory systems and input/output subsystems. *(Prerequisite: CSE 5001. Noncredit for CS majors.)*

CSE 5230 OPERATING SYSTEMS 1 (3 credits). A study of the initial components and various functions provided by an operating system. Topics include the structure of operating systems, process scheduling, process synchronization, memory management, virtual memory, file system management and input/output device management. *(Prerequisites: CSE 5001, CSE 5100. Noncredit for CS majors.)*

CSE 5231 COMPUTER NETWORKS (3 credits). Theory, design and analysis of computer communication systems. Topics include TCP/IP, Internet, the World Wide Web, ISO-OSI network architecture, LANs (Ethernet, Fast Ethernet, Token Ring, Token Bus, etc.) FDDI, ATM, SONET, wireless communications, satellite networks, DNS, firewalls, network modeling and simulation.

CSE 5232 NETWORK PROGRAMMING (3 credits). Design and implementation of programs that communicate with other programs across a computer network. Topics include streams, server-side networking, client-side networking, multithreading, exceptions and remote method invocation. *(Prerequisite: CSE 5231.)*

CSE 5240 PARALLEL PROCESSING (3 credits). Architectures for parallel computers and parallel algorithms for computational problems are investigated. Performance evaluation metrics for the performance of parallel processing are discussed. *(Prerequisites: CSE 5100, CSE 5220.)*

CSE 5241 DISTRIBUTED COMPUTING (3 credits). A study of the fundamental concepts in software systems that support and work in a distributed computing environment. Topics in network communication mechanisms, distributed operating systems, services supporting distributed systems, distributed database systems, fault-tolerant systems and distributed algorithms are discussed. *(Prerequisite: CSE 5230.)*

CSE 5250 PROGRAMMING LANGUAGES (3 credits). A survey of programming language concepts including language features, implementation issues and language groups. *(Prerequisite: CSE 5100. Noncredit for CS majors.)*

CSE 5251 COMPILER THEORY AND DESIGN (3 credits). An extensive treatment of the major topics of compiler design, including lexical analysis, scanner-generator tools, parsing, syntax-directed translation, static semantic checking, storage organizations, code generation and code optimization. *(Prerequisite: CSE 5100.)*

CSE 5260 DATABASE SYSTEMS (3 credits). An introduction to the analysis and design of typical database systems. Includes theoretical and practical aspects of designing database systems. A substantial project is included. *(Corequisite: CSE 5100.)*

CSE 5261 INFORMATION RETRIEVAL (3 credits). Overview of key models (vector space, Boolean, probabilistic) and utilities (relevance ranking, relevance feedback, n-gram processing) for information retrieval. Additional models and utilities are also described based on current trends in the field. Benchmarking efforts and case studies are presented. *(Corequisite: CSE 5260.)*

CSE 5280 COMPUTER GRAPHICS (3 credits). The graphics pipeline for polygonal-based models. Mathematical concepts and data structures for graphics, coordinate systems, clipping, scan conversion, hidden-object detection, rendering, color models and graphics programming standards. *(Prerequisite: CSE 5100.)*

CSE 5281 GRAPHICAL USER INTERFACES (3 credits). The theories and techniques of human-computer interaction, and the design of direct manipulation graphical-user interfaces that support menus, buttons, sliders and other widgets for input, text and graphics for output. Students design, implement and evaluate a graphical-user interface. *(Prerequisite: CSE 5100.)*

CSE 5290 ARTIFICIAL INTELLIGENCE (3 credits). Introduction to the theoretical foundations of artificial intelligence, focusing on the areas of automated reasoning, search and heuristics. An AI language is introduced to implement concepts presented in the course. *(Prerequisite: CSE 5100.)*

CSE 5294 THEORY AND APPLICATIONS OF NEURAL NETWORKS (3 credits). Topics include learning in a single neuron, single and multilayer perceptrons, recurrent neural networks, structured neural networks, neural networks to perform principal component analysis, principal component regression and partial least squares regression. *(Prerequisite: ECE 5201 or MTH 5102 or permission of the instructor.)*

CSE 5400 TOPICS IN COMPUTER SCIENCE (3 credits). Current topics in computer science at the introductory graduate level. Topics vary and the course may be repeated for credit. *(Prerequisite: Permission of the instructor.)*

CSE 5401 INDEPENDENT STUDY IN COMPUTER SCIENCE (1–3 credits). Working closely with a faculty member, the student probes a subject in greater depth than is normally possible in a regular class. A comprehensive paper is required. The course may be repeated for credit. *(Prerequisite: Permission of the instructor.)*

CSE 5402 PROJECTS IN COMPUTER SCIENCE (1–3 credits). The student works closely with a faculty member to develop a project in computer science to a greater depth than is normally possible in a regular class. An applied research project is required. *(Prerequisite: Permission of the instructor.)*

CSE 5500 COMPUTER SCIENCE SEMINAR (1 credit). Presentations by faculty, graduate students and guest speakers on topics of current interest. Appropriate participation in conferences, workshops or other professional activities may be substituted. This course may be repeated for credit.

CSE 5610 COMPUTATIONAL COMPLEXITY (3 credits). A review of problems, algorithms, Turing machines and computability. Boolean and first-order logic are studied, leading to undecidability results; relations among complexity classes are studied using reductions and completeness; approximate and randomized algorithms are presented. *(Prerequisites: CSE 5210, CSE 5211.)*

CSE 5620 ADVANCED COMPUTER ARCHITECTURE (3 credits). Design of interleaved memory systems and multiprocessor caches; linear and nonlinear pipelines; data-flow and reduction machines; Vector computers, multiprocessors and array processors. Performance, scheduling and scalability of parallel machines. Introduction to parallel programming and parallel algorithms. *(Prerequisite: CSE 5220.)*

CSE 5630 ADVANCED OPERATING SYSTEMS (3 credits). A detailed study of the design and implementation of an operating system. Various data structures and algorithms for process, memory and input/output device management are discussed. Issues in distributed operating systems are investigated. *(Prerequisite: CSE 5230.)*

CSE 5631 ADVANCED COMPUTER NETWORKS (3 credits). Computer network design and analysis topics: network management, distributed network environments, bridges, routers, gateways, congestion control, ATM application program interface, multimedia and network applications. *(Prerequisite: CSE 5231.)*

CSE 5632 SURVIVABLE NETWORK OBJECTS (3 credits). Theory, design and analysis of secure computer communication systems. Topics include encryption, authentication, digital signature, digital certificate, secure socket layer, agent-based network applications and development of distributed applications over the Internet using COBRA and Java. *(Prerequisite: CSE 5631 or ECE 5535.)*

CSE 5650 ADVANCED PROGRAMMING LANGUAGES (3 credits). Theoretical topics in programming languages. The main topics are the lambda-calculus, functional programming, type interface and different approaches to the semantics of programming languages. *(Prerequisite: CSE 5250.)*

CSE 5660 DATABASE MANAGEMENT SYSTEMS (3 credits). A study of the internal components of a Database Management System (DBMS). Topics include data organization, query optimization, transaction processing, concurrency control, logging and recovery, security and distributed DBMS. *(Prerequisite: CSE 5260.)*

CSE 5661 ADVANCED INFORMATION RETRIEVAL (3 credits). Topics include but are not limited to integration of multiformat data, parallel processing, grammar processing, information filtering and integration of learning techniques into information processing. Research papers are read, presented, evaluated and extended. *(Prerequisite: CSE 5261.)*

CSE 5680 ADVANCED COMPUTER GRAPHICS (3 credits). Image synthesis using textures, shadows, ray tracing and radiosity methods. Animation, solid modeling fractals, nonuniform rational B-splines, antialiasing and advanced graphical data structures. *(Prerequisite: CSE 5280.)*

CSE 5690 EXPERT SYSTEMS (3 credits). A study of the components and characteristics of an expert (knowledge-based) system. Issues including knowledge acquisition/engineering, knowledge representation, reasoning and uncertainty are discussed. An AI language is explored to implement expert system concepts. *(Prerequisite: CSE 5290.)*

CSE 5691 SEARCH AND ARTIFICIAL INTELLIGENCE (3 credits). A survey of the latest results in AI research on effective search strategies for intelligent systems. Constructive and local approaches to search, heuristic search algorithms including A* and IDA, and adversary search techniques such as minimax and a–b will be investigated. *(Prerequisite: CSE 5290.)*

CSE 5692 CONSTRAINT REASONING (3 credits). Foundations of constraint satisfaction and constraint-based reasoning; problem representation and characterization; consistency checking, heuristics and search; deterministic and stochastic solving methods; applications such as scheduling, timetabling and temporal reasoning. *(Prerequisite: CSE 5100; recommended CSE 5211 and CSE 5290.)*

CSE 5693 MACHINE LEARNING (3 credits). Computational paradigms and techniques in learning and adaptation. Topics include tree learning, rule learning, genetic algorithms, neural networks, case-based learning, Bayesian learning, analytical learning and reinforcement learning. *(Prerequisite: CSE 5290.)*

CSE 5801 INDEPENDENT RESEARCH IN COMPUTER SCIENCE (1–3 credits). Working closely with a faculty member, the student studies a research topic and writes a research paper. The course may be repeated for credit. *(Prerequisite: Instructor's approval.)*

CSE 5802 RESEARCH PROJECTS IN COMPUTER SCIENCE (1–3 credits). The student works closely with a faculty member on a well-defined research project. The course may be repeated for credit. *(Prerequisite: Instructor's approval.)*

CSE 5810 ADVANCED TOPICS IN COMPUTER SCIENCE THEORY (3 credits). Topics vary and the course may be repeated for credit. *(Prerequisite: CSE 5210.)*

CSE 5820 ADVANCED TOPICS IN COMPUTER ARCHITECTURE (3 credits). Topics are selected according to the choice and expertise of the instructor. Possible subjects may include advanced processor design, data communications, microcomputer systems, theory of coding, the architecture of symbolic computers, distributed systems and parallel processing. *(Prerequisite: CSE 5290.)*

CSE 5830 ADVANCED TOPICS IN OPERATING SYSTEMS (3 credits). Current topics in operating systems at the graduate level. Topics vary and the course may be repeated for credit. *(Prerequisites: CSE 5230, instructor's approval.)*

CSE 5835 ADVANCED TOPICS IN COMPUTER NETWORKS (3 credits). Current topics in computer networks at the advanced graduate level. Topics vary and the course may be repeated for credit. *(Prerequisite: CSE 5231.)*

CSE 5840 ADVANCED TOPICS IN PARALLEL AND DISTRIBUTED COMPUTING (3 credits). Current topics in parallel and distributed computing at the graduate level. Topics vary and the course may be repeated for credit. *(Prerequisites: CSE 5240, CSE 5241, instructor's approval.)*

CSE 5850 ADVANCED TOPICS IN PROGRAM LANGUAGES (3 credits). Current topics in program languages at the graduate level. Topics vary and the course may be repeated for credit. *(Prerequisite: CSE 5250.)*

CSE 5860 ADVANCED TOPICS IN DATABASE SYSTEMS (3 credits). Current topics in database systems at the graduate level. Topics vary and the course may be repeated for credit. *(Prerequisite: CSE 5260.)*

CSE 5880 ADVANCED TOPICS IN COMPUTER GRAPHICS (3 credits). Current topics in computer graphics at the graduate level. Topics vary and the course may be repeated for credit. *(Prerequisite: CSE 5280.)*

CSE 5890 ADVANCED TOPICS IN ARTIFICIAL INTELLIGENCE (3 credits). Current topics in artificial intelligence at the graduate level. Topics vary and the course may be repeated for credit. *(Prerequisite: CSE 5290.)*

CSE 5999 THESIS IN COMPUTER SCIENCE (1–6 credits). Research and preparation of a thesis under the direction of a member of the graduate faculty. A maximum of six credit hours may be applied toward the master of science degree requirements. *(Prerequisite: Permission of the instructor/adviser.)*

CONTINUING EDUCATION

DCE 5150 CONTRACT MANAGER'S REVIEW (4.5 CEUs). This course is designed to assist practicing, experienced acquisition managers prepare for the Certified Professional Contract Manager's (CPCM) examination. It provides a comprehensive review of the material covered by that examination. The areas covered by this course include general procurement and contracting issues, the legal aspects of procurement, finance/economics/accounting, production management and logistics problems. This course is not intended to replace the need for individual study for the CPCM.

DCE 5160 PROFESSIONAL IN HUMAN RESOURCES MANAGEMENT EXAMINATION REVIEW (4.5 CEUs). This course is designed to assist human resource/personnel management practitioners prepare for the Personnel Accreditation Institute's national exam for Professional in Human Resources (PHR) designation. The course focuses on the seven competency areas covered in the exam: management practices; employment, placement and personnel planning; compensation; employee and labor relations; training and development; health, safety and security; and personnel research. This course is not intended to replace the need for individual study for the PHR exam.

DCE 5200 PRACTICAL ASPECTS OF INTERSTATE COMMERCE LAW (4.5 CEUs). This course is designed to provide a practical and workable understanding of the most recent statutory laws evolving from rulings of the Interstate Commerce Commission, Federal Maritime Commission and the Civil Aeronautics Board. Inclusive within the areas covered by this course will be a discussion of the statutory provisions covering the schedules of rates, fares and charges for all common carriers operating under the provisions of the Interstate Commerce Act; a wide range of opinions as to the interpretation of just and reasonable charges, and classification of commodities that are governed under these rates; measures of control exerted by the Interstate Commerce Commission and other regulatory agencies over violations of these regulations; usual current practices, preferences and prejudices of all common carriers, including unjust discrimination against shippers and unfair methods of competition; applicable laws controlling the administrative jurisdiction of unfair practices in conjunction with the practices themselves; statutory provisions covering such interrelationships between carriers as pooling and conference agreements, division of traffic, consolidations and mergings, purchase and acquisition agreements and tracking rights; practice and procedure before the Interstate Commerce Commission, the Civil Aeronautics Board and the Federal Maritime Commission and judicial review of orders of these three administrative agencies.

DCE 5210 LOGISTICS PRINCIPLES, CONCEPTS AND APPLICATIONS (4.5 CEUs). This course provides a comprehensive review of logistical systems design, development and management, acquisition and production support, and distribution and customer support. The material includes theory and definitions, practice problems and reference materials. This course is intended to provide sufficient information concerning the Certified Logistician Examination contents to enable a student to identify his/her weaknesses and to obtain material for further self-study. This course is not intended to teach practical applied logistics.

ELECTRICAL ENGINEERING

ECE 5111 RADIO FREQUENCY PROPAGATION (3 credits). Link budgets, free space propagation, antenna radiation patterns, multipath, fading, interference, reflection, refraction, rain attenuation, indoor propagation and RF safety. Applications to radar and terrestrial as well as satellite communication systems are considered. Real world effects and impairment reduction methods. *(Prerequisites: ECE 3442, ECE 4221, MTH 2401.)*

ECE 5112 INTRODUCTION TO WIRELESS SYSTEMS AND APPLICATIONS (3 credits). Principles, fundamental equations, and functional components that use RF propagation for various applications are developed. A broad variety of applications (e.g., communications, radar) are described including the functions and interconnection of subsystems required for these applications. System design considerations for applications. *(Prerequisite: ECE 3442, ECE 4221, MTH 2401.)*

ECE 5113 WIRELESS LOCAL AREA NETWORKS (3 credits). This introductory course provides the basics of wireless networking and WLAN technologies, the leading WLAN standards, WLAN configurations, WLAN implementation considerations, the benefits and applications of WLANs, WLAN trends and case studies.

ECE 5114 RADIO LOCATION, SENSING AND MEASUREMENT (3 credits). The theory and functional design of a variety of important applications of radio, e.g., location and tracking systems, navigation, radio altimetry and radar mapping systems. For each application, real world effects and impairment reduction methods are treated. *(Prerequisite: ECE 5111 or ECE 5112.)*

ECE 5115 MODERN WIRELESS DESIGN CONCEPTS (3 credits). Key design criteria, techniques, and component technologies of major components or subsystems for wireless applications are treated, including transmitters and power amplifiers, receivers, modems, synthesizers, mixers and duplexers. *(Prerequisites: ECE 3442, ECE 4221.)*

ECE 5201, ECE 5202 LINEAR SYSTEMS 1, 2 (3, 3 credits). These courses consist of a study of linear spaces, linear operators and matrix calculus; mathematical description of linear dynamic systems, the relation between state variable descriptions and system transfer functions; controllability and observability of systems, realization of rational transfer function matrices and an introduction to nonlinear analysis. *(Prerequisite: ECE 4231 or MTH 2201.)*

ECE 5221 PERSONAL COMMUNICATION SYSTEMS (3 credits). This course provides an overview of RF and cellular communications techniques. Existing technology will be used as a basis for the classroom studies. Laboratory experiment based on measurement of component performing and system analysis will be included.

ECE 5222 COMPONENTS FOR PERSONAL COMMUNICATION SYSTEMS (3 credits). Basic operation of components is described and students will build and characterize key subsystems using a vector network analyzer. *(Prerequisite: ECE 4221.)*

ECE 5223 DIGITAL COMMUNICATIONS (3 credits). This course covers physical media, digital modulation, detection, intersymbol interference, adaptive equalization, spectrum control, error control, synchronization. *(Prerequisites: ECE 4221, MTH 5425.)*

ECE 5231 OPTIMAL SYSTEMS (3 credits). Includes optimization of dynamic systems, calculus of variations, necessary conditions for optimality; the study of constrained systems using the maximum principle and development of cost functions; Hamilton–Jacobi theory, Pontryagin's principle and dynamic programming; linear optimal deterministic optimal tracking systems; and robust control. *(Prerequisite: ECE 5201; corequisite: MTH 5425.)*

ECE 5233 SATELLITE COMMUNICATIONS (3 credits). A comprehensive study of the systems aspects of satellite communications, with emphasis on digital communications. An analysis is included of AWGN channels, performance degradation caused by band limiting, nonlinearities, phase noise, etc. The course presents a survey of existing operational satellite systems. *(Prerequisite: ECE 4221.)*

ECE 5234 COMMUNICATION THEORY (3 credits). This course covers theory of signal spaces; dimensionality and distance; optimum methods of statistical detection and estimation; characteristics of noise; introduction to information theory, including channel capacity, source coding and channel coding; and time-bandwidth limitations and rate-distortion theory. *(Prerequisites: ECE 4221, MTH 5425.)*

ECE 5238 ERROR CONTROL CODING (3 credits). Topics include an introduction to algebra, linear block codes, Galois fields, cyclic codes, circuits for cyclic codes, BCH codes, spectral techniques for encoding and decoding, and convolutional codes.

ECE 5243 DIGITAL CONTROL SYSTEMS (3 credits). An analysis and design of digital control systems using state-variable techniques and time-domain analysis; sampling, z-transform analysis and the frequency domain; and controllability and observability. *(Prerequisite: ECE 5201.)*

ECE 5244 ADVANCED DIGITAL CONTROL SYSTEMS (3 credits). Include digital simulation techniques and digital redesign, multirate sampled-data systems, discrete stochastic optimal control and estimation and hardware implementation issues relating to sampled-data control systems. Students are expected to perform computer simulations using a standard controls software package. *(Prerequisite: ECE 5243.)*

ECE 5245 DIGITAL SIGNAL PROCESSING 1 (3 credits). A description of discrete-time signals in the time and frequency domains; z-transform, discrete Fourier transform, FFT algorithms; introduction to classical digital filter design techniques; and introduction to linear predictive coding.

ECE 5246 DIGITAL SIGNAL PROCESSING 2 (3 credits). Modern methods of data compression, signal modeling spectral estimation and linear prediction; Wiener filtering and an introduction to Kalman filtering and adaptive filtering; and other topics from the current literature. *(Prerequisites: ECE 5245, MTH 5425.)*

ECE 5248 ADVANCED FILTERING (3 credits). Bayesian estimation theory; filtering, smoothing and prediction for linear and nonlinear systems, Gaussian and non-Gaussian models, and for known or unknown models; fast algorithms for filter design and implementation; linear, nonlinear and adaptive filters; applications. *(Prerequisites: ECE 5201, MTH 5425.)*

ECE 5251 RADAR SYSTEMS (3 credits). Characteristics of radar, prediction of range and performance, types of radar (pulse-Doppler, MTI, CW, etc.); modern radar technologies, phased-array systems, clutter, jamming; and an introduction to signal processing methods.

ECE 5256 DIGITAL IMAGE PROCESSING (3 credits). Investigates image processing by machine for such purposes as robotics, biomedicine, remote sensing and photogrammetry. Topics include image enhancement and image analysis, transform techniques including the wavelet transform, feature extraction, segmentation, compression and morphology. The Khoros graphical interface programming language is used.

ECE 5258 PATTERN RECOGNITION (3 credits). Includes Bayes decision theory; optimal pattern recognition algorithms; feature extraction criteria and algorithms; adaptive pattern recognition; supervised and unsupervised learning; and applications to failure detection, target recognition, image recognition and speech recognition. *(Prerequisites: ECE 5201, MTH 5425.)*

ECE 5260 APPLICATION OF ARTIFICIAL NEURAL NETWORKS IN EE (3 credits). Current applications of artificial neural networks to various topics in electrical engineering will be presented. Neural signal processing, closed loop neural control and design of neural systems will be discussed. *(Prerequisite: MTH 5320 or permission of the instructor.)*

ECE 5268 THEORY AND APPLICATIONS OF NEURAL NETWORKS (3 credits). Topics include learning in a single neuron, single- and multilayer perceptrons, recurrent neural networks, structured neural networks, neural networks to perform principal component analysis, principal component regression and partial least squares regression. *(Prerequisite: ECE 5201 or MTH 5102 or permission of the instructor.)*

ECE 5270 SPECIAL TOPICS IN SYSTEMS (3 credits). A course based on topics of current interest in the technical literature on systems.

ECE 5301 SEMICONDUCTOR DEVICE THEORY (3 credits). A review of basic semiconductor physics and band theory; and development of detailed theory of p-n junctions; Schottky barrier diodes, bipolar transistors and heterojunctions. Introduction of field effect transistor theory include JFETs, MOSFETs and VLSI technologies. *(Prerequisite: ECE 3331.)*

ECE 5310 VLSI PROCESSING (3 credits). Presents VLSI fabrication theory. Course includes silicon material properties, growth techniques and defects; details of chemical vapor deposition (CVD), thermal oxidation, solid-state diffusion, ion implantation, VLSI lithography and metallization. *(Prerequisite: ECE 3331.)*

ECE 5311 MICROELECTRONICS FABRICATION LAB (3 credits). Hands-on fabrication and testing of integrated circuits including oxidation, diffusion, photolithography, metallization and etching. Students perform all process steps required, beginning with polished silicon wafers and ending with completed integrated circuits that are tested and characterized.

ECE 5331 IC COMPUTER-AIDED ANALYSIS (3 credits). Presents the fundamentals of CAD techniques for the IC design verification including the hierarchy of simulation tools. Emphasis is placed on the mathematical and numerical techniques used for circuit level simulation. *(Prerequisites: CSE 1502, ECE 3111.)*

ECE 5333 ANALOG IC DESIGN (3 credits). Design of analog circuits using CMOS and related technologies. Switching and op-amps, A/D converter and D/A converter circuits are designed and verified using simulation tools. *(Prerequisites: ECE 3111, ECE 3331.)*

ECE 5335 ADVANCED IC DESIGN AND SIMULATION (3 credits). Design of advanced analog circuit and system ICs using op-amps and transconductance amplifiers as the core component. Topics include op-amp modeling, fully differential op-amp considerations and noise limitations Filter approximation and active network synthesis using switched-capacitor techniques. A/D and D/A conversion. *(Prerequisite: ECE 5333.)*

ECE 5350 OPTICAL ELECTRONICS (3 credits). Principles of stimulated emission; electromagnetic field modes in optical resonators; ray tracing techniques in laser resonators and beam delivery systems; Gaussian beam profiles and laser linewidths; noise in lasers and optical amplifiers; excitation methods; mode locking and Q-switching techniques; picosecond and femtosecond laser pulse generation; optical bistable devices.

ECE 5351 FIBEROPTIC COMMUNICATION SYSTEMS (3 credits). Includes optical fiber links, comparison between optical and electronic communication links; data encoding and bit error rates; properties of single, multimode and polarization preserving optical fibers, including attenuation, pulse spreading, bandwidth and maximum bit rate; transmitter and receiver design considerations.

ECE 5352 FIBEROPTIC SENSOR SYSTEMS (3 credits). Students study fundamental theory and state-of-the-art fiberoptic sensor systems; comparison with conventional sensors for strain, temperature, electric and magnetic fields; specialized fiberoptic components; use of multimode, singlemode, polarization preserving and high birefringence optical fibers, interferometric- and intensity-based sensor architectures.

ECE 5353 OPTICAL COMPUTING (3 credits). A study of the basic principles, applications and recent advances in optical signal processing. Topics include diffraction theory, Fourier transform optics, devices, machine vision algorithms, optical neural networks.

ECE 5354 ACOUSTOOPTIC AND ELECTROOPTIC DEVICES (3 credits). Theory of operation and system applications, including optical wave propagation through an anisotropic medium, electrooptic and acoustooptic effects; Raman–Nath and Bragg regimes of operation, acoustooptic and electrooptic material properties and selection criteria, operation of laser modulators, deflectors and frequency.

ECE 5355 ELECTROOPTICS LABORATORY (3 credits). Lectures and experiments in photonics with emphasis on lasers, optical fibers, photodetectors, links, sensors, etc.

ECE 5356 OPTICAL WAVEGUIDES AND DEVICES (3 credits). Applications of Maxwell's equations and time-harmonic electromagnetic waves to fiberoptical waveguides; ray trajectories; electromagnetic fields in single- and multimode fibers; attenuation and dispersion mechanisms; inelastic scattering and nonlinear propagation; erbium-doped ultra-broadband optical traveling wave amplifiers.

ECE 5358 ADVANCED TOPICS IN PHOTONICS (3 credits). Addresses state-of-the-art topics in the current literature in electrooptics.

ECE 5370 SPECIAL TOPICS IN PHOTONICS (3 credits). This course is based on topics of current interest in the technical literature on electrooptics.

ECE 5371 SPECIAL TOPICS IN MICROELECTRONICS (3 credits). This course is based on topics of current interest in the technical literature on microelectronics.

ECE 5410 ELECTRODYNAMICS 1 (3 credits). Covers electrostatics and boundary value problems; solutions of Laplace's and Poisson's equations in Cartesian, spherical and cylindrical coordinates; electrostatic multipole fields; fields in dielectrics; magnetostatics; Maxwell's equations; plane electromagnetic waves; guided waves and resonant cavities; antennas and vector diffraction. *(Prerequisite: ECE 3442.)*

ECE 5411 ELECTRODYNAMICS 2 (3 credits). Topics include relativity; Lorentz transformations, relativistic kinematics, relativistic energy and momentum; covariance in electrodynamics; relativistic transformations of electromagnetic fields; Lagrangian and Hamiltonian formulations of relativistic particles and fields; the Lienard–Wiechert potentials; radiation from relativistically moving charges. *(Prerequisite: ECE 5410.)*

ECE 5418 FIELD THEORY OF GUIDED WAVES 1 (3 credits). Maxwell's equations; time-harmonic electromagnetic waves; vector and scalar wave equations, analysis of electromagnetic field modes in rectangular and circular cylindrical waveguides using vector potential methods; phase and group velocity; transverse wave impedance; propagating waves and evanescent fields; resonant cavities. *(Prerequisite: ECE 3442.)*

ECE 5419 FIELD THEORY OF GUIDED WAVES 2 (3 credits). Green functions and their applications to electromagnetics; Strum–Liouville systems; eigenfunction expansions and integral formulations of Green functions; time-harmonic electromagnetic fields and scalar Helmboltz-equation solutions using Green functions; pertubational and variational techniques. *(Prerequisite: ECE 3442.)*

ECE 5425 ANTENNAS 1 (3 credits). Students review basic electromagnetic principles; radiation from infinitesimal electric and magnetic dipoles; antenna directivity and gain; the one-way and radar range equations; array theory and phased arrays; wire antennas and broadband antennas. *(Prerequisite: ECE 3442.)*

ECE 5426 ANTENNAS 2 (3 credits). Includes Pocklington's integral equation and the point matching technique; weighted residuals and Galerkin's method of moments; analysis of aperture antennas; the geometric theory of diffraction; antenna pattern synthesis. *(Prerequisite: ECE 5425.)*

ECE 5430 ELECTROMAGNETIC TENSOR GREEN FUNCTIONS (3 credits). Students learn formulation of Maxwell's equations for anisotropic media; derivation of the vector and scalar wave equations and the Helmholtz (time-harmonic) wave equations; Green functions for scalar wave equations in rectangular, cylindrical and spherical coordinates; Dyadic Green's functions. *(Prerequisite: ECE 3442.)*

ECE 5431 COMPUTATIONAL ELECTROMAGNETICS (3 credits). Includes method-to-moments and integral equation treatments of wire antennas and scatterers; FDTD and PDE analyses in propagating and diffracting media; finite element, conjugation gradient and mode matching solutions of electromagnetic boundary value problems. *(Prerequisite: ECE 3442.)*

ECE 5450 AUTOMATED RF MEASUREMENT (3 credits). Modern techniques for measurement of radio frequency characteristics of passive and active devices are discussed; S-parameter methods are described; the use of an automated vector network analyzer is discussed; measurement of actual devices is performed; and reflection loss, S_{11}, transmission loss, S_{12}, S_{21}, VSWR and gain are measured.

ECE 5451 MICROWAVE CIRCUIT DESIGN (3 credits). Scattering matrix representation of two-port microwave networks; impedance matching networks and signal flow graphs; microwave transistor amplifier and oscillator design; synthesis of Butterworth and Tschebyscheff filters.

ECE 5470 SPECIAL TOPICS IN ELECTROMAGNETICS (3 credits). This course is based on topics of current interest in the technical literature on electromagnetics.

ECE 5534 COMPUTER NETWORKS 1 (3 credits). Theory, design and analysis of computer communications systems. Topics include TCP/IP, Internet, the World Wide Web, ISO-OSI network architecture, LANs (Ethernet, Fast Ethernet, Token Ring, Token Bus, etc.), FDDI, ATM, SONET, wireless communications, satellite networks, UNIX network programming, network modeling and simulation. *(Prerequisite: ECE 3551.)*

ECE 5535 COMPUTER NETWORKS 2 (3 credits). A continuation of ECE 5534 to include the following computer network design and analysis topics: network security, network management, distributed network environment, bridges, routers, gateways, congestion control, UNIX network programming, multimedia and network applications. *(Prerequisite: ECE 5534.)*

ECE 5536 COMPUTER HARDWARE DESIGN/ BIT-SLICE ARCHITECTURE (3 credits). A study of the design of large computer systems and special-purpose controllers. The theory behind bit-slice concepts, microcode, pipelines, cache memory, instruction execution overlappings is also covered. Systems are designed using bit-slice technology and microcode.

ECE 5546 SURVIVABLE NETWORK OBJECTS (3 credits). Development of distributed applications capable of surviving and roaming throughout the Internet by adapting to new environments while protecting their states. Topics include encryption, authentication, digital signature, digital certificate, secure socket layer, agent-based network applications and object registry. *(Prerequisite: ECE 5534.)*

ECE 5547 PRACTICAL INTERNET (3 credits). Network planning and configuration, switches, routers, firewalls, intrusion detection systems, private networks and virtual private networks, network management, client-server applications *(Prerequisite: CSE 5231 or ECE 5534 or ECE 4561).*

ECE 5551 HIGH-PERFORMANCE COMPUTING AND COMMUNICATION CONCEPTS (3 credits). Explores the software and hardware concepts of high-performance computing and communications. It addresses the vertical integration of integrated circuits through HPCC computer architectures and includes a thorough treatment of software for HPCC systems. *(Prerequisites: CSE 2502 and ECE 3551, or CSE 4001.)*

ECE 5555 WAVELET TRANSFORMS FOR IMAGE PROCESSING (3 credits). Topics include wavelet transforms, multiresolution analysis and wavelet design. Applications to signal compression, denoising and feature detection are discussed. *(Prerequisites: Graduate standing, ECE 5201 or ECE 5245 recommended, but not required.)*

ECE 5561 SWITCHING CONCEPTS (3 credits). The theory and logic design of combinational and sequential circuits. Topics include Boolean algebra, combinational circuit analysis, synthesis, decomposition, symmetric functions, threshold functions and logical completeness; sequential circuit analysis, synthesis and state minimization; and linear sequential circuits. *(Prerequisites: ECE 1552, Graduate standing.)*

ECE 5570 SPECIAL TOPICS IN COMPUTER ENGINEERING SPECIAL (3 credits). This course is based on state-of-the-art topics in the current literature in computer engineering. *(Prerequisite: Permission of the instructor.)*

ECE 5571, ECE 5572 DIGITAL SYSTEM DESIGN 1, 2 (3, 3 credits). An application of techniques learned in switching theory to the hardware organization of digital systems. Topics include organization and programming of a small computer; design convention; introduction to a hardware-design programming language and hardware programs; control unit microprogramming; intersystem communication; interrupt and input/output.

ECE 5577, ECE 5578 DIAGNOSIS AND RELIABLE DESIGN OF DIGITAL SYSTEM 1, 2 (3, 3 credits). This course sequence addresses concepts of test generation, simulation and reliability-enhancing design techniques for digital circuits and systems. Topics include basic concepts of reliability as applied to digital systems and the importance of maintainability; faults in digital circuits; test generation; fault-tolerant design.

ECE 5583 MULTIPROCESSING SYSTEMS (3 credits). Topics include the uniprocessor organization; advantages and limitations; the need for more than one processor; complexity of the task, widely different tasks, physically distant tasks, reliability; multiprocessor organization; parallel processing, distributed processing, networks; multiprocessor hierarchy; vertical hierarchy, horizontal hierarchy. *(Prerequisite: ECE 5563 or ECE 5571.)*

ECE 5595 SPECIAL PROJECTS IN COMPUTER ENGINEERING (3 credits). Special graduate projects are undertaken on a cooperative basis between the student and a member of the graduate faculty. *(Prerequisite: Permission of the instructor.)*

ECE 5683 POWER SYSTEMS OPERATION AND CONTROL (3 credits). An in-depth analysis of computer methods for power systems. Topics include system matrices, power-flow studies, optimal dispatch, fault studies and stability analysis with programming considerations for each topic. *(Prerequisite: ECE 4681.)*

ECE 5684 POWER SYSTEM RELIABILITY AND PLANNING (3 credits). An appraisal of modern techniques for assessing the adequacy of power systems and for evaluating expansion alternatives. Topics include reliability theory, the state–space method, assessment techniques for various system topologies and determination of feasible expansion. *(Prerequisite: ECE 4681.)*

ECE 5999 M.S. THESIS IN ELECTRICAL OR COMPUTER ENGINEERING (3 credits). Individual work under the direction of a member or members of the graduate faculty on a selected topic.

ECE 6301 ADVANCED SEMICONDUCTOR DEVICE THEORY (3 credits). Several semiconductor physical phenomena related to electrical device operation are discussed, including scattering and recombination theory, interactions of photons and phonons, detailed band theory and quantum effects in semiconductor devices. *(Prerequisite: ECE 5301.)*

ENGINEERING MANAGEMENT

Note: All ENM courses have as a prerequisite the permission of the instructor.

ENM 5100 QUALITY ENGINEERING (3 credits). Principles and techniques for establishing quality goals, identification of customer needs and requirements, measurement of quality objectives and product/process engineering to improve system performance.

ENM 5200 PROJECT ENGINEERING (3 credits). Principles of project management to design and develop products and services within budget, on time and to specification. Topics include work planning, organization design, requirements analysis and project control.

ENM 5310 TOPICS IN SYSTEMS ENGINEERING (3 credits). Topics selected from the field of systems engineering, such as requirement analysis, function allocation, cost engineering, risk management and system-level design.

ENM 5320 TOPICS IN TECHNICAL MARKETING (3 credits). Topics such as technology diffusion, competitive advantage, innovation, product development and positioning of high-technology products and services.

ENM 5330 TOPICS IN ENGINEERING OPERATIONS AND LOGISTICS (3 credits). Topics such as forecasting, plant location, facility layout, inventory systems, maintenance, process engineering, supply chains, scheduling, manufacturing and materials handling.

ENM 5340 TOPICS IN TEAM DYNAMICS AND PRODUCTIVITY (3 credits). Topics selected from the areas of team building, communications, creative problem solving in engineering, work design and engineering ethics.

ENM 5350 TOPICS IN ENGINEERING MODELING AND DESIGN (3 credits). Topics such as simulation, visualization, animation, graphics, CAD, deterministic and probabilistic models, and data analysis.

ENM 5360 TOPICS IN PRODUCT DEVELOPMENT AND TECHNOLOGY STRATEGY (3 credits). Topics such as technology transfer, product strategy formulation, visioning, technology road maps and innovation.

ENM 5495 SPECIAL PROJECTS IN ENGINEERING MANAGEMENT (3 credits). Special graduate projects are undertaken on a cooperative basis between the student and a member of the graduate faculty. The project may include a literature search in a selected area or research and development in one of the engineering management specialty areas.

ENM 5900 ENGINEERING MANAGEMENT INTERNSHIP (3 credits). Industry-based internship experience undertaken under the supervision of a member of the graduate faculty. The objective is to provide industrial experience to students without prior experience in a practical engineering setting. Industrial presentations are required.

ENM 5999 THESIS RESEARCH (3 credits). Individual research work under the direction of a member of the graduate faculty on a selected topic.

MECHANICAL/AEROSPACE ENGINEERING

MAE 5050 FINITE ELEMENT FUNDAMENTALS (3 credits). Includes finite element formulation of a continuum, virtual work and energy principles, one- and two-dimensional problems; Ritz method, weighted residuals; time-dependent problems; Isoparametric formulations and recent developments utilizing elementary finite element methods and existing software. *(Prerequisites: MAE 2082, MAE 3082; MTH 2201.)*

MAE 5060 APPLICATIONS IN FINITE ELEMENT METHODS (3 credits). Emphasizes finite element simulation methods for problems in mechanical design; static solutions; eigenvalue techniques in stability and dynamic analysis; direct and reduced basis formulation of dynamical equations; analyses of structures; use of commercially available software. *(Prerequisites: MAE 2082, MAE 3083, MTH 2201.)*

MAE 5110 CONTINUUM MECHANICS (3 credits). Mathematical preliminaries, kinematics of motion, equation of conservation mass, equations for the rates of change of translational momentum, rotational momentum, and energy; the entropy inequality; models of material behavior including the linearly viscous fluid and the linearly elastic solid. *(Prerequisites: MTH 2001, MTH 2201.)*

MAE 5120 AERODYNAMICS OF WINGS AND BODIES (3 credits). Approximate analytic solution of nonlinear problems in aerodynamics (including those associated with the effects of compressibility) by iterative methods that exploit the smallness of small parameter; flow about slender wings and bodies; flow about wings with high-aspect ratio. *(Prerequisite: MAE 5110.)*

MAE 5130 VISCOUS FLOWS (3 credits). Theory of Navier–Stokes equations; exact solutions for steady and unsteady plane, duct, jet and stagnation point flows; Stokes and Oseen approximations; the Prandtl concept of the boundary layer and similarity solutions Blasius, Hiemenz, Faulkner and Skan, Hartree, etc.; approximate solutions for non-similar boundary layers. *(Prerequisite: MAE 5110.)*

MAE 5140 EXPERIMENTAL FLUID DYNAMICS (3 credits). Introduces students to test facilities such as wind tunnels and water tanks. Topics include measurements of force and pressure distribution on airfoil principles and applications of laser Doppler velocimetry, hot-wire anemometry, flow visualization methods and modern data acquisition systems (LABVIEW). *(Prerequisite: MAE 5110.)*

MAE 5150 COMPUTATIONAL FLUID DYNAMICS (3 credits). Elliptic, parabolic, and hyperbolic PDEs; finite-difference formulations; explicit and implicit methods, stability analysis; operator splitting, multistep methods; boundary conditions; grid generation techniques; applications involving Euler boundary layer and full Navier–Stokes equations. *(Prerequisites: MAE 5110, MTH 3201.)*

MAE 5160 GAS DYNAMICS (3 credits). Differential conservation equations; one-dimensional steady flows; unsteady wave motion; small perturbations and linearized flows; bodies of revolution, conical flows, and slender body theory; blunt-body flows; three-dimensional supersonic flows; transonic flows; the method of characteristics and numerical computation for supersonic flows; real gas effects. *(Prerequisites: MAE 5110, MAE 5150.)*

MAE 5180 TURBULENT FLOWS (3 credits). General introduction, isotropic, homogeneous and shear-flow turbulence, transport processes in turbulent flows, wall and free turbulent shear flows, atmospheric turbulence. *(Prerequisite: MAE 5110 or MAE 5130.)*

MAE 5190 SELECTED TOPICS IN FLUID DYNAMICS (3 credits). Selected topics reflecting the current research interests of the faculty and visiting scholars.

MAE 5210 CONDUCTION HEAT TRANSFER (3 credits). Conservation of energy in a deformable continuous medium, the thermal conductivity tensor, superposition, Duhamel's theorem and product solutions; heat flow in one dimension, similarity, Sturm–Liouville theory, the Laplace transform and variable conductivity; generalized Fourier series and Green function techniques. *(Prerequisite: MAE 4171.)*

MAE 5220 CONVECTION HEAT TRANSFER (3 credits). Review of the principle of energy conservation, heat conducting fluid; boundary-layer approximations for large Reynold's number; exact and approximate treatment of laminar internal and external forced convection; turbulent forced convection; and buoyancy-induced convection. *(Prerequisite: MAE 5210 or approval of the instructor.)*

MAE 5230 RADIATION HEAT TRANSFER (3 credits). Development of radiative properties from electromagnetic theory; theory and analysis of shape factors, enclosure radiative transfer with diffuse-gray and nongray surfaces and an introduction to radiative transfer within participating media and semitransparent solids. *(Prerequisite: MAE 4171.)*

MAE 5290 SELECTED TOPICS IN HEAT TRANSFER AND ENERGY (3 credits). Address advanced topics reflecting the current research interests of the faculty and visiting scholars. *(Prerequisite: Approval of the instructor.)*

MAE 5310 COMBUSTION FUNDAMENTALS (3 credits). Includes equilibrium chemical thermodynamics and thermochemistry, chemical kinetics, transport phenomena and conservation equations; Rankine–Hugoniot theory, Chapman–Jouguet waves and detonation and deflagration; diffusion flames and premixed flames; flammability, ignition, and quenching. *(Prerequisite: MAE 3062.)*

MAE 5320 INTERNAL COMBUSTIONENGINES (3 credits). Investigates the applications of thermodynamic, fluid dynamic and combustion principles to spark- and compression-ignition engines, and direct-injection stratified charge engines; ideal and actual cycle analyses; exhaust emissions, air pollution and control; engine heat transfer; and engine modeling. *(Prerequisite: MAE 5310.)*

MAE 5350 GAS TURBINES (3 credits). Introduces characteristics, performance analyses and design methodologies for stationary aircraft gas turbines. Topics include gas turbine cycle analyses, component design of combustors, compressors, turbines and nozzles, fluid dynamics and heat transfer, gas turbine fuels and emissions. *(Prerequisite: MAE 5310.)*

MAE 5360 HYPERSONIC AIR-BREATHING ENGINES (3 credits). Introduces the analysis of hypersonic aerospace vehicles, with emphasis on air-breathing propulsion concepts and systems. Topics include performance behavior and cycle analysis of ramjets and scramjets, supersonic mixing and combustion processes, and component design. *(Prerequisite: MAE 5310.)*

MAE 5390 SELECTED TOPICS IN COMBUSTION AND PROPULSION (3 credits). Address selected topics reflecting the current research interests of the faculty and visiting scholars. *(Prerequisite: Approval of the instructor.)*

MAE 5410 ELASTICITY (3 credits). An analysis of stress and strain in two and three dimensions, equilibrium, compatibility and constitutive equations, energy methods, flexure, stretching, torsion and contact stress formulations, axially symmetric problems. *(Prerequisite: MTH 5201 or approval of the instructor.)*

MAE 5420 ADVANCED MECHANICAL DESIGN (3 credits). Covers essential aspects of elasticity-plasticity, kinematics, dynamics, tribology and materials science. *(Prerequisites: MAE 4024, MAE 4194 or MAE 4293.)*

MAE 5430 DESIGN OF AEROSPACE STRUCTURES (3 credits). Applications of mechanics to lightweight structures. Considers designing with monolithic and advanced composite materials; stiffened shell structures; buckling instability; failure analysis; variable section beams subjected to nonuniform loads; and computer formulations used in solving structural problems. *(Prerequisite: MAE 4281.)*

MAE 5460 FRACTURE MECHANICS AND FATIGUE OF MATERIALS. (3 credits). Covers static and dynamic design and maintenance to prevent structural failure; presence of cracks, stress intensity factor, linear elastic and elastic-plastic fracture mechanics, fracture tests, fatigue crack initiation and propagation, environmental and corrosion effects, fatigue life prediction. *(Prerequisites: CHE 3260, CHE 3265, MAE 3083.)*

MAE 5470 PRINCIPLES OF COMPOSITE MATERIALS (3 credits). Covers particulate and fiber composites; forms, properties and processing of constituent materials; manufacture of composites, interaction of constituents, micro- and macro-mechanics and design of composite materials; stress-strain tensors and their transformation, laminate theory of orthotropic materials; and strength properties. *(Prerequisites: CHE 3260, CHE 3265, MAE 3083.)*

MAE 5480 STRUCTURAL DYNAMICS (3 credits). Principles of dynamics applied to structural analysis, analysis of continuous media and discretized models, free vibration and forced response of structures, modal analysis, energy methods and approximate methods, applications in structural design and experimentation.

MAE 5610 ADVANCED DYNAMICS (3 credits). Newtonian and analytical mechanics; rigid-body dynamics, Euler's equations and spinning bodies; Lagrange's equations, Routhian and Hamiltonian mechanics, canonical transformations and Hamilton–Jacobi theory; dissipative, gyroscopic and circulatory systems; applications of numerical methods to complex dynamics problems. *(Prerequisite: MAE 2082.)*

MAE 5630 MODELING AND SIMULATION OF DYNAMIC SYSTEMS (3 credits). A study of theoretical, experimental, and computer methods for characterizing dynamic behavior of various physical systems, including generalized approaches to modeling complex interactions between mechanical, electrical, fluid and thermal systems. *(Prerequisite: Graduate standing.)*

MAE 5640 ADVANCED KINEMATICS (3 credits). Provides a uniform presentation of the mathematical foundations for studying spatial motion. Specific topics include general rigid body motion invariants, instantaneous kinematics, finite position theory, bivectors and multivectors, screw theory, theory of Clifford Algebras, quaternions and dual quaternions and exponential coordinates. *(Prerequisite: MAE 3091 or equivalent.)*

MAE 5650 ROBOTICS (3 credits). Provides an introduction to the study of robotic manipulators. Topics include spatial rigid body displacement, Euler angles, Denavit–Hartenberg coordinate convection for kinematic analysis, forward and inverse kinematic analyses of serial and parallel chain manipulators, manipulator Jacobians and trajectory generation. *(Prerequisite: MAE 2082 or equivalent.)*

MAE 5660 ROBOT CONTROL (3 credits). An introduction to the control of robotic manipulators. Topics include Lyapunov control theory, independent joint control, set point and trajectory tracking control, inverse dynamics control, impedance control, force control, hybrid position/force control and robust control. *(Prerequisite: MAE 3091 or equivalent.)*

MAE 5670 SPATIAL MECHANISM DESIGN (3 credits). Advanced topics in spherical and spatial mechanisms. Approximate motion synthesis and quasi-position synthesis methodologies. Analysis techniques, with respect to force transmission, order, singularity avoidance and solution branching are included. Computer-aided design and visualization software is used.

MAE 5690 SELECTED TOPICS IN SYSTEMS AND DYNAMICS (3 credits). Addresses selected topics reflecting the current research interests of the faculty and visiting scholars. *(Prerequisite: Approval of the instructor.)*

MAE 5997 INDEPENDENT STUDY (1–3 credits). An individual study under the direction of a member of the MAE graduate faculty.

MAE 5998 NONTHESIS PROJECT (1–3 credits). A directed-study project under the direction of the student's committee. Upon satisfactory completion of the Nonthesis Project, a maximum of three credits may be applied as part of the requirements for the master of science degree (Nonthesis Option). Attendance at the weekly MAE Seminar is required.

MAE 5999 MASTER OF SCIENCE THESIS (3 credits). Individual work under the direction of a member of the MAE graduate faculty on a selected topic. Attendance at the weekly MAE Seminar is required.

MANAGEMENT

MGT 5000 FINANCIAL ACCOUNTING (3 credits). An introductory-level course. Examines accounting concepts, the accounting model, measurement processes, financial statements, financial analysis, the accounting cycle, monetary and fixed assets, inventory, current and long-term liabilities and equity structures of partnerships, proprietorships and corporations.

MGT 5001 MANAGERIAL ACCOUNTING (3 credits). Focus of this course is on internal reporting to managers for use in planning and control, in making nonroutine decisions and in formulating major plans and policies. Coverage includes cost-volume-profit relationships, flexible budgets and standards, job order and process cost, and cost allocation and accumulation. *(Prerequisite: MGT 5000.)*

MGT 5002 CORPORATE FINANCE (3 credits). Concepts and tools of corporate financial management, including corporate financial planning, forecasting, budgeting, quantitative techniques and practices. Throughout the course, the importance of ethics and the international aspects in financial decision making will be considered. *(Prerequisite: MGT 5000.)*

MGT 5003 PUBLIC FINANCE (3 credits). Concepts and methods of public-sector financial management in federal, state and local governments. This includes the analysis of the theory and practice of public finance through taxation, debt instruments, intergovernmental funds and other revenue sources. Course includes a review of financial planning, forecasting and budgeting, as well as financial management practices. *(Prerequisite: MGT 5000.)*

MGT 5006 INTRODUCTORY MANAGERIAL STATISTICS (3 credits). Methods of collecting, analyzing and interpreting data for managerial decision making. Topics include data presentation, measures of central tendency, dispersion and skewness; discrete and continuous probability distributions; sampling methods and sampling distributions; and confidence interval estimation of parameters and tests of hypotheses.

MGT 5007 INTERMEDIATE MANAGERIAL STATISTICS (3 credits). Application of statistical theory to managerial problems, particularly methods of statistical inference for management decision making. Topics include F- and Chi-square distributions; nonparametric tests, analysis of variance, regression and correlation analysis. *(Prerequisite: MGT 5006.)*

MGT 5008 FINANCE SEMINAR (3 credits). Advanced topics in the field of finance are discussed, including current activity in the field of finance, as well as financial tools and strategy. The course is intended to blend financial theory with the current practice in finance. *(Prerequisite: MGT 5002.)*

MGT 5010 SEMINAR IN RESEARCH METHODOLOGY (3 credits). Reviews research methods in the managerial disciplines. Includes nature and sources of secondary data, primary data collection techniques, design of research projects, sample selection, model building, etc. A research proposal is prepared and presented by each student. A fully documented research report completes the results of the study.

MGT 5011 MANAGEMENT THEORY AND THOUGHT (3 credits). An overview of classical and contemporary management philosophies and theories. Focus is applied to managing enterprises in today's rapidly changing global economy. Coverage includes developing strategic vision, planning, organizing, directing and controlling, social responsibility and international management.

MGT 5012 SEMINAR IN PROFESSIONAL ACCOUNTANCY (3 credits). Current issues and trends in areas within the discipline of accountancy. Includes, but not restricted to, professional ethics, historical trends, developments in sampling techniques and IRS procedures. Various journals are used and an original research project in a current topic is required. *(Prerequisites: MGT 5001, MGT 5201, MGT 5202, MGT 5203.)*

MGT 5013 ORGANIZATIONAL BEHAVIOR (3 credits). Familiarizes the student with the contributions to management theory made by the behavioral sciences. Essentially, it is intended to give the student a better understanding of the human being and why he acts as he does. Both the individual and group behavior aspects are studied. Extensive use is made of current periodicals and case materials.

MGT 5014 INFORMATION SYSTEMS (3 credits). A study of information systems design associated with business organizations. Topics include development life cycles, requirements analysis, systems design and performance considerations. Information systems are viewed as strategic tools to provide competitive advantage.

MGT 5015 ORGANIZATIONAL PLANNING AND DEVELOPMENT (3 credits). A study of the concepts, theory, research and operational problems of modern organizations. Includes both classical and modern organizational theory with emphasis on the latter. Attention is given to recent research findings and the theory of human relations in industry. Involves students in case studies.

MGT 5016 EMPLOYEE RELATIONS (3 credits). Analyzes, synthesizes and evaluates the major federal and state laws that impinge on the modern work environment. Students will draw upon new insights in the human resources management discipline to abstract, summarize and evaluate the impact of the ever-growing field of legislation and laws regulating the employee/employer relationship.

MGT 5017 PROGRAM MANAGEMENT (3 credits). Addresses responsibility and authority of a program manager and the integration of program functions in complex organizational structures. Interpersonal relationships within matrix organizations, as well as program conflict resolution and organizational priorities are discussed.

MGT 5018 POLICY AND STRATEGY FOR BUSINESS (3 credits). The process of formulation and implementation of competitive strategies, with emphasis on the role of top management. Case analyses are employed to expose the student to the multifunctional nature of decision making at the top management level. *(Prerequisites: MGT 5002, MGT 5019, recommended for the graduating semester.)*

MGT 5019 MARKETING (3 credits). The marketing function is approached from the point of view of the marketing manager, with the role of marketing in the firm, the economy and society being examined. Marketing concepts and operational approaches for marketing decision making are introduced. The case method is employed extensively to force the student to imaginatively apply theory to the development of a marketing mix.

MGT 5020 APPLIED MANAGEMENT PROJECT (3 credits). An advanced course covering concepts, tools and techniques for evaluation of research proposals and studies. Involves designing, conducting, evaluating and presenting oral and written forms of one's own research. Assignments build upon quantitative and qualitative research methods. Students present their research in an oral presentation and in a written project report.

MGT 5021 BUSINESS LAW (3 credits). Students learn to better understand, analyze and effectively deal with issues such as jurisprudence, contracts, property, agency, partnerships, corporations, sales, commercial paper and secured transactions. Aspects of the Uniform Commercial Code will also be studied.

MGT 5022 ANALYTICAL METHODS FOR MANAGEMENT (3 credits). Familiarizes students with fundamental concepts in business mathematics. Topics include linear systems, linear programming (graphical method), matrices and logarithms; differential calculus and its applications. *(Noncredit for graduate management programs except to meet foundation requirements for those programs.)*

MGT 5024 PRODUCTION AND OPERATIONS MANAGEMENT (3 credits). The translation of product and service requirements into facilities, procedures and operating organizations. Topics include product design, production alternatives, facilities location and layout, resource requirements planning and quality control.

MGT 5026 COMPUTER APPLICATIONS FOR BUSINESS (3 credits). Emphasizes a hands-on approach to solving business applications using computer applications. Includes discussion of the most recent developments in computer hardware, software, programming techniques, computer ethics and security. *(Noncredit for graduate management programs except to meet foundation requirements for those programs.)*

MGT 5031 SEMINAR IN INTERNATIONAL MANAGEMENT (3 credits). This course focuses on the problems of the senior executive in the management of the multinational firm. Executive decision making is examined within the scope of international concerns relative to various economic, political and cultural environment.

MGT 5033 HUMAN RESOURCES MANAGEMENT (3 credits). Issues surrounding the employment of human resources in various organizational settings are explored using lectures/guided discussion and case study examples. Issues may include recruitment/development, job analyses/evaluation, equal employment opportunity, training/development, compensation/benefits, appraisal, labor relations, health and safety, and separation/retirement.

MGT 5034 LAW, TECHNOLOGY AND SOCIETY (3 credits). A critical examination of the impact of technology on the legal system and social organization, origin and methodology of the common law. Provides a framework for analyzing social change caused by advancing technology. Legal concepts are analyzed from the standpoint of societal reaction to technology. The case study method is included.

MGT 5035 PUBLIC ADMINISTRATION AND MANAGEMENT (3 credits). Focuses on the problems of administrative management in public agencies and presents methods and strategies to remedy administrative management problems. Case studies will be used to apply principles of effective public administrative management.

MGT 5037 GLOBAL ECONOMIC ENVIRONMENT OF BUSINESS (3 credits). The focus of this course is the importance and impact of foreign trade for world economies. Particular emphasis is placed on balance of trade, technology transfer and service economies, along with trade barriers, GATT, NAFTA, the World Bank and other issues related to global trade. *(Prerequisite: MGT 5149.)*

MGT 5039 ECONOMETRICS (3 credits). Emphasizes construction of econometric models and their application in business and economic analyses. Topics include single equation regression models, autoregressive and distributed-lag models, dummy variables, simultaneous-equation models and methods. Problems and remedies for violations of classical model assumptions are covered. *(Prerequisites: MGT 5007, MGT 5132, MGT 5133.)*

MGT 5040 PUBLIC PROGRAM POLICY AND EVALUATION (3 credits). Techniques for evaluating the effectiveness of public programs will be used to asses effectiveness, efficiency, responsiveness, equity and trade-offs of public programs. Various evaluation techniques and methods will be applied to public programs in the federal, state and local government agencies.

MGT 5041 FEDERAL INCOME TAX (3 credits). This course is designed to cover Federal Income Taxes for individuals, corporations and partnerships. Includes procedure and administration of Federal Tax Law, as well as Federal Tax Research. *(Prerequisite: MGT 5000.)*

MGT 5042 INTERNATIONAL BUSINESS (3 credits). Addresses world environments and specific international business activities such as foreign investment and international marketing. The decision-making process for going abroad is examined along with current issues in international business. *(Prerequisites: MGT 5002, MGT 5019.)*

MGT 5047 NEW VENTURE DEVELOPMENT (3 credits). This course introduces students to the New Venture Development process, including all the steps in the process, the behaviors and characteristics of entrepreneurs, creating the business concept, the business plan, financing and growth management. *(Prerequisites: MGT 5002, MGT 5019.)*

MGT 5048 MARKETING ANALYSIS AND STRATEGY (3 credits). Advanced analysis of current marketing opportunities and problems stemming from the ever-changing social, economic and political environments. The course entails the preparation of detailed marketing programs for all or part of an organization's marketing effort, consistent with its financial and managerial resources. *(Prerequisite: MGT 5019.)*

MGT 5049 INTERNATIONAL MARKETING (3 credits). Formulation of marketing strategies and techniques are studied within the framework of the world marketplace. Fundamental marketing concepts are examined and adapted to various economic, cultural, political, legal and business environments. *(Prerequisites: MGT 5000, MGT 5019.)*

MGT 5050 ADVANCED INTERNATIONAL MARKETING (3 credits). The complex environment of international marketing and the need for organization marketing on a global basis to investigate the various economic, social, political, cultural and legal dimensions of marketing concepts. Includes discussions of emerging issues that create new problems and opportunities for international marketing managers. *(Prerequisite: MGT 5019.)*

MGT 5060 MANAGEMENT OF ASSETS (3 credits). Determination of requirements for management of major and secondary items. Needs and techniques for accurate asset reporting and analysis of demand data for customers' requirements are reviewed. Emphasis is placed on problems related to unstable items and the management methods required to integrate the acquisition and management of assets into the life-cycle program.

MGT 5061 SYSTEMS AND LOGISTICS SUPPORT MANAGEMENT (3 credits). Addresses the management of evolving systems. Emphasis is placed on the planning and support requirements of the system during its life cycle. Areas of study include maintenance planning, physical distribution, manpower requirements, facilities and equipment needs, documentation, systems integration and other support requirements.

MGT 5062 LOGISTICS POLICY (3 credits). This course analyzes logistics as a science and provides a comparative analysis of different policy considerations. The role of logistics in organizational policy and problems is reviewed, and future trends in logistics are studied. *(Prerequisites: MGT 5061, MGT 5100.)*

MGT 5063 INVENTORY CONTROL AND MANAGEMENT (3 credits). Management techniques and methods related to the life-cycle management of material. Material management systems are assessed and considerations given to concepts of standardization, modernization, material reserve, cataloguing, pro-ordering, storage and distribution.

MGT 5064 COST AND ECONOMIC ANALYSIS (3 credits). Cost effectiveness, trade-off analysis, system effectiveness model structure, development of criteria for evaluation of alternative systems, principles of cost accounting and cost estimating for system life cycle. Assesses basic math to perform cost-effective analysis, computer tools for economic modeling and risk assessment. *(Prerequisites: MGT 5002, MGT 5006, MGT 5026.)*

MGT 5065 SUPPLY CHAIN MANAGEMENT (3 credits). This course combines lectures, class discussions on assigned topics and case analyses. Covered areas include the role of SCM in the economy and organizations; customer service; SCM information systems; inventory management; managing materials flow and handling; transportation; warehousing; computerization and packaging issues; purchasing; global logistics; organizing for effective SCM; methods to control SCM performance; and implementing SCM strategy.

MGT 5066 SYSTEMS ANALYSIS AND MODELING (3 credits). Application of case analysis and modeling tools in a business environment. Concept of systems analysis discussed and computer models are constructed to illustrate key issues. Includes classification of systems, problem formulation, decision and risk analysis, modeling

techniques, discrete event simulation and evaluation of information. A design project is required. *(Prerequisite: MGT 5006.)*

MGT 5067 SYSTEM MANAGEMENT (3 credits). Nature and operations of systems, system science and general system theory, strategic concepts, analytical tools, general systems approach, process management; systematic decision-making, problem-solving concepts, scientific and technical disciplines, communications theory, socio-environmental factors, interface and strategic management.

MGT 5068 SYSTEM ENGINEERING MANAGEMENT (3 credits). Study of system technical management concepts and methods as applied to the management of system engineering activities. It covers the general principles and requirements of system engineering and the application of system management techniques used to manage the multidiscipline technical teams engaged in development programs. *(Prerequisite: MGT 5067.)*

MGT 5069 ADVANCED TECHNIQUES IN SUPPLY CHAIN MANAGEMENT (3 credits). Advanced theory and practice of supply chain management, including operational and logistics support areas. Provides an understanding of strategy, organizational structure and new technologies in SCM. This course covers the use of the Internet and its effect on SCM, and the concepts and tools used in SCM. It examines requirements, specifications, planning, program design, and maintenance and quality assurance of SCM systems. *(Prerequisite: MGT 5065.)*

MGT 5070 SPECIAL TOPICS IN BUSINESS (3 credits). Independent study in some area of business that allows the student to work closely with a faculty member and probe a subject within the business discipline in greater depth than is normally possible in a regular class. A comprehensive term paper is required.

MGT 5071 DECISION THEORY (3 credits). This course is an examination of both the normative and empirical dimensions of judgment analysis. It introduces the use of Management Science techniques and mathematical modeling as a methodology for understanding and facilitating the decision-making process. *(Prerequisite: MGT 5006.)*

MGT 5079 TRAFFIC MANAGEMENT (3 credits). This course examines the various means of directing, controlling and supervising functions involved in furnishing transportation services and facilities. Service support to the customer and the principles and problems involved therein are examined in detail.

MGT 5084 MATERIEL ACQUISITION MANAGEMENT (3 credits). This course examines the life cycle process involving the acquisition of materiel and materiel systems. The concept of systems management is utilized and its application to the acquisition phase to termination phase is emphasized. Need requirements analysis, cost and schedule considerations and procurement policies and procedures are studied.

MGT 5087 MANAGEMENT OF TRANSPORTATION SYSTEMS (3 credits). This course studies various contemporary carrier modes, emphasizing management problems common to all modes of domestic and international transportation. Investigates and discusses transportation engineering, use of transportation facilities and materiel, economic, personnel, labor and union aspects.

MGT 5088 PROJECT AND PROGRAM RISK MANAGEMENT (3 credits). A systematic approach to risk management from project initiation to project planning, implementation, control and close out. Various techniques and models for quantitative/qualitative risk assessment and risk management in areas such as cost, schedule and outputs, are discussed. *(Prerequisites: MGT 5006, MGT 5017.)*

MGT 5089 MULTIPLE PROJECT MANAGEMENT (3 credits). An examination of various alternative methods for project managers to plan, schedule and control multi-projects within an organizational setting. Topics include the role of multiple projects within an organization and the impact on conventional day-to-day workflow. *(Prerequisite: MGT 5017.)*

MGT 5090 PRACTICUM FOR PROJECT MANAGEMENT (3 credits). Provides an opportunity to formulate and apply the knowledge and skills of project management principles and practices in an integrative fashion within a project team environment. The end product of the course is a written project plan. *(Prerequisites: MGT 5017, MGT 5088, MGT 5089.)*

MGT 5091 RESEARCH SEMINAR IN MANAGEMENT 1 (1 credit). Independent study in some area within management. It permits the students to work closely with a faculty member and probe a subject within the management discipline in greater depth than is normally possible in a regular class. A comprehensive term paper is required.

MGT 5092 RESEARCH SEMINAR IN MANAGEMENT 2 (2 credits). Independent study in some area within management. It permits the students to work closely with a faculty member and probe a subject within the management discipline in greater depth than is normally possible in a

regular class. A comprehensive term paper is required.

MGT 5100 DISTRIBUTION MANAGEMENT (3 credits). Distribution systems and management of systems from a cost vs. return view. U.S. and world transportation systems impact on distribution centers, automated order processing, warehousing techniques and layout, organization for physical distribution management, total systems approach, government regulation, distribution components and management of distribution resources.

MGT 5101 LEADERSHIP THEORY AND EFFECTIVE MANAGEMENT (3 credits). Historical development of leadership theory and supporting research, followed by examination of contemporary leadership and research. Consideration of past and contemporary theory provides a basis of self-analysis by students, enabling them to define their own personal leadership styles. *(Prerequisite: MGT 5013.)*

MGT 5105 INTERPERSONAL RELATIONS AND CONFLICT RESOLUTION (3 credits). Focus on interpersonal behavior in two-person relationships with emphasis placed on interpersonal communication and conflict resolution. Coverage is also devoted to group processes, development and how group norms and culture influence interpersonal relationships. *(Prerequisite: MGT 5013.)*

MGT 5106 ORGANIZATIONAL COMMUNICATION (3 credits). Basic communication theory and the effects of communication on human behavior and organizational effectiveness. The course is designed to provide a basic understanding of organizational communication theory and, through the use of case studies and experiential exercises, to provide the opportunity for the students to improve communication skills.

MGT 5112 SEMINAR IN CONTEMPORARY ISSUES IN HUMAN RESOURCES MANAGEMENT (3 credits). A survey of significant political, psychological, sociological, legal, technological and economic issues affecting contemporary organizations and the quality of work lives of their members. Students draw on current events and on personal experiences within their work organizations. *(Prerequisite: MGT 5032.)*

MGT 5119 ACCOUNTING FOR NONPROFIT ENTITIES (3 credits). This course covers accounting systems employed by universities and other nonprofit entities. It includes fund accounting used by municipalities, county, state and federal government, and covers financial management cycle from planning stage through evaluation. *(Prerequisite: MGT 5001.)*

MGT 5131 PRODUCTIVITY MEASUREMENT AND IMPROVEMENT (3 credits). The productivity and quality improvement process, preparing for implementation, organizing for successful implementation of the Deming philosophy, organizational structure, and implementing teams. Includes productivity, profit and quality; organizational anxieties, measurement problems, partial/total firm productivity, JIT and TQM. *(Prerequisite: MGT 5006.)*

MGT 5132 BASIC ECONOMICS (3 credits). Covers market forces of supply and demand, concept of utility, firm and production, production function and costs of production, and various market structures. The macroeconomics portion of the course covers basic introduction to macroeconomics, the issues of aggregation, circular flow model, monetary sector and the government stabilization policies.

MGT 5133 ADVANCED ANALYTICAL METHODS FOR MANAGEMENT (3 credits). Quantitative models using management science/operations research/decision science techniques with business applications. Includes linear and integer linear programming (graphical and simplex methods), inventory models, queuing models and Markov processes. Uses a suitable PC-based package. *(Prerequisites: MGT 5022, MGT 5006.)*

MGT 5134 COMMERCIAL ENTERPRISE IN SPACE (3 credits). Economic considerations of space processing and Earth resources observation; history of in-space experimentation and developments; definition of the Earth's orbital environment and its attendant commercial advantages; launch operations and landing/retrieval; financial/profit considerations of operating in space; current commercial space opportunities and risks.

MGT 5136 INVESTMENT ANALYSIS (3 credits). This advanced course covers the topics of portfolio design, analysis and management, including the Markowitz approach to portfolio design; the simplified model of William Sharpe; and the capital asset pricing model. The management of bond and equity portfolios will be discussed, as will portfolio optimization, arbitrage and hedging techniques. *(Prerequisites: MGT 5002, MGT 5006.)*

MGT 5137 THE MANAGEMENT OF ENGINEERING AND TECHNOLOGY (3 credits). Relationships between technology, innovation, management, and business operations are explored. Technology strategy is studied in terms of the discovery-product-market path. The management functions of planning, organizing and controlling are related to life-cycles. Case studies are used to promote class participation.

MGT 5138 BUSINESS ETHICS (3 credits). The primary objectives of this course are to increase students' understanding of concepts of moral philosophy and their relevance to decision making, and to provide an opportunity for students to apply this understanding in a wide variety of practical management settings. Extensive use is made of case analyses.

MGT 5139 INTERNATIONAL FINANCIAL ANALYSIS (3 credits). This course focuses on understanding the problems associated with international financial management. Topics include the environment of international financial management, foreign exchange risk management, multinational working capital management, foreign investment analysis and financing foreign operations. *(Prerequisite: MGT 5002.)*

MGT 5140 INTERNATIONAL FINANCE (3 credits). International financial systems and methods needed to adapt to the international setting. Includes international monetary system, foreign exchange markets and international trade, international accounting and taxation, foreign direct financial investment, international capital markets, multinational capital budgeting, exchange exposure and risk management. *(Prerequisite: MGT 5002.)*

MGT 5141 IMPLEMENTING STATISTICAL PROCESS CONTROL (3 credits). Implementation of an overall SPC program, with emphasis on how to manage a process throughout the entire organization with the aid of tools and methods for the improvement of quality. Topics include how to target processes for SPC, conduct process capability studies and maintain ongoing process control. *(Prerequisite: MGT 5006.)*

MGT 5142 BUSINESS, GOVERNMENT AND PUBLIC POLICY (3 credits). Legal basis of the relationship of business and government, dimensions of federal regulation of business through congressional action, administrative oversight by executive department agencies, regulatory power of independent agencies (Federal Reserve, SEC and FTC) and importance of Political Action committees in the influencing of public policy.

MGT 5145 TECHNOLOGY AND BUSINESS STRATEGY (3 credits). Focuses on the process of developing a technology strategy and integrating it with business strategy. Involves technology situation analysis, technology portfolio development, technology and corporate strategy integration and establishing technology investment priorities. Extensive use is made of actual case studies.

MGT 5146 MANAGEMENT OF INNOVATION (3 credits). Considers innovation in a historical context, organizing organizational culture and innovation, managing cross-functional teams, venturing and organization learning, intra- and entrepreneurship, managing R&D resources, executive leadership and the management of innovation and change and designing innovative organizations. *(Prerequisite: MGT 5013.)*

MGT 5147 MANAGEMENT OF TECHNOLOGY RESEARCH SEMINAR (3 credits). An overview of past and current MOT research. Systematically explores adaptation of scientific methodology to the analysis and solution of technology management problems. Students will be required to develop a written proposal and conduct a formal oral defense.

MGT 5148 DESIGN AND ANALYSIS OF EXPERIMENTS (3 credits). Productivity measurement and improvement and quantitative methods used in the management of technology. Topics covered include analysis of means, multifactor analysis of variance, factorial experiments and orthogonal arrays, including DESIGN-AESEIM (personal computer software) applications for the design and analysis of experiments. *(Prerequisite: MGT 5007.)*

MGT 5149 ECONOMICS FOR BUSINESS (3 credits). An advanced economics course consisting of several parts: 1) economic modeling and forecasting; 2) economic efficiency and allocation of resources in product markets and public sector; 3) macroeconomics; and 4) open economy, foreign exchange and international trade. *(Prerequisites: MGT 5006, MGT 5022, MGT 5132.)*

MGT 5150 MANAGEMENT OF SOFTWARE SYSTEMS (3 credits). This course is designed to explore management's consideration of functional requirement specifications, design, development, implementation and maintenance of computer-based software systems that provide information technology related services to organizations. Included are software-related management topics in cost estimating/control, risk management, system life cycle models, prototype development/testing, development tools (e.g., Computer-aided Software Engineering (CASE)), and maintenance (e.g., software modification after delivery in order to improve performance, correct faults or adapt the product to a changed organizational environment). *(Prerequisite: MGT 5014 or equivalent; may not be taken for credit if MGT 5027 has been taken for credit.)*

MGT 5151 DATABASE SYSTEMS MANAGEMENT (3 credits). This course is designed to investigate how database management system techniques

are used to design, develop, implement and maintain modern database applications in organizations. Related to management's needs, topics explored in the course include database design and structured queries for data retrieval/analysis, data modeling techniques (e.g., entity-relationship diagrams), knowledge management (e.g., data warehousing/mining techniques), data security/privacy/recovery, Internet/Intranet distributed databases in electronic commerce and uses/risks of standard application development software. *(Prerequisite: MGT 5014 or equivalent; may not be taken if MGT 5028 has been taken for credit.)*

MGT 5152 COMPUTER SYSTEMS ADMINISTRATION (3 credits). This course is designed to explore the need for effective and efficient management of computer-based technology in local or globally networked organizational settings. Topics include chief information officer's (CIO) multiple role in management of computer-based resources, managing both centralized and networked data center operations with wide-area networks (WANs) and local-area networks (LANs), computer-based systems development/maintenance/security. Help Desk operations, personnel requirements (e.g., systems analysts, programmers, computer operators, database administrators (DBAs), network administrators and computer security specialists), support to an organization's Internet/Intranet applications and systems documentation standards. *(Prerequisite: MGT 5014 or equivalent; may not be taken for credit if MGT 5029 has been taken for credit.)*

MGT 5153 TELECOMMUNICATIONS SYSTEMS MANAGEMENT (3 credits). This course is designed to explore both the legal and the technical operation environment of telecommunications in organizations. Organizational ramifications are assessed of government telecommunication laws, policies and deregulatory activities. Technical topics include network design/construction/management, telecommunication architectures/standards, data/voice/multimedia communication, Internet applications of telecommunications, increased demand for bandwidth and network transmission, and organizations' strategic use of telecommunications. *(Prerequisite: MGT 5014 or equivalent; may not be taken for credit if MGT 5030 has been taken for credit.)*

MGT 5154 ADVANCED MANAGEMENT INFORMATION SYSTEMS (3 credits). This course is design to develop an understanding of the relationship between information technology (IT) and the strategic operational and functional areas of organizations in both global and domestic environments. Topics include current and emerging computer-based management information and decision support systems' impact upon organizations, key functional roles performed by IT in an organization's effectiveness and efficiency, Internet electronic commerce, Intranet/Internet network management, electronic data interchange (EDI) and data encryption, computer crime and network risk/security and enterprise modeling/computing. *(Prerequisite: MGT 5014 or equivalent; may not be taken for credit, if MGT 5143 has been taken for credit.)*

MGT 5160 INTRODUCTION TO eBUSINESS (3 credits). Introduces the concepts of eBusiness and how it affects businesses, governments, and people in general. The major building blocks of an eBusiness organizational system, such as marketing, information technology, product/services distribution, and strategic policy/planning are identified. How these building blocks interact to form an effective organization in eBusiness and its relation to the Internet's capabilities are also discussed. *(Prerequisite: Undergraduate course work in business fundamentals or marketing.)*

MGT 5161 POLICY AND ORGANIZATIONAL STRATEGIES FOR eBUSINESS (3 credits). The various organizational strategies for eBusiness are discussed, including business to business, business to consumer, business to government and the emerging government to government, and how they impact the organization's policy-making process. Various eBusiness business models, such as Internet-specific business services, online stores, and Internet-enabled customer service improvements are analyzed in depth. *(Prerequisite: MGT 5160.)*

MGT 5162 SURVEY OF INFORMATION TECHNOLOGIES FOR eBUSINESS (3 credits). Information technologies available for an organization's eBusiness are surveyed. The role of the World Wide Web; use of search engines for business promotions; strategies for evaluation of effectiveness of eBusiness sites; cost estimation for eBusiness Web site design, development and implementation; and maintenance technologies, such as frame relay, ISDN and storage area networks (SANs) are covered. *(Prerequisites: MGT 5014 and MGT 5160.)*

MGT 5163 MARKETING IN AN INTERNET-BASED ENVIRONMENT (3 credits). The organization's marketing function is developed in an expanded, multi-channel capacity to conduct eBusiness in an Internet-based environment. Barriers to eBusiness market entry and their impact on the organization's decision-making are discussed. Sources of product/service availability and cost reduction strategies in eBusiness are analyzed.

Impact of advertising and other models of consumer behavior in an eBusiness environment are also discussed. *(Prerequisites: MGT 5019 and MGT 5160.)*

MGT 5165 SPECIAL TOPICS IN eBUSINESS (3 credits). Employs case studies to analyze organizations that plan, design, develop and implement eBusiness operations. Students study the characteristics that make an eBusiness successful or unsuccessful in a dynamic environment. Students prepare written evaluation reports of the eBusiness case studies. *(Prerequisite: MGT 5160.)*

MGT 5166 PROJECTS IN eBUSINESS (3 credits). Students work closely with a faculty member to develop an eBusiness project, such as a business plan for a start-up company or plan for an acquisition/merger of existing companies. An applied research project report is required. *(Prerequisite: MGT 5160.)*

MGT 5170 QUALITY MANAGEMENT (3 credits). Introduces principles and techniques for establishing quality goals, identification of customer needs, measurement of quality objectives and development of process features and controls for improving overall system performance.

MGT 5171 MANAGERIAL DECISION MODELING (3 credits). Solving problems with decision trees, decision models based on expected value/uncertainty; forecasting; PERT/CPM; utility-based decision making; and decision support systems. Case studies and computer software are used and emphasis is placed on practical applications. Topics feature decision scenarios, decision criteria and decision states. *(Prerequisite: MGT 5006.)*

MGT 5211 PROCUREMENT AND CONTRACT MANAGEMENT (3 credits). An in-depth overview of the federal acquisition process and introduction to the basic concepts, policies and procedures incident to government contracting through the FAR and supplementing directives.

MGT 5212 ADVANCED PROCUREMENT AND CONTRACT MANAGEMENT (3 credits). Principles, policies, concepts and procedures in post-award management of contracts and subcontracts. Includes rules of interpretation, subcontracting terms/conditions, in-depth examination of significant contract clauses, patent/data provisions, risk allocation and assumption, impossibility of performance, product liability, warranties and claims.

MGT 5213 CONTRACT CHANGES, TERMINATIONS AND DISPUTES (3 credits). Case studies and lectures are used to provide an in-depth examination of the post-award management problems associated with contract administration. Contract changes, terminations and disputes, as well as other issues are covered. *(Prerequisite: MGT 5211.)*

MGT 5214 COST PRINCIPLES, EFFECTIVENESS AND CONTROL (3 credits). Financial and accounting overview of government acquisition policy and procedures. *(Prerequisites: Completion of foundation requirements, MGT 5211, MGT 5001.)*

MGT 5217 CONTRACT AND SUBCONTRACT FORMULATION (3 credits). An in-depth study of the pre-award phase of the federal acquisition process. Class discussions and case studies are used to examine the management problems from the perspective of the contracting office, requiring activity, courts, Congress and the contractors. *(Prerequisite: MGT 5211.)*

MGT 5218 CONTRACT NEGOTIATIONS AND INCENTIVE CONTRACTS (3 credits). A seminar in which negotiation concepts and techniques are explored, analyzed, discussed and then placed into practice through the use of mock negotiations. All types of contracts are examined. *(Prerequisite: MGT 5211.)*

MGT 5220 CONTRACT MANAGEMENT RESEARCH SEMINAR (3 credits). Advanced seminar course devoted to the study of and research into topical government contract management issues. *(Prerequisite: MGT 5211.)*

MGT 5231 GOVERNMENT CONTRACT LAW (3 credits). The concentration in this course is on the method rather than the material. Utilizing the case method of study and basic source material, all the facets of procurement law are studied. Emphasis is placed on legal methods, logic and the developmental concepts of procurement law.

MGT 5240 BUSINESS AND LEGAL ASPECTS OF INTELLECTUAL PROPERTY (3 credits). This course will familiarize the student with patents, trademark, copyright and trade secret law.

MGT 5270 SPECIAL TOPICS IN CONTRACTS MANAGEMENT (3 credits). Independent study in some area within contract management. This course permits the student to work closely with a faculty member and probe a subject within the contract management discipline in greater depth than is normally possible in a regular class. A comprehensive term paper is required. *(Prerequisites: MGT 5211, permission of the instructor.)*

MGT 5500 INTEGRATED LOGISTICS MANAGEMENT (3 credits). Provides the framework for integrated logistics support (ILS). Discusses the management tools available to logistics' managers and places ILS in perspective within the weapons systems acquisition process. Objectives

include understanding all of the elements of ILS, the relationship of ILS elements to ILS planning and current systems acquisition practices.

MGT 5999 THESIS (3 credits). This course offers individual research work under the direction of a member of the graduate faculty on a selected topic. After satisfactorily completing the thesis, a maximum of six credits can be applied as part of the requirements for certain master's programs.

MATHEMATICS

MTH 1701 COLLEGE ALGEBRA (3 credits). Real-number system; arithmetic operations with polynomials, special products and factoring; linear, fractional and quadratic equations; inequalities, exponents, radicals and absolute values; functions and graphs; and complex numbers, logarithms, logarithmic and exponential functions. *(Noncredit for all majors except business, management, humanities and psychology.)*

MTH 1702 APPLIED CALCULUS (3 credits). Elements of differential and integral calculus with application to business, economics, management and the social and life sciences, as well as maxima, minima, rates, exponential growth and decay and some techniques of integration. *(Prerequisite: MTH 1701.)*

MTH 2051 DISCRETE MATHEMATICS (3 credits). Formulation of precise definitions and their negations using propositional and predicate logic; argument analysis and proof techniques including induction; number theory; and sets, relations, functions, directed graphs and elementary counting arguments. *(Prerequisite: MTH 1000 or MTH 1001 or MTH 1702.)*

MTH 5050 SPECIAL TOPICS (3 credits). Contents of this course may vary depending on the needs and interests of the students and the fields of expertise of the faculty. *(Prerequisite: Permission of the instructor.)*

MTH 5051 APPLIED DISCRETE MATHEMATICS (3 credits). Logic fundamentals induction recursion, combinatorial mathematics, discrete probability, graph theory fundamentals, trees, connectivity and traversability. Applications from a variety of sciences, operations research, and computer and electrical engineering. *(Prerequisite: MTH 2051 or MTH 1702.)*

MTH 5102 LINEAR ALGEBRA (3 credits). Linear algebra, systems of linear equations and Gauss elimination method; inverses, rank and determinants; vector spaces; linear transformations, linear functional and dual spaces; eigenvalues, eigenvectors; symmetric, Hermitian and normal transformations; and quadratic forms. *(Prerequisite: Undergraduate course in multivariable calculus or linear algebra.)*

MTH 5120 CALCULUS OF VARIATIONS AND OPTIMAL CONTROL (3 credits). Topics include necessary conditions for smooth and nonsmooth problems, Euler–Lagrange equations, Pontryagin's maximum principle and its applications, elements of convex analysis, special problems and sufficient conditions and existence theory. *(Prerequisite: MTH 2201.)*

MTH 5125 APPLIED COMPLEX VARIABLES (3 credits). Includes functions of complex variables, Cauchy–Riemann equations, Cauchy's integral formula, Laurent series, residues, bilinear transformation, conformal mapping, Schwarz–Christoffel transformation, argument principle, Rouche's theorem, Poisson integral formula, and Dirichlet boundary value problem. *(Prerequisite: MTH 2001, MTH 2201.)*

MTH 5130 THEORY OF COMPLEX VARIABLES (3 credits). Topology of the complex plane, analytic functions, Cauchy's integral formula, Liouville's theorem, maximum modulus theorem, Taylor and Laurent series, singularities, residue theorem, analytic continuation, entire functions, infinite product representation and conformal mapping. *(Prerequisites: MTH 2201, MTH 4101.)*

MTH 5201 MATHEMATICAL METHODS IN SCIENCE AND ENGINEERING 1 (3 credits). Fourier series and their convergence properties; Sturm–Liouville eigenfunction expansion theory; Bessel and Legendre functions; solution of heat, wave and Laplace equations by separation of variables in Cartesian coordinates. *(Prerequisite: MTH 2001, MTH 2201.)*

MTH 5202 MATHEMATICAL METHODS IN SCIENCE AND ENGINEERING 2 (3 credits). Solution of heat, wave and Laplace equations by separation of variables in cylindrical and spherical coordinates. Associated Legendre functions, hypergeometric functions and spherical harmonics. Fourier transforms and separation of variables for heat and wave equations on infinite intervals. Vector integral calculus. *(Prerequisite: MTH 5201.)*

MTH 5220 THEORY OF ORDINARY DIFFERENTIAL EQUATIONS (3 credits). Includes basic existence theory, differential and integral inequalities, qualitative and quantitative theory, and Lyapunov's second method. *(Prerequisites: MTH 2201, MTH 4101.)*

MTH 5230 PARTIAL DIFFERENTIAL EQUATIONS (3 credits). Includes the Hamilton–Jacobi equation; and elliptic, parabolic and hyperbolic problems, Green function methods, transform methods, maximum principle. *(Prerequisites: MTH 2001, MTH 2201, MTH 4101.)*

MTH 5301 NUMERICAL ANALYSIS (3 credits). Includes Gaussian elimination and solution of linear systems of equations, root finding methods, systems of nonlinear equations, interpolation, numerical integration, initial value problems for ODEs and fast Fourier transform. *(Prerequisites: MTH 2201 and CSE 1502 or CSE 1503 or CSE 2050.)*

MTH 5305 NUMERICAL LINEAR ALGEBRA (3 credits). Covers iterative methods of solution of systems of linear equations, numerical methods for computing eigenvalues and eigenvectors, and singular value methods for least-squares problems. *(Prerequisite: MTH 5301.)*

MTH 5310 NUMERICAL METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS (3 credits). Numerical methods for initial value problems, boundary value problems and eigenvalue problems for ordinary differential equations. Runge–Kutta methods, multistep and adaptive methods, stiff equations and A-stable methods, collocation. *(Prerequisites: MTH 5301.)*

MTH 5315 NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS (3 credits). Covers finite difference and finite element methods for partial differential equations. *(Prerequisites: MTH 3201, MTH 5301.)*

MTH 5320 NEURAL NETWORKS (3 credits). An introduction to architectures, algorithms, and applications. Topics include single and multilayer perceptrons, counterpropagation, Kohonen self-organization, adaptive resonance theory, neocognitron, probabilistic neural networks and Boltzmann machines with and without learning, recurrent neural networks. *(CSE 1502, or CSE 1503 or CSE 2050, MTH 2201.)*

MTH 5401 APPLIED STATISTICAL ANALYSIS (3 credits). Covers statistical distributions, statistical tests for data, least squares and regression, estimations, tests of hypotheses, analysis of variance, planning and designing research experiments, randomized blocks, Latin and Graeco–Latin squares and data reduction, analysis using ANOVA (analysis of variance) and other methods. *(Prerequisite: MTH 2001.)*

MTH 5411, MTH 5412 MATHEMATICAL STATISTICS 1, 2 (3, 3 credits). Introductory survey of the basic concepts of probability and statistics. Topics include sample spaces, random variables and distributions, moments, statistics, estimation, tests of hypotheses and regression analysis. *(Prerequisites: Undergraduate courses in multivariable calculus and linear algebra.)*

MTH 5420 THEORY OF STOCHASTIC PROCESSES (3 credits). Course includes discrete- and continuous-time stochastic processes, point and counting processes and Poisson counting process; as well as compound Poisson process, nonstationary Poisson process, renewal theory, regenerative processes and Markov chains. *(Prerequisite: MTH 5411.)*

MTH 5425 THEORY OF STOCHASTIC SIGNALS (3 credits). A study of the Wiener process, stationary and weakly stationary processes, white noise processes, stochastic differential equations, spectral theory of stationary processes, linear filtering problems, Hilbert spaces, autoregressive processes and mean square error prediction. *(Prerequisite: Permission of the instructor.)*

MTH 5430 QUEUING THEORY (3 credits). Includes queuing processes: imbedded and continuous time parameter processes; Markov, semi-Markov and semi-regenerative processes; single-server and multiserver queues; and processes of servicing unreliable machines. Controlled stochastic models. *(Prerequisite: MTH 5411.)*

OPERATIONS RESEARCH

ORP 5001 DETERMINISTIC OPERATIONS RESEARCH MODELS (3 credits). An applied treatment of modeling, analysis and solution of deterministic operations research problems. Topics include model formulation, linear programming, network flow and transportation problems and algorithms, integer programming and dynamic programming. *(Prerequisite: At least one upper-level math course.)*

ORP 5002 STOCHASTIC OPERATIONS RESEARCH MODELS (3 credits). An applied treatment of modeling, analysis and solution of probabilistic operations research problems. Topics chosen from decision analysis, game theory, inventory models, Markov chains, queuing theory, simulation, forecasting models. *(Prerequisites: At least one upper-level undergraduate math course, preferably probability and statistics.)*

ORP 5003 OPERATIONS RESEARCH PRACTICE (3 credits). An introduction to the practice of operations research (OR). Lecture topics include the OR methodology, how an OR analyst interacts with clients, and preparation and presentation of oral reports. Students form teams to analyze real cases where each student gets an opportunity to be a team leader and perform the oral reports. *(Prerequisite: ORP 5001, ORP 5002.)*

ORP 5010 MATHEMATICAL PROGRAMMING (3 credits). A survey of popular optimization techniques. Topics chosen from linear, integer, nonlinear, dynamic and network flow programming; combinatorial graph algorithms. *(Prerequisites: ORP 5001 or MTH 5102, or permission of the instructor.)*

ORP 5011 DISCRETE OPTIMIZATION (3 credits). A study of combinatorial optimization and integer programming. *(Prerequisites: ORP 5001, MTH 5051.)*

ORP 5020 THEORY OF STOCHASTIC PROCESSES (3 credits). This course introduces stochastic models, discrete- and continuous-time stochastic processes, point and counting processes, Poisson counting process, compound Poisson processes, nonstationary Poisson processes, renewal theory, regenerative processes and Markov chains. *(Prerequisite: MTH 5411, or permission of the instructor.)*

ORP 5021 QUEUING THEORY (3 credits). Topics include queuing processes; imbedded and continuous time parameter processes; Markov, semi-Markov and semi-regenerative processes; single-server and multiserver queues; processes of servicing unreliable machines and computer applications; and controlled stochastic models. *(Prerequisite: MTH 5411, or permission of the instructor.)*

ORP 5030 DECISION ANALYSIS (3 credits). Covers normative models of decisions under certainty, risk and uncertainty; assessment of subjective probability and utility functions; Bayesian decision analysis and the value of information; influence diagrams; and descriptive aspects of decision making. *(Prerequisite: Undergraduate statistics.)*

ORP 5031 MULTIOBJECTIVE DECISION ANALYSIS (3 credits). Covers normative models of decisions considering multiobjective and multiattribute models. Topics include multiattribute utility theory, the analytical hierarchy process, linear multiobjective programming and goal programming. *(Prerequisites: ORP 5001, ORP 5030.)*

ORP 5040 QUALITY ASSURANCE (3 credits). Covers the principles and application of statistical quality control and statistical process control. *(Prerequisite: Undergraduate statistics.)*

ORP 5041 RELIABILITY ANALYSIS (3 credits). Covers the principles of reliability analysis and assessment; reliability probability models; combinatorial and system reliability; and reliability estimation. *(Prerequisite: MTH 5411, or permission of the instructor.)*

ORP 5042 RELIABILITY, AVAILABILITY AND MAINTAINABILITY (3 credits). Discussion of maintainability concepts relating to system effectiveness and support-system design. Topics include basic mathematical concepts, design concepts and data analysis used in quantifying availability, maintainability and reliability as measures of operational readiness and system effectiveness. *(Prerequisite: ORP 5041.)*

ORP 5050 DISCRETE SYSTEM SIMULATION (3 credits). Covers the principles of building and using a discrete event simulation; construction and statistical testing of random variate generators; statistical analysis and validation of results; design of simulation projects; and variance reduction methods. *(Prerequisite: MTH 5411, or permission of the instructor.)*

ORP 5051 APPLIED EXPERT SYSTEMS (3 credits). Covers the concepts and methods of rule-based expert systems; methods of knowledge representation; and use of an expert system shell to build a small expert system. *(Noncredit for CS majors.)*

ORP 5070 SEQUENCING AND SCHEDULING (3 credits). This course bridges the gap between scheduling theory and its application in manufacturing and service environments. It emphasizes basic scheduling principles and will use selected readings and case studies to illustrate the use of these concepts in industrial environments.

ORP 5090, ORP 5091 SPECIAL TOPICS IN OPERATIONS RESEARCH 1, 2 (3, 3 credits). Content of these operations research study courses are variable depending on the fields of expertise of the faculty and the desire and needs of the students.

ORP 5999 THESIS RESEARCH (3 credits). Individual research under the direction of a major adviser approved by the chairman of the program. A maximum of six credits may be credited toward the master's degree.

SPACE SYSTEMS

SPC 5001 INTRODUCTION TO SPACE SYSTEMS (3 credits). Includes systems engineering; space flight history, space environment, astrodynamics, rocket propulsion, launch vehicle selection, space telecommunications, remote sensing, spacecraft configuration, structures, materials, power and thermal systems, launch and space mission operations, spacecraft navigation, guidance, control and military space applications.

SPC 5002 INTRODUCTION TO SPACE ENVIRONMENT (3 credits). Introduces properties of the space environment, particularly those important to space system design and operations.

Includes microgravity, high vacuum, excited molecular species, space debris, the heliosphere, solar and cosmic radiation, solar-planetary interactions, planetary magnetospheres, trapped radiation and planetary ionospheres and thermal plasmas.

SPC 5004 SPACE PROPULSION SYSTEMS (3 credits). Topics include principles of rocket propulsion, liquid and solid chemical rockets, throttling and thrust vectoring, electric and electromagnetic propulsion, solar sailing, space tethers and nuclear radioisotope, fission reactor and fusion propulsion systems. *(Prerequisite: SPC 5001.)*

SPC 5005 SPACE POWER SYSTEMS (3 credits). Includes energy conversion and storage in space; chemical, mechanical and thermal energy storage; fuel cell types; photovoltaic cells, thermionic, thermoelectric and radioisotope thermoelectric generators; power generators; space nuclear technology; and space station energy system design. *(Prerequisite: SPC 5001.)*

SPC 5006 SPACE COMMUNICATIONS AND DATA SYSTEMS (3 credits). Reliable spacecraft telecommunication systems via radio frequency links with small performance margins. Digital modulation techniques, noise temperature, channel capacity and data/waveform coding techniques for BER improvement. Methods of data acquisition, storage and processing. *(Prerequisite: SPC 5001.)*

SPC 5009 SPACE STRUCTURES AND MATERIALS (3 credits). Design of structures of adequate strength and stability with little weight margin. Tension, torsion, compound stresses, simple and composite beams, thin- and thick-walled cylinders and buckling. Properties of space-qualified materials, deterioration, damage, outgassing, oxidation, radiation resistance. *(Prerequisite: SPC 5001.)*

SPC 5010 SPACECRAFT GUIDANCE, NAVIGATION AND CONTROL (3 credits). The principles and practice of electronic, inertial, and stellar navigation, onboard and ground-controlled; attitude control methods and systems; and orbital guidance technology and systems. *(Prerequisite: SPC 5001.)*

SPC 5011 HUMAN SPACE SYSTEMS (3 credits). The role of astronauts in space. Astronaut and cosmonaut achievements in space research, extravehicular activity, long-duration space flight and lunar exploration. The space shuttle, space stations, future space habitats, lunar bases and expansion into heliocentric space. *(Prerequisite: SPC 5001.)*

SPC 5013 SPACE SYSTEMS ASTRODYNAMICS (3 credits). Topics include two- and three-body orbital problems, sun-synchronous mapping orbits, geostationary orbit and perturbations, out-of-plane orbital transfers, orbital rendezvous, ballistic missile problems and patched conic and gravity-assist interplanetary trajectories.

SPC 5017 AEROSPACE REMOTE SENSING SYSTEMS (3 credits). Principles and applications of remote sensing from the atmosphere and space; sensors for various wavelengths, imaging systems, data handling, image reconstruction and processing; contemporary remote sensing applications; geographic information systems and nonterrestrial atmospheres. *(Prerequisite: SPC 5001.)*

SPC 5018 LAUNCH AND SPACE MISSION OPERATIONS (3 credits). Overviews typical mission operations, from prelaunch through launch, tracking, orbit modification, spacecraft deployment and checkout. Range tracking, telemetry, safety instrumentation, transition to on-orbit communications and Tracking and Data Relay Satellite System. *(Prerequisite: SPC 5001.)*

SPC 5065 SPACE SYSTEMS FOR REMOTE OPERATIONS (3 credits). Principles of robotics, artificial intelligence and remotely controlled exploration, operation, observation and manipulation. Design of equipment for processing, manufacturing, maintaining and repairing equipment in space, and in lunar and planetary environments. *(Prerequisite: SPC 5001.)*

SPC 5066 SPACEFLIGHT HUMAN PHYSIOLOGY (3 credits). Emphasis is on the physiologic capabilities and limitations of astronauts. Data from both the United States and Russian space programs are reviewed for each phase of space flight. Human participation in long-duration space station, lunar and planetary missions is previewed. *(Prerequisite: Graduate standing.)*

SPC 5080 SPACE MISSIONS (3 credits). The competitive design, by student teams, of a space mission specified by the instructor. Candidate mission subjects include astronomy, communications, human space missions, planetary and interplanetary robotic exploration and remote sensing. *(Prerequisite: Satisfactory completion of six required space systems courses with a GPA of at least 3.0.)*

SPC 5090 SPECIAL TOPICS IN SPACE SYSTEMS (3 credits). Individual study of specific problems in space systems. *(Prerequisite: Permission of the program chair.)*

SPC 5091 SPECIAL TOPICS IN SPACE SYSTEMS (1 credit). Individual study of specific problems in space systems. *(Prerequisite: Permission of the program chair.)*

SPC 5092 SPECIAL TOPICS IN SPACE SYSTEMS (2 credits). Individual study of specific problems in space systems. *(Prerequisite: Permission of the program chair.)*

SPC 5999 THESIS (3 credits). Individual work, under the direction of a member of the graduate faculty, on a selected topic in the field of space systems. *(Prerequisites: Completion of 18 semester hours in space systems with a GPA of at least 3.0 and written approval from the program chair.)*

SPACE SCIENCES

SPS 1010 INTRODUCTORY ASTRONOMY (3 credits). A descriptive survey of astronomical topics suitable for both majors and nonmajors in the space sciences. Topics include properties of light, astronomical instrumentation, stellar structure and evolution, the interstellar medium, galactic formation and evolution, large scale structure and cosmology.

SPS 1020 INTRODUCTION TO SPACE SCIENCES (3 credits). A study of the solar system and its member planets, moons, rings and small bodies —their formation, dynamic, chemistry, atmospheres, surface features, interiors and magnetic fields. Results of recent space probes are presented in a comparative study of the solar system's members.

SPS 2010 OBSERVATIONAL ASTRONOMY (3 credits). The course combines lecture and observational labs to provide an introduction to the techniques of observational astronomy. Topics, include celestial coordinate systems, time, apparent stellar motions, constellations, the use of star charts and catalog, and visual, photoelectric and CCD photometry. *(Prerequisites: SPS 1010, MTH 1001.)*

SPS 3010 GEOPHYSICS (3 credits). Introductory study of the structure, internal constitution, deformation and dynamics of the solid earth as revealed by surface geophysical manifestations (gravity, magnetic, electrical, seismic). Topics include heat flow, electromagnetic induction, tides, the gravitational field and magnetic field. *(Prerequisites: MTH 2001, PHY 2002.)*

SPS 3020 METHODS AND INSTRUMENTATION (3 credits). A detailed introduction to the techniques and instrumentation used in modern observational astronomy and space science. Topics include astronomical sources, observational limits, telescopes, atmospheric effects, spectrographs, single-channel detectors and advanced solid-state detectors of all types. *(Prerequisite: PHY 2002.)*

SPS 3030 ORBITAL MECHANICS (3 credits). This course provides the foundations of basic gravitation and orbital theory. Topics include coordinate and timekeeping systems, the two-body problem, particle dynamics and motion under inverse square forces, particularly as applied to spacecraft orbit determinations, trajectories, time of flight and maneuvers. *(Prerequisite: PHY 3011.)*

SPS 3040 FUNDAMENTALS OF REMOTE SENSING (3 credits). History, measurement philosophy, orbits, vehicles, the nature of electromagnetic radiation (EMR), blackbodies, Maxwell's equations, interaction of EMR with matter, polarization, radiance, irradiance, radiative transfer and an overview of ultraviolet, visible, infrared and microwave radiometry and instrumentation. *(Prerequisite: PHY 2002.)*

SPS 4010 ASTROPHYSICS 1: INTRODUCTION TO STELLAR STRUCTURE AND EVOLUTION (3 credits). An introduction to the physics of the Sun and stars. Topics include properties of E&M radiation, stellar distances and magnitudes, radiative transfer, the Sun, the ISM and star formation, stellar evolution, stellar endpoints and variable stars. *(Prerequisites: MTH 2201, PHY 3060.)*

SPS 4020 ASTROPHYSICS 2: GALACTIC STRUCTURE AND COSMOLOGY (3 credits). Topics include galactic coordinates, galactic rotation curve, N-body concepts and the virial theorm, Galactic formation and evolution, external galaxies, galaxy cluster evolution, Hubble's law and the distance scale, large-scale structure, cosmology and the particle physics connection. *(Prerequisite: SPS 4010.)*

SPS 4025 INTRODUCTION TO SPACE PLASMA PHYSICS (3 credits). The physics of ionized gases is introduced beginning with the subjects of single-particle motion, collection of particles, fluid description of plasmas and magnetohydrodynamics. The role of plasmas in solar-terrestrial space physics is emphasized. Heliospheric, magnetospheric and ionospheric topics are included. *(Prerequisite: PHY 3440.)*

SPS 4030 PHYSICS OF THE ATMOSPHERE (3 credits). A study of the behavior of the Earth's lower atmosphere, including an introduction to comparative planetology, atmospheric evolution, thermodynamics, dynamics, waves and turbulence clouds, hurricanes, global circulation and global change *(Prerequisites: PHY 3060, MTH 2201.)*

SPS 4035 COMPARATIVE PLANETOLOGY (3 credits). A comprehensive survey. Observations from both space-based and Earth-based experimentation is incorporated with the major planetary bodies, asteroids, comets and other small orbitals. The topics of both planetary interiors surface features and atmospheres will be discussed. *(Prerequisites: PHY 3060 and SPS 1020.)*

SPS 4100 SENIOR LABORATORY 1 (2 credits). Students conduct experiments in optics, atomic structure, nuclear and solid state physics that are basic to observations in space sciences. *(Prerequisite: Senior standing in physics or space sciences.)*

SPS 4110 SENIOR LABORATORY 2 (2 credits). Students conduct experiments in optics, atomic structure, nuclear and solid state physics that are basic to observations in space sciences. *(Prerequisite: Senior standing in physics or space sciences.)*

SPS 4200, SPS 4210 SENIOR SEMINAR 1, 2 (1, 1 credit). This seminar includes reports and discussions on selected topics in contemporary, experimental and theoretical physics and space sciences. *(Prerequisite: Student must be within three semesters of graduation.)*

SPS 4201 SPECIAL TOPICS IN SPACE SCIENCES (3 credits). Specific problems of space sciences are studied. *(Prerequisite: Permission of the department head.)*

SPS 4301 INDEPENDENT STUDIES (3 credits). Individual study of specific problems in space sciences. *(Prerequisite: Permission of the department head.)*

SPS 4400 SPACE LAUNCH SYSTEMS (3 credits). The assembly, preparation and checkout for launch of several space-launch systems built by different manufacturers. Students review the actual procedures, hardware and facilities used. *(Prerequisite: Senior standing or permission of the instructor.)*

SPS 4401 MATERIAL PERFORMANCE (3 credits). Special requirements for materials used in space flight hardware, including characterizing and evaluation of performance and failure analysis of the components. The materials analytical facilities at NASA/KSC will be utilized. *(Prerequisite: Senior standing or permission of the instructor.)*

SPS 4402 TELEMETRY AND SPACE COMPUTER SYSTEMS (3 credits). This course is concerned with the transmitted data stream from and to a typical space vehicle during its mission. Students also study the computer software and systems used to control the vehicle. *(Prerequisite: Senior standing or permission of the instructor.)*

SPS 4403 SMALL SATELLITE/PAYLOAD INTEGRATION AND MISSION ANALYSIS (3 credits). A course on payload integration in conjunction with actual shuttle payload activities at NASA/KSC. Classes center on vehicle and payload systems as they are being prepared for launch, including spacecraft power, altitude control, communications, etc. *(Prerequisite: Senior standing or permission of the instructor.)*

SPS 5010 ASTROPHYSICS 1: STELLAR STRUCTURE AND EVOLUTION (3 credits). Introduces basic interior structural equations, energy generation processes, opacity, and energy transport; radiation transport in stellar atmospheres, star formation, late stages of stellar evolution, stellar binaries and clusters. Special emphasis is placed on analytic and numerical models relevant to the sun. *(Prerequisites: SPS 1010, PHY 3064.)*

SPS 5011 ASTROPHYSICS 2: GALACTIC STRUCTURE AND COSMOLOGY (3 credits). Topics include formation and evolution of the Galaxy, including stellar populations and kinematics, spiral density theory; extragalactic astronomy, active galactic nuclei, Hubble's law, large-scale structure; and cosmology, including inflationary cosmology and the particle physics connection. *(Prerequisite: SPS 5010.)*

SPS 5020 SPACE PHYSICS 1: THE LOW-ENERGY UNIVERSE (3 credits). An introduction to low-energy space plasma physics including the statistical behavior of plasmas, kinetic theory and magnetohydrodynamics. Emphasis is on solar system space plasma physics and the Sun-Earth connection including magnetospheric physics. *(Prerequisite: ECE 5410.)*

SPS 5021 SPACE PHYSICS 2: THE HIGH-ENERGY UNIVERSE (3 credits). The theorectical background and methods for observing gamma rays, x-rays, high-energy electrons, heavy particles, cosmic rays, neutrons and gravitational waves from both spacecraft and Earth. *(Prerequisite: SPS 5020 or instructor approval.)*

SPS 5030 PLANETARY SCIENCE 1: INTERIORS (3 credits). Mechanical and thermal processes governing the interior structure and surfaces of the major and minor planetary bodies of the solar system. Topics include the planetary crust, mantel, core, core-mantle interface, seismicity, density and elastic constraints. *(Prerequisite: SPS 3010 or permission of the instructor.)*

SPS 5031 PLANETARY SCIENCE 2: ATMOSPHERES (3 credits). Principles governing the evolution, composition and retention of planetary atmospheres and the interplanetary environment.

Topics include the neutral atmosphere, photochemical processes, diffusion dynamics and planetary ionospheres and magnetospheres. *(Prerequisite: SPS 4030.)*

SPS 5050 ASTRODYNAMICS (3 credits). Topics include the gravitational force, circular restricted three-body problem, many-bodies problem, perturbation theory, rocket dynamics, transfer orbits, motion of an artificial satellite and interplanetary trajectories. *(Prerequisite: SPS 3030.)*

SPS 5088, SPS 5089 SPECIAL TOPICS IN SPACE SCIENCES (3, 3 credits). Investigation of specific problems in the space sciences. *(Prerequisite: Permission of the department head.)*

SPS 5090, SPS 5091 SPECIAL TOPICS IN OBSERVATIONAL ASTRONOMY 1, 2 (3, 3 credits). Participation in advanced observing programs at the university's observatories. *(Prerequisite: Permission of the department head.)*

SPS 5999 THESIS (3 credits). Individual work under the direction of a member or members of the graduate faculty on a selected topic in space sciences. *(Prerequisite: Permission of the department head.)*

SOFTWARE ENGINEERING

SWE 5001 SOFTWARE ENGINEERING 1 (3 credits). The application of engineering rigor to all phases of software development, including requirements elicitation and analysis, and software architecture, design, construction, integration, testing and maintenance. Each student will work individually to apply a prescribed discipline from an initial problem statement through the release of the completed software.

SWE 5002 SOFTWARE ENGINEERING 2 (3 credits). Covers the application of engineering rigor and team coordination to the development of a software product. Teams will create and document their own disciplined procedures for each phase of software development based on an initial problem statement, then create the software from the established procedure. Upon completion, teams will be required to provide an in-depth critique of the process. *(Prerequisite: SWE 5001.)*

SWE 5110 REQUIREMENTS ENGINEERING (3 credits). This course provides an in-depth study of software requirements, engineering tools and techniques. Topics will include gathering user requirements, formal specification of system behavior, system interfaces, end-user and system documentation and validation techniques. The end-user aspect of gathering and formalizing or user requirements is emphasized. *(Prerequisite: SWE 5000.)*

SWE 5310 INTERFACE DEVELOPMENT (3 credits). This course focuses on a specific class of software for which special engineering consideration must be given—software interfaces. The four major categories to be explored (human interfaces, file/database interfaces, APIs and real-time interfaces) and techniques to read from and write to these interfaces are given. *(Prerequisite: SWE 5000.)*

SWE 5320 WINDOWS SYSTEMS PROGRAMMING (3 credits). Focuses on programming for Windows 32- and 64-bit operating systems. Windows handling of processes, threads and memory management with emphasis on writing programs to optimally use these resources. Use of and programming for UNICODE, dynamic link libraries and the WIN32 API. Students write substantial programs in Visual C++. *(Prerequisite: SWE 5000).*

SWE 5411 SOFTWARE TESTING 1 (3 credits). Explores functional (black box) methods for testing software systems, reporting problems effectively and planning testing projects. Students will apply their learning throughout the course to a sample application that is commercially available or under development. The choice of sample application changes from term to term. Past applications have included OpenOffice, Microsoft Office, and the TI interactive calculator. *(Prerequisites: CSE 2410 or SWE 5000, and MTH 2051, MTH 2401.)*

SWE 5415 SOFTWARE TESTING 2 (3 credits). Explores structural (glass box) methods for testing software the student has written or can analyze at the source code level. Testing of variables in simultaneous and sequential combinations; application programmer interfaces; protocols; design (and test) by contract, coverage analysis, testability, diagnostics, asserts and other methods to expose errors; regression test frameworks; and the test-first approach to programming. *(Prerequisites: CSE 2410 or SWE 5000, and CSE 3411 or SWE 5411; corequisite: CSE 3101 or CSE 4001 or CSE 5001.)*

SWE 5430 SOFTWARE TESTING TOOLS (3 credits). This project-oriented course requires students to perform a survey of existing testing tools and to test a featured software product. Students are responsible for assessing functionality of testing tools and working with tool vendors to acquire and deploy a number of tools to test a real software application. *(Prerequisite: SWE 5410).*

SWE 5440 INTRODUCTION TO SOFTWARE ARCHITECTURE (3 credits). Covers the role of architecture in the software engineering life cycle. Techniques covered include those for designing a software architecture that satisfies functional requirements; analyzing with respect to certain required attributes such as performance, reliability and maintainability; and transforming the initial architecture to one that better satisfies the required attributes while still meeting the functional requirements. *(Prerequisite: SWE 5001.)*

SWE 5460 COMPUTER AND INFORMATION SECURITY (3 credits). An examination of concepts of modern computer security from a practical point of view. Topics include secure system design, system vulnerability, threat assessment, intrusion detection, cryptography, and legal and ethical issues in computer security. Emphasis on software engineering applications of security and implementation of a secure computer system.

SWE 5510 SOFTWARE MAINTENANCE (3 credits). This course describes abstraction techniques to extract specifications and design from existing code. The use of these techniques in debugging, re-engineering and software enhancement is discussed. *(Prerequisite: SWE 5000.)*

SWE 5621 SOFTWARE METRICS AND MODELING (3 credits). Examines common software metrics, axiomatic foundations of measurement, validity of measurements and measurement dysfunction, and some statistical and modeling approaches that may help students make their software measurements meaningful. *(Prerequisites: CSE 2410 or SWE 5000 or SWE 5001, and MTH 2401.)*

SWE 5630 SOFTWARE TOOLS AND TECHNOLOGY (3 credits). This course presents the tools and techniques that support software engineering at all levels. Computer-aided software engineering is assessed in terms of development support at the technical level (decomposition, analysis, design and implementation support, and verification/validation capabilities) and at the management level. *(Prerequisites: SWE 5000, SWE 5010.)*

SWE 5900 SPECIAL TOPICS IN SOFTWARE ENGINEERING (1–3 credits). Selected topics of current interest in software engineering. Material varies according to faculty and student interest. This course may be repeated for credit. *(Prerequisite: Permission of the instructor.)*

SWE 5999 THESIS IN SOFTWARE ENGINEERING (3 credits). This course is individual work under the direct guidance of a faculty member, culminating in the formal defense of a written thesis. *(Prerequisite: Permission of the instructor.)*

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