Paul LaViolette ’79
Venture Partner
SV Life Sciences
Boston, MA

Joan B. Makara
Vice President Global Risk Operations
Consumer Finance
GE Capital
Norwalk, CT

Christopher McCormick ’77
President & Chief Executive Officer
LL Bean
Freeport, ME

Andrew McMahon ’89, P’13
President Financial Protection and Wealth Management
AXA Equitable Life Insurance
New York, NY

Robert M. McMahon ’87
Senior Managing Director
GE Capital Americas
Norwalk, CT

Gavin O’Connor ’88
CAO Investment Management Division
Goldman Sachs
New York, NY

Managing Director & Practice Leader
Alvarez & Marsal Valuation Services, LLC
New York, NY

James J. O’Shaughnessy ’79
Global Chairman, Entertainment and Media Practice
PricewaterhouseCoopers LLP
Stamford, CT

Kevin C. Piccoli ’79
Deputy Director
CFTC
New York, NY

Joseph D. Sargent ’59, P’86, ’88
Fairfield, CT

Maive Scully ’76
Senior Vice President & CFO (Retired)
GE Money
Fairfield, CT

Kevin C. Shea ’87
Managing Director
Goldman Sachs
New York, NY

Steven Siwinski ’92
Upper Montclair, NJ

Christopher J. Stephens, Jr.
Senior Vice President
Finance and CFO
Barnes Group Inc.
Bristol, CT

School of Engineering
2012-13
A Message to Students

Welcome to the School of Engineering of Fairfield University. Here, we are devoted to serving students as they pursue successfully undergraduate and graduate engineering degrees. The School provides opportunities to students to combine study with experience and professional practice through classroom instruction and industrial internships, offering the prospect for the best in engineering education.

The School of Engineering strives to maintain the highest level of institutional and instructional integrity, and remains committed to the Ignatian ideals of education, including intellectual rigor, service to others, and service to faith, with the promotion of justice for all as an absolute requirement. In pursuit of this mission, the School dedicates its resources to the nurturing of the intellectual capital and skills of its students across disciplines, and devotes the material means needed to support a robust working and learning environment. The School's graduates will have mastered theoretical and practical knowledge of engineering skills, and will have acquired additional competencies in communications, critical judgment, social responsibility, and a sense of economic and ethical values.

In the following pages in this catalog, you will find an explicit description of the academic goals of each of the engineering disciplines offered in the School of Engineering. As expected, these goals dictate the curricula and degree requirements. The engineering curricula include a robust core of liberal arts courses - the hallmark of Fairfield's education - that aim to endow our engineering graduates with competencies that transform them into thinking citizens and lifelong learners, and prepare them to live an inspired life. Additionally, our ambition in the School of Engineering is to enable all our students to assume positions of technical leadership and professional responsibilities by the time they graduate.

Furthermore, we train our graduates to become energetic participants in the social change that engineering and science bring about in the course of time. On behalf of the entire School of Engineering faculty, staff, and administration, welcome. We remain committed to excellence in engineering education.

Dr. Jack W. Beal
Dean, School of Engineering

Program Goals and Assessment

The School of Engineering aims to graduate students with leading-edge engineering skills and additional competencies in oral and written communications and critical thinking who possess a well-developed cultural orientation, an understanding of economic values, and a sense of ethical and social responsibility. The engineering curriculum addresses several knowledge areas: science and mathematics, computer science, major engineering field requirements, and engineering design. On one hand, a liberal studies core composed of courses in English, the humanities, social sciences, and the arts, on the other. Of particular note is the first-year course, Fundamentals of Engineering (EG 31), which is designed to introduce students to the engineering mindset - the tools and vision of engineering - and enable them to recognize the role of creativity and innovation in engineering, and to differentiate among engineering disciplines and their interactions. At the other end of the engineering experience, during the fourth year of studies, the team-driven senior project course offers a rigorous learning experience that completes the education of engineering students.

The mission of Fairfield's engineering program is to graduate liberally educated engineers equipped with knowledge and experiential skills so they may successfully enter the mainstream of industrial/manufacturing activity, education, or government service, or to continue with postgraduate studies. To that end, the School of Engineering:

- continuously improves the quality and currency of its instructional programs and monitors their outcome,
- equips engineering laboratories with modern and versatile equipment and software applications,
- provides support services - advising, self-paced learning, tutorials - as needed by engineering students,
- maintains a close working relationship with industry to better know its needs and identify new opportunities to serve it.

SCHOOL OF ENGINEERING

Administration

Dean: Jack W. Beal, Ph.D.
Associate Dean: William Taylor, Ph.D.
Director of Laboratories: Paul Botosani, Ph.D.

Program Goals and Assessment

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Facilities

The School of Engineering, along with primary laboratory and computer facilities, are located in McAuliffe Hall. Science and additional classroom and computer application facilities are in the Bannew Science Center. A tutorial facility and a reading and reference lounge are also in McAuliffe Hall. The engineering reference and circulating collection is housed in the University's Dhimenna-Nyaeilus Library. The School's laboratories are equipped with modern instrumentation and are subject to continuous innovation in order to provide an environment for experiential learning that is closely integrated with classroom learning. The School of Engineering complements its educational activities through its Web-based facility, which links laboratory instrumentation to the School's global network, and so

Mentoring

Entering and continuing students meet with academic advisors to design jointly their schedule of courses. Students review their academic records before course registration each semester with assistance from advisors to keep abreast of their progress. The school provides counseling to students upon request so that their academic goals can be achieved efficiently and economically. Department chairs and program directors are actively involved in student advising and mentoring. Practicing engineers are often invited to participate in mentoring of interdisciplinary teams in the final senior design project.

Tutoring

Out-of-classroom assistance, provided by engineering professionals, is available in the school's tutorial center on a daily basis. A schedule of tutorial/mentoring services is distributed to all students in the beginning of each term.

School of Engineering
enables demonstration of phenomena, simulation of processes, measurements, and data management in learning-supporting fashion. Finally, a small number of engineering courses are offered online as needed. A video-tutorial format is among the teaching tools in the School of Engineering. The School’s website is www.fairfield.edu/engineering. It offers information on the School, its programs, courses, and faculty.

Transfer Admission

General Transfer

Students with previous studies at other accredited institutions may apply for transfer to the School of Engineering. Credit for work completed elsewhere, with a grade of C or better, will be granted for equivalent Fairfield courses, in accordance with Fairfield University guidelines. The transfer student must provide an official transcript of all academic work and a catalog with course descriptions from each institution previously attended.

Transfer from Community Colleges

The School of Engineering has articulation agreements with the Connecticut College of Technology embracing the 12 community colleges in Connecticut. Under this agreement, the B.S. degree completion by graduates of community colleges with an engineering associate’s degree is greatly facilitated at Fairfield University. Bridge courses to facilitate transfer, and some financial aid to transfers from community colleges, are also offered by the School of Engineering.

School Activities/Relationships with Area Industry

Engineering students at Fairfield University may join the Engineering Student Society, an umbrella organization that embraces student chapters of the American Society of Mechanical Engineers, Society of Manufacturing Engineers, the Institute of Electrical and Electronics Engineers, and the Society of Women Engineers. Students are encouraged to join EES and profit from events sponsored by the chapters.

The School of Engineering maintains direct relations with area industries and manufacturers. These open lines of communication encourage the flow of information and support that keeps the engineering curriculum current and relevant to the environment in industry. These contacts are particularly useful to students in the senior design project course where they tackle real-life engineering problems encountered by practicing engineers and become involved in the mainstream of engineering activity.

The SOE Advisory Board

The School of Engineering receives support and guidance in program development and other matters from its Advisory Board, a group of men and women in leading positions in industry and education.

General Education Core Curriculum

The general education core curriculum provides a liberal education, drawing upon four major areas of knowledge. For each of these four areas of competency, Engineering majors select courses as follows.

Area I: Mathematics and Natural Sciences

• Three semesters of Mathematics: MA 145, MA 146; MA 245. In addition, Computer Engineering majors also take MA 231, MA 321, and MA 351. Electrical Engineering majors also take MA 231 and MA 351. Mechanical Engineering majors also take MA 321. Software Engineering majors also take MA 231, MA 321, MA 351, and a MA elective.

• Two semesters of General Physics: PS 16/15 Lab, PS 16/15 Lab, Automated Manufacturing Engineering, Electrical and Mechanical Engineering majors also take CH 111/111 Lab. Computer Engineering majors also take a 4-credit science/lab elective. Software Engineering majors also must take a science elective.

Area II: History and Social Sciences

• Two semesters of History: HI 10 is required plus one 200-level History course. CL 115/116 (Greek and Roman Civilization) may be taken to fulfill this requirement.

• EEC 11 Introduction to Microeconomics plus one Social Science elective.

Area III: Philosophy and Religious Studies

• Two semesters of Philosophy: PH 101 is required plus one 200-level Philosophy course.

• Two semesters of Religious Studies: RS 101 is required plus one 200-level Religious Studies course.

• AE 287 Engineering Ethics.

Area IV: English and Visual and Performing Arts

• EN 11 Texts and Concepts I.

• EN 12 Texts and Concepts II.

• One semester of English literature with a course number between EN 100-199. Writing courses (EN/W) do not fulfill the core literature requirement. Selected courses offering literature in translation may also fulfill this requirement - see listings under classical studies as well as modern languages and literature.

• One semester of visual and performing arts history - art history, music history, theatre history or new media film, television, and radio history.


Area V: Modern and Classical Languages

• Engineering majors are exempt for the Modern and Classical Languages requirement.

Diversity Requirements

All full-time and part-time students must complete one U.S. and one World Diversity course from a designated list of courses.

Undergraduate Programs

The School of Engineering offers undergraduate programs leading to the Bachelor of Science in Engineering degree and the associate degree in engineering, as well as certificate programs in automated manufacturing and information technology.

Bachelor of Science in Engineering

Students in this program complete 132 to 134 credit hours. Students begin their studies with EG 31, Fundamentals of Engineering, and complete the degree requirements with the team-based Senior Design Project. EG 31 is designed to introduce first-year students to important design elements and the tools of engineering and develop their skills in analysis and synthesis, and in teamwork. It further provides the basis for students to select the engineering discipline most suitable to their skills and career objectives. The Senior Design Project caps students' engineering education by demanding the implementation of engineering design principles and associated skills in designing for functionality, reliability, and economy in real-world projects undertaken by multidisciplinary teams. All engineering programs include experiential learning in laboratory courses and culminate with the Senior Design Project. Students can avail themselves of opportunities for independent study and for internships in local industry. As a rule, the undergraduate curriculum, pursued on a full-time basis, is completed in:

- The traditional 4-year full-time program.
- The 3/2 five-year program.
- The part-time evening program.

The Full-Time Traditional Program

This program leads to a B.S. in Engineering degree in one of the following:

- automated manufacturing engineering
- computer engineering
- electrical engineering
- mechanical engineering
- software engineering

As shown in later pages, this four-year course of study encompasses 132 to 134 credit hours, depending on the specific degree, in areas of engineering, science, mathematics, computer science, and the liberal arts. Freshmen are introduced into the spirit and vision of engineering through the Fundamentals of Engineering course. Seniors complete their degree requirements with the Senior Design Project.

The 3/2 Five-Year Program

The 3/2 engineering program is a five-year course of study. Students complete three years of studies at Fairfield in the areas of mathematics, the sciences, a portion of the engineering curriculum, humanities and social sciences, and two years of specialized engineering studies at one of four partner institutions: Columbia University, Rensselaer Polytechnic Institute, the University of Connecticut, and Stevens Institute of Technology. Students in this program earn two degrees, a B.A. from Fairfield University and a B.S. in engineering from one of the other four institutions. Through our partner schools, students have expanded options in choosing an engineering discipline: e.g., aeronautical, chemical, civil, environmental, biomedical, and nuclear engineering. With a 3.2 grade point average, students in the 3/2 program may transfer automatically to a university of their choice among the four partner institutions. Students who have completed the liberal arts core will be awarded the B.A. degree from Fairfield University at the end of their fourth year of studies, and will be graduated with their Fairfield class.

The Part-Time Evening Program

This program leads to either:

- a B.S. degree in electrical, mechanical, automated manufacturing, computer, or software engineering covering the same curriculum as the traditional 4-year full-time program.
- an associate degree (A.S.) in electrical or mechanical engineering, or
- a certificate in automation, and/or information technology.

This program allows fully employed students to pursue engineering degrees on a part-time basis at a pace suited to their circumstances. In most instances, employers provide tuition reimbursement. The technical curriculum requirements for this program are the same as those for the full-time traditional program. However, occasionally work and/or life experience may count toward a reduced required curriculum upon permission of the dean. Advanced engineering classes, offered in the evening, are subscribed by both full-time and part-time students.

Major Areas of Study

Specific program objectives and curriculum requirements are provided in the sections that follow each engineering discipline. In general, the curricula consist of four areas:

- major field requirements
- major field electives
- general education and core curriculum courses
- general electives
Graduates may continue their studies to the B.S. and master’s degree simultaneously, when all the requirements of the combined degree curriculum have been satisfied.

Minor in Engineering
The School of Engineering offers a minor in engineering for non-engineering students. This is a 14-credit hour course of study for students who have completed two courses in calculus and two in physics with a grade of C or better. Students who choose the engineering minor will benefit intellectually from exploring the field of engineering and will strengthen their candidacy for professional studies such as medicine or law.

Graduate Programs
The School of Engineering offers four master of science in engineering degrees: M.S. in the management of technology, which is offered in conjunction with the MBA program in the Charles F. Dolan School of Business; M.S. in software engineering; M.S. in electrical and computer engineering; and M.S. in mechanical engineering. In addition, graduate engineers with special interests may enroll in certificate programs in Automated Manufacturing, Database Management, Information Security, Network Technology, and Web Application Development. For information about these programs, please see the School of Engineering graduate catalog, or visit the School’s website at www.fairfield.edu/engineering.

Bachelor of Science
Automated Manufacturing Engineering is a multidisciplinary field; it integrates knowledge from areas of science, mathematics, computers, mechanical engineering, electronics engineering, and automation. Following courses in fundamental engineering knowledge, students learn how to apply sound scientific principles to solve practical problems in industry in the area of automated manufacturing engineering. This program places an emphasis on the application of computer systems to modern manufacturing by means of such topics as robotics, computer-aided design (CAD), application of hydraulics and pneumatics in Automation (H&P), programmable logic controllers (PLC), computer-aided manufacturing (CAM), and computer integrated manufacturing (CIM). Logic in Automation, Automation Instrumentation, Automation Process, Network Automation Systems.

The educational objectives of the Bachelor of Science degree program in automated manufacturing engineering are as follows:

• Domain Knowledge: Graduates will be able to apply their in-depth understanding of automated manufacturing engineering within the constraints of performance specification, budget, and scheduling.

• Professional Practice: Graduates will develop their skills in engineering design, problem-solving and communication, and their aptitude for innovation and teamwork, especially important for work on interdisciplinary projects.

• Lifelong Learning: Graduates will become experts in their chosen fields, members of their professional societies, and broaden their professional knowledge with formal and/or informal continuing education.

• Engineering Citizenship: Graduates will practice the ethics of their profession, consistent with a sense of social responsibility and the promotion of a diverse and just society.

Minors in Other Fields of Study
Engineering students are automatically awarded a mathematics minor with the completion of five mathematics courses. It should be noted that all engineering programs require five, or more, mathematics courses.

In addition, engineering majors can opt and fulfill the requirements for other minors. For example, an engineering student who wishes to gain further knowledge in economics could use the two social science electives and the two general electives in the liberal arts core, and with one summer course, he/she will complete the requirements for an economics minor. Similar arrangements can be made for a business minor or a physics minor.

Associate's Degree in Engineering
Students may earn an associate degree in electrical engineering (ASEE) or mechanical engineering (ASME) by completing coursework representative of the first two-year phase of the 4-year engineering education; curriculum requirements for the associate degree are approximately one-half those of the B.S. degree. Graduates may continue their studies to the B.S. degree, or seek employment immediately upon graduation with an A.S. degree. The detailed 2-year A.S. curriculum is shown in later pages.

Combined Bachelor's and Master's Degree
The Five-Year Dual Degree, B.S./M.S. Program in Software Engineering

This is a fast track program to a master’s degree in software engineering. Students may request a change of status from the undergraduate to the undergraduate/graduate five-year combined plan of study at any point after the following conditions are met:

• Completed all required junior-level math and software engineering courses specified in the undergraduate catalog.

• Successfully completed six courses in software engineering or computer science with a GPA of 3.2, and are enrolled in at least one graduate course in software engineering.

• Have an overall GPA of 3.0.

Students will be awarded both the B.S. and master’s degree simultaneously, when all the requirements of the combined degree curriculum have been satisfied.

Bachelor of Science
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## Automated Manufacturing Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MF 316</td>
<td>Automation Instrumentation &amp; Measurement</td>
<td>3</td>
</tr>
<tr>
<td>MF 317</td>
<td>Automation Process Design</td>
<td>3</td>
</tr>
<tr>
<td>EE 213</td>
<td>Introduction to Electric Circuits</td>
<td>3</td>
</tr>
<tr>
<td>EE 213L</td>
<td>Electric Circuits Lab</td>
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</tr>
<tr>
<td>MF 354</td>
<td>Product and Process Design for Manufacturing</td>
<td>3</td>
</tr>
<tr>
<td>HI 10</td>
<td>Origins of the Modern World</td>
<td>3</td>
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<td><strong>Total 16</strong></td>
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## Year 3 - Spring Semester Credits

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>MF 318</td>
<td>Applications of Hydraulics and Pneumatics in Automation</td>
<td>3</td>
</tr>
<tr>
<td>MF 250</td>
<td>Programmable Logic Control (PLC) Systems</td>
<td>3</td>
</tr>
<tr>
<td>MF 250L</td>
<td>Programmable Logic Control (PLC) Systems Lab</td>
<td>1</td>
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<tr>
<td>MC 396</td>
<td>Mechatronics Applications</td>
<td>3</td>
</tr>
<tr>
<td>GE</td>
<td>General Elective</td>
<td>3</td>
</tr>
<tr>
<td>HI</td>
<td>History Elective</td>
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</tr>
<tr>
<td>EC 11</td>
<td>Intro to Microeconomics</td>
<td>3</td>
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<td><strong>Total 18</strong></td>
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## Year 4 - Fall Semester Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>MF 315</td>
<td>Computer-Integrated Manufacturing (CIM)</td>
<td>3</td>
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<tr>
<td>MF 319</td>
<td>Network Systems Automation</td>
<td>3</td>
</tr>
<tr>
<td>EG 390</td>
<td>Senior Design Project I</td>
<td>3</td>
</tr>
<tr>
<td>MF</td>
<td>Major Elective</td>
<td>3</td>
</tr>
<tr>
<td>RS</td>
<td>Religious Studies Elective</td>
<td>3</td>
</tr>
<tr>
<td>AE 287</td>
<td>Engineering Ethics</td>
<td>3</td>
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<td><strong>Total 19</strong></td>
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</table>

## Year 4 - Spring Semester Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EG 391</td>
<td>Senior Project II</td>
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<tr>
<td>MF</td>
<td>Major Elective</td>
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<tr>
<td>PH</td>
<td>Philosophy Elective</td>
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<tr>
<td>SS</td>
<td>Social Science Elective</td>
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<tr>
<td>EN 100</td>
<td>English Core Literature</td>
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<td><strong>Total 15</strong></td>
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</table>

## Automated Manufacturing Engineering Electives Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>MC 290</td>
<td>Engineering Systems Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 311</td>
<td>Machine Design</td>
<td>3</td>
</tr>
<tr>
<td>ME 318</td>
<td>Finite Element Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MF 350</td>
<td>Advanced Programmable Logic Control (PLC) Systems</td>
<td>3</td>
</tr>
<tr>
<td>MF 350L</td>
<td>Advanced Programmable Logic Control (PLC) Systems Lab</td>
<td>1</td>
</tr>
<tr>
<td>MF 351</td>
<td>Manufacturing Systems I</td>
<td>3</td>
</tr>
<tr>
<td>MF 352</td>
<td>Manufacturing Systems II</td>
<td>3</td>
</tr>
<tr>
<td>MF 353</td>
<td>Manufacturing Processes and Materials</td>
<td>3</td>
</tr>
<tr>
<td>MF 361</td>
<td>Automation and Robotics I</td>
<td>3</td>
</tr>
<tr>
<td>MF 362</td>
<td>Automation and Robotics II</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<td><strong>16</strong></td>
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## Automation Systems Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>MC 300</td>
<td>Feedback and Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>MF 350</td>
<td>Advanced Programmable Logic Control (PLC) Systems</td>
<td>3</td>
</tr>
<tr>
<td>MF 350L</td>
<td>Advanced Programmable Logic Control (PLC) Systems Lab</td>
<td>1</td>
</tr>
<tr>
<td>MF 355</td>
<td>Product Planning, Control and Forecasting</td>
<td>3</td>
</tr>
<tr>
<td>MF 361</td>
<td>Automation and Robotics I</td>
<td>3</td>
</tr>
<tr>
<td>MF 362</td>
<td>Automation and Robotics II</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>17</strong></td>
</tr>
</tbody>
</table>

## Certificate in Automated Manufacturing Engineering

Engineers with the requisite background may opt for a Certificate in Automated Manufacturing Engineering consisting of a minimum of four courses, e.g., MF 230, MF 240, MF 250 with Lab, and MF 318, or other electives.

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## Bachelor of Science

The Computer Engineering Program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. Computer engineering is an interdisciplinary degree program that enables its graduates to design and develop computer-based systems. In the computer engineering curriculum, theoretical work is integrated with experiential learning and design activity. Demand for engineers who can do both hardware and software is consistently strong and is expected to persist.

The Department of Computer Engineering supports the mission of the University through its undergraduate program by providing students with appropriate curricula and educational experiences. To accomplish the mission, the faculty, with advice from students, alumni and employers, determine a set of Program Educational Objectives. The Program Educational Objectives are broad statements that describe what graduates are expected to attain within a few years following graduation. The program prepares our alumni to achieve the following Program Educational Objectives.

- **Domain Knowledge**: Alumni apply their in-depth understanding in areas of computer systems to solve computer systems related problems with real-world constraints (i.e., constraints on performance, budget, and scheduling, etc). They solve problems in a modern technological society in the professional environment of their employment, as productive engineers and/or enter and succeed in a graduate program.
- **Professional Practice**: Alumni practice engineering design, problem-solving skills and attitude for innovation and communication skills as they function effectively, both individually and within multidisciplinary teams.
- **Lifelong Learning**: Alumni continue to develop engineering design abilities, problem-solving skills, and attitude for innovation and communication skills as they function effectively, both individually and within multidisciplinary teams.

### Faculty

**Professors**
- Beal
- Lyon, chair

**Lecturers**
- Cavali
- Craicin
- Lopes
- Mandello

### Computer Engineering Curriculum (132 Credits)

#### Year 1 - Fall Semester Credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 145</td>
<td>Calculus I: Engineering &amp; Physics Majors</td>
<td>4</td>
</tr>
<tr>
<td>PS 15</td>
<td>General Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PS 15L</td>
<td>General Physics I Lab</td>
<td>1</td>
</tr>
<tr>
<td>EG 31</td>
<td>Fundamentals of Engineering</td>
<td>3</td>
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<tr>
<td>PH 101</td>
<td>Intro to Philosophy</td>
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<tr>
<td>EN 11</td>
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#### Year 1 - Spring Semester Credits

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<tbody>
<tr>
<td>MA 146</td>
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<td>4</td>
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<tr>
<td>PS 16</td>
<td>General Physics II</td>
<td>3</td>
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<tr>
<td>PS 16L</td>
<td>General Physics II Lab</td>
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</tr>
<tr>
<td>SW 131</td>
<td>Fundamentals of Programming for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>HI 10</td>
<td>Origins of Modern World</td>
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<tr>
<td>EN 12</td>
<td>Texts and Contexts II</td>
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#### Year 2 - Fall Semester Credits

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<tbody>
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<td>Calculus III: Engineering &amp; Physics Majors</td>
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<td>EE 213</td>
<td>Introduction to Electric Circuits</td>
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<td>EE 213L</td>
<td>Electric Circuits Lab</td>
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<tr>
<td>RS 101</td>
<td>Exploring Religion</td>
<td>3</td>
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<tr>
<td>MA 231</td>
<td>Discrete Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>SW 232</td>
<td>Advanced Programming and Data Structures</td>
<td>3</td>
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<td><strong>Total 17</strong></td>
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</tbody>
</table>

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*Engineering Citizenship: Alumni practice professional ethics with social responsibility in the framework of a global technical community. Alumni promote justice in all matters and are of service to the community.*

Computer Engineering students obtain a background in the next generation of hardware and software computer technologies. They learn computer design, computer science, electrical engineering, physics, mathematics and the liberal arts. Computer engineering students obtain depth in the domains of computer-based systems that impact areas of biomedical engineering, and mathematics. Graduates of the program have enough credit hours to get a minor in mathematics. Our close interactions with industry enables employment of our graduates in all sectors of industry, government, and academe. They are active in the areas of hardware and software design and information technologies, and take the lead in the research and development of new computer systems and applications.
The electrical engineering program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. The electrical engineering courses have been designed to provide a strong design component. Students learn the theory in the classroom and put it into practice in the laboratory, resulting in an electrical engineering graduate who is ready to put these skills into practice in an industrial environment. The electrical engineering curriculum blends theoretical knowledge with hands-on experimental learning. An interdisciplinary team-based senior design project completes the technical education.

The educational objectives of the Bachelor of Science degree program in Electrical Engineering are as follows:

- **Domain Competence**: BSEE program alumni apply their technical skills in the design and management of electrical systems. They balance technical requirements, quality control, scheduling, and cost constraints in the design process.
- **Professional Practice**: BSEE program alumni practice the profession of electrical engineering as an individual contributor to their discipline or as a contributing member of an interdisciplinary team in a competent and efficient manner.
- **Lifelong Learning**: BSEE program alumni maintain membership in professional societies as part of their commitment to lifelong learning about their profession and its relationship to society.
- **Engineering Citizenship**: BSEE program alumni practice in an ethical and professional manner and are constantly aware of the impact of their efforts on social welfare, safety, and the environment. They promote justice and are of service to their community.

### Year 1 - Fall Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tr>
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<td>PS 15</td>
<td>General Physics I</td>
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<tr>
<td>PS 15L</td>
<td>General Physics I Lab</td>
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</tr>
<tr>
<td>EG 31</td>
<td>Fundamentals of Engineering</td>
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<tr>
<td>PH 101</td>
<td>Introduction to Philosophy</td>
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<td>EN 11</td>
<td>Texts and Contexts I</td>
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### Year 1 - Spring Semester

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<td>Calculus II Engineering &amp; Physics Majors</td>
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<td>PS 16</td>
<td>General Physics II</td>
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<td>General Physics II Lab</td>
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<tr>
<td>SW 131</td>
<td>Fundamentals of Programming for Engineers</td>
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<td>EN 12</td>
<td>Texts and Contexts II</td>
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<td>EG 145</td>
<td>Mathematical Analysis</td>
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### Year 2 - Fall Semester

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<tr>
<td>MA 245</td>
<td>Calculus III Engineering &amp; Physics Majors</td>
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<tr>
<td>EE 213</td>
<td>Introduction to Electric Circuits</td>
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<td>ME 201</td>
<td>Engineering Statics</td>
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### Year 2 - Spring Semester

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<th>Course Name</th>
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<tr>
<td>MA 321</td>
<td>Ordinary Differential Equations</td>
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<td>EE 221</td>
<td>Frequency Domain Circuit Analysis</td>
<td>3</td>
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<tr>
<td>HI 10</td>
<td>Origins of Modern World</td>
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<tr>
<td>ME</td>
<td>Mechanical Engineering Elective</td>
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<tr>
<td>PH</td>
<td>Philosophy Elective</td>
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<td>AH</td>
<td>Art History Elective</td>
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<td><strong>Total</strong></td>
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</table>
**Mechanical Engineering Program Educational Objectives**

The Mechanical Engineering Department is committed to graduating engineers who:

- Apply engineering science to analyze and design energy and mechanical systems.
- Pursue engineering careers or advanced studies in mechanical engineering or related technical fields.
- Employ effective communication skills as a team member or team leader in an ethical and professional manner with a sense of social responsibility.
- Engage in lifelong learning by contributing to their chosen field, actively participating in professional societies and broadening their professional knowledge with formal and informal continuing education.

The mechanical engineering curriculum is constructed to include abundant experiential learning. This is accomplished through the integration of synchronized laboratory experiences within the framework of the theoretical courses in the basic curriculum, and by making use of well-equipped laboratories and computing facilities.

**Mechanical Engineering Curriculum (134 credits)**

<table>
<thead>
<tr>
<th>Year 1 - Fall Semester</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MA 145</td>
<td>Calculus I: Engineering &amp; Physics Majors</td>
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<tr>
<td>PS 15</td>
<td>General Physics I</td>
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<tr>
<td>PS 15L</td>
<td>General Physics I Lab</td>
</tr>
<tr>
<td>EG 31</td>
<td>Fundamentals of Engineering</td>
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<tr>
<td>PH101</td>
<td>Introduction to Philosophy</td>
</tr>
<tr>
<td>EN 11</td>
<td>Texts and Contexts I</td>
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<td><strong>Total</strong></td>
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<th>Year 1 - Spring Semester</th>
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<td>MA 148</td>
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<td>EG 145</td>
<td>Mathematical Analysis</td>
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<tr>
<td>CD 211</td>
<td>Engineering Graphics I</td>
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<td>Texts and Contexts II</td>
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<td><strong>Total</strong></td>
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</table>

**Bachelor of Science**

The mechanical engineering program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. This engineering discipline has a very broad spectrum of applications in all aspects of modern technology. Students undertake studies in statics and dynamics, CAD, materials science, solid and fluid mechanics, thermodynamics, heat transfer, machine design, and system dynamics. A team-based senior design project completes the technical education.

The mechanical engineering curriculum is constructed to include abundant experiential learning. This is accomplished through the integration of synchronized laboratory experiences within the framework of the theoretical courses in the basic curriculum, and by making use of well-equipped laboratories and computing facilities.

**School of Engineering**

<table>
<thead>
<tr>
<th>Year 3 - Fall Semester</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EE 231</td>
<td>Intro to Electronics Circuits &amp; Devices</td>
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<td>Electronics Circuits Lab</td>
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<tr>
<td>EE 301</td>
<td>Signals and Systems I</td>
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<tr>
<td>MA 351</td>
<td>Probability and Statistics</td>
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<td>Digital Design I Lab</td>
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<tr>
<td>EN 100-199</td>
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<th>Year 3 - Spring Semester</th>
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<tr>
<td>EE 331</td>
<td>Electromagnetics Design</td>
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<tr>
<td>GE</td>
<td>General Elective I</td>
</tr>
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<td>HI</td>
<td>History Elective</td>
</tr>
<tr>
<td>CD 211</td>
<td>Engineering Graphics I</td>
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<tr>
<td>MC 300</td>
<td>Feedback and Control Systems</td>
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<tr>
<th>Year 4 - Fall Semester</th>
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<tr>
<td>EE 321</td>
<td>Electromagnetic Fields</td>
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<td>EG 380</td>
<td>Senior Design Project I</td>
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<tr>
<td>EC 11</td>
<td>Introduction to Microeconomics</td>
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<td>EE</td>
<td>Major Elective I</td>
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<tr>
<td>RS</td>
<td>Religious Studies Elective</td>
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<th>Year 4 - Spring Semester</th>
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<tr>
<td>EG 391</td>
<td>Social Science elective</td>
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<td>Major Elective II</td>
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<td>GE</td>
<td>General Elective II</td>
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<tr>
<td>AE 287</td>
<td>Engineering Ethics</td>
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<td>Social Science Elective</td>
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**Electrical Engineering Electives**

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<th>Biomedical Engineering</th>
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<td>CR 332</td>
<td>Biomedical Imaging</td>
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<td>CR 333</td>
<td>Biomedical Visualization</td>
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<td><strong>Communications</strong></td>
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<tr>
<td>EE 350</td>
<td>Analog Communication Systems</td>
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<tr>
<td>EE 373</td>
<td>Microwave Structures</td>
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<td>EE 383</td>
<td>Wireless Systems</td>
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<td><strong>Computer Engineering</strong></td>
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<td>CR 310</td>
<td>Voice and Signal Processing</td>
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<td>CR 311</td>
<td>Image Processing</td>
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<td>CR 320</td>
<td>Computer Networks</td>
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<td><strong>Design</strong></td>
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<tr>
<td>EE 346</td>
<td>Embedded Microcontrollers</td>
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<td>EE 346L</td>
<td>Microcontrollers Lab</td>
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<td>EE 382</td>
<td>Advanced Electrical Project</td>
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<td><strong>Digital Signal Processing</strong></td>
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<td>EE 350</td>
<td>Analog Communication Systems</td>
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<td>EE 352</td>
<td>Digital Communications</td>
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<td><strong>Microelectronics &amp; Nano-electronics</strong></td>
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<td>EE 315</td>
<td>Nano-electronics I</td>
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<td>EE 316</td>
<td>Nano-electronics II</td>
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<td><strong>Power Systems</strong></td>
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<td>EE 385</td>
<td>Power Generation and Distribution</td>
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<td>EE 386</td>
<td>Fault Analysis of Power Systems</td>
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<td><strong>Systems and Controls</strong></td>
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<td>EG 325</td>
<td>Engineering Applications of Numerical Methods</td>
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<tr>
<td>MF 361</td>
<td>Automation and Robotics I</td>
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</table>
| **Note:** In addition to the undergraduate courses listed, advanced juniors and seniors are allowed to take appropriate graduate courses as electives with the permission of the department chair and the instructor.**

**School of Engineering**
Year 2 - Fall Semester  Credits
MA 245 Calculus III: Engineering &
Physics Majors  4
ME 201 Engineering Statics  3
ME 206L Mechanics Lab  1
CH 111 General Chemistry I  1
CH 111L General Chemistry Lab I  1
ME 207 Materials Science  3
EC 11 Introduction to Microeconomics  3
Total 18

Year 2 - Spring Semester  Credits
MA 321 Ordinary Differential Equations  3
ME 203 Kinematics and Dynamics  3
ME 308 Strength of Materials  3
ME 307L Dynamics Systems Lab  1
RS 101 Exploring Religion  3
AH Art History Elective  3
Total 16

Year 3 - Fall Semester  Credits
ME 241 Principles of Thermodynamics  3
EE 213 Introduction to Electric Circuits  3
EE 213L Electric Circuits Lab  1
ME 311 Machine Design  3
HI 10 Origins of the Modern World  3
PH Philosophy Elective  3
Total 16

Year 3 - Spring Semester  Credits
ME 342 Applications of Thermodynamics  3
ME 347 Fluid Mechanics  3
ME 348L Thermal and Fluids Lab  1
ME 318 Finite Element Analysis  3
HI History Elective  3
RS Religious Studies Elective  3
Total 16

Year 4 - Fall Semester  Credits
ME 290 Engineering Systems Dynamics  3
ME 349 Heat Transfer  3
ME 300L Energy Transfer Lab  1
ME Major Elective  3
EG 390 Senior Design Project I  3
GE General Elective  3
Total 16

Year 4 - Spring Semester  Credits
EG 391 Senior Design Project II  3
ME Major Elective  3
AE 287 Engineering Ethics  3
SS Social Science Elective  3
EN 100- 199 English Core Literature  3
GE General Elective  3
Total 18

Mechanical Engineering Electives  Energy Systems:
ME 346 Energy Conversion
ME 351 Gas Dynamics
ME 353 Computational Fluid Dynamics
ME 354 Heat and Mass Transfer
ME 362 Turbomachinery
Controls Systems:
ME 300 Feedback and Control Systems
ME 320 Vibration Analysis
ME 321 Advanced Kinematics
ME 322 Advanced Dynamics
Mechanics and Manufacturing:
CD 212 Engineering Graphics II
ME 312 Advanced Machine Design
ME 319 Applications of Finite Element Analysis
ME 327 Applications of Fracture Mechanics in
Engineering Design
ME 330 Mechanics of Composite Materials
ME 382 Independent Study, Advanced
Mechanical Project
Note: In addition to the undergraduate courses
advanced juniors and seniors are allowed to take
appropriate graduate courses as electives with the
permission of the department chair and the instructor.

Software

SOFTWARE ENGINEERING

Faculty

Associate Professor
Yoo, chair
Assistant Professor
Rusu

Lecturers
Corcoran
Gallaiso
Govindaraja
Guilekis
LaMastra

The Software Engineering program is accredited by the
Engineering Accreditation Commission of ABET,
www.abet.org.

The Software Engineering program offers both a
Bachelor of Science in Engineering degree and a five-
year Bachelor/Master dual-degree track. For the latter
program see details later in this section.

Bachelor of Science

The mission of Fairfield University is to educate its
students through a variety of scholarly and professional
disciplines. It offers opportunities for individual and com-
mon reflection, and it provides training in such essential
human skills as analysis, synthesis, and communica-
tion. Fairfield recognizes that learning is a life-long
process and sees the education which it provides as
the foundation upon which its students may continue
to build within their chosen areas of scholarly study
or professional development. The Software Engineer-
ing program supports the mission of the University by
providing a curriculum focusing on the most advanced
practices of software engineering through continued
assessment by employers, alumni, faculty and students.
The educational objectives of the program are to
produce graduates within three years of graduation
who will:

\- be employed in fields of software engineering.
\- continue the process of life-long learning through for-
mal and informal education.
\- communicate effectively.
\- practice professional ethics with social responsibility.

The program emphasizes the complete lifecycle of the
software development process. Students learn how to
gather requirements, design, develop, test, deploy, and
maintain software using rigorous software engineering
practices. They are taught how to leverage technol-
ogy to create flexible and scalable applications and to
address the challenges that arise during the develop-
ment process. Also, the program exposes students to
a range of other disciplines, such as the physical
sciences, social sciences, economics, and business so
they gain an understanding of the real world instances
that make up the software engineering environment.
These courses are supported by rigorous labora-
tory tasks.

Software Engineering Curriculum (132 credits)

Year 1 - Fall Semester  Credits
MA 145 Calculus I: Engineering
& Physics Majors  4
PS 15 General Physics I  3
PS 15L General Physics I Lab  1
EG 31 Fundamentals of Engineering  3
PH 101 Intro to Philosophy  3
EN 11 Texts and Contexts I  3
Total 17

Year 1 - Spring Semester  Credits
MA 146 Calculus II: Engineering
& Physics Majors  4
PS 16 General Physics II  3
PS 16L General Physics II Lab  1
SW 131 Fundamentals of Programming
for Engineers  3
RS 101 Exploring Religion  3
EN 12 Texts and Contexts II  3
Total 17

Year 2 - Fall Semester  Credits
MA 245 Calculus III: Engineering &
Physics Majors  4
MA 231 Discrete Mathematics  3
SW 232 Advanced Programming and
Data Structures  3
SW 304 Web Development  3
EC 11 Intro to Microeconomics  3
Total 16

Year 2 - Spring Semester  Credits
SW 327 Operating Systems and Programming  3
CR 245 Digital Design I  3
CR 245L Digital Design I Lab  1
GE General Elective I  3
SW EL Major Elective  3
EN 100- 199 English Core Literature  3
Total 16

Year 3 - Fall Semester  Credits
SW 201 Software Engineering Methods  3
SW 355 Database Management Systems  3
MA 351 Probability and Statistics  3
HI 10 Origins of the Modern World  3
SSE Social Science Elective  3
PH Philosophy Elective  3
Total 18

Year 4 - Fall Semester  Credits
MA 321 Ordinary Differential Equations  3
ME 300L Energy Transfer Lab  1
ME Major Elective  3
AE 287 Engineering Ethics  3
SS Social Science Elective  3
EN 100- 199 English Core Literature  3
GE General Elective  3
Total 18

Year 4 - Spring Semester  Credits
ME 351 Gas Dynamics  3
ME 353 Computational Fluid Dynamics  3
ME 354 Heat and Mass Transfer  3
ME 362 Turbomachinery  3
Controls Systems:
ME 300 Feedback and Control Systems  3
ME 320 Vibration Analysis  3
ME 321 Advanced Kinematics  3
ME 322 Advanced Dynamics  3
Mechanics and Manufacturing:
CD 212 Engineering Graphics II  3
ME 312 Advanced Machine Design  3
ME 319 Applications of Finite Element Analysis  3
ME 327 Applications of Fracture Mechanics in
Engineering Design  3
ME 330 Mechanics of Composite Materials  3
ME 382 Independent Study, Advanced
Mechanical Project  3
Note: In addition to the undergraduate courses
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permission of the department chair and the instructor.
### School of Engineering

#### Year 3 - Spring Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
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<td>Software Design Methods</td>
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<td>MA EL</td>
<td>Math Elective*</td>
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<td>CR 346</td>
<td>Computer System Architecture</td>
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#### Year 4 - Fall Semester

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<tr>
<td>SW 205</td>
<td>Software Testing and Maintenance</td>
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<td>EG 390</td>
<td>Senior Design Project I</td>
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</tr>
<tr>
<td>CR 320</td>
<td>Computer Networks</td>
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<tr>
<td>SC EL</td>
<td>Science Elective</td>
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#### Year 4 - Spring Semester

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<tbody>
<tr>
<td>SW 204</td>
<td>Software Project Management</td>
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<tr>
<td>EG 391</td>
<td>Senior Design Project II</td>
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<tr>
<td>GE</td>
<td>General Elective 2</td>
<td>3</td>
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<tr>
<td>VP</td>
<td>Visual and Performing Arts Elective</td>
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<tr>
<td>AE 287</td>
<td>Engineering Ethics</td>
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* Math Elective: MA 211, MA 235 or MA 321 recommended

#### General Electives (6 credits)

Software engineering program provides various elective courses and is recommended for software engineering students to choose the general electives from the courses to bring the students depth in the computing and software engineering fields.

General electives and a major elective will be chosen under advisement of department chair or academic advisor.

#### Electives in Programming

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>SW 403</td>
<td>Visual C# for Programmers I</td>
<td></td>
</tr>
<tr>
<td>SW 506</td>
<td>Visual C# for Programmers II</td>
<td></td>
</tr>
<tr>
<td>SW 409</td>
<td>Java for Programmers II</td>
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<tr>
<td>SW 410</td>
<td>Enterprise Java</td>
<td></td>
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<tr>
<td>SW 512</td>
<td>Web Development II with ASP.NET</td>
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<tr>
<td>SW 516</td>
<td>High Performance Database Web Applications</td>
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#### Electives in Database Concepts

<table>
<thead>
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<tbody>
<tr>
<td>SW 505</td>
<td>Advanced Database Concepts</td>
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<tr>
<td>SW 508</td>
<td>Data Warehouse Systems</td>
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</tr>
<tr>
<td>SW 518</td>
<td>Data Mining and Business Intelligence</td>
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#### Electives in Network Administration

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<tbody>
<tr>
<td>SW 314</td>
<td>Network Concepts</td>
<td></td>
</tr>
<tr>
<td>SW 348</td>
<td>Server Management</td>
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<tr>
<td>SW 396</td>
<td>Network Routing and Switching</td>
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#### Electives in Information Security

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<tbody>
<tr>
<td>SW 530</td>
<td>Introduction to Information Security</td>
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</tr>
<tr>
<td>SW 531</td>
<td>Applications and Data Security</td>
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<tr>
<td>SW 535</td>
<td>Web Application Security</td>
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</tr>
<tr>
<td>SW 599</td>
<td>Information Security Measures and Countermeasures</td>
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#### Electives in Electrical Engineering/Computer Hardware

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<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CR 246</td>
<td>Digital Electronics Design II</td>
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<tr>
<td>EE 346</td>
<td>Embedded Microcontrollers</td>
<td></td>
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<tr>
<td>EE 346L</td>
<td>Microcontroller Laboratory</td>
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#### Electives in Computer Graphics and Image Processing

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<tr>
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<th>Course Name</th>
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<tbody>
<tr>
<td>CR 310</td>
<td>Voice and Signal Processing</td>
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<tr>
<td>CR 311</td>
<td>Image Processing</td>
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<tr>
<td>MA 211</td>
<td>Applied Matrix Theory</td>
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<tr>
<td>CR 325</td>
<td>Computer Graphics</td>
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#### Electives in Computer Theory

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>CS 355</td>
<td>Artificial Intelligence</td>
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<tr>
<td>CS 342</td>
<td>Theory of Computation</td>
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### Software Engineering Five-Year Dual-Degree BS/MS Program

A five-year program is offered in Software Engineering at Fairfield’s School of Engineering, leading to a combined Bachelor of Science and Master of Science degrees. This program embraces the educational objectives of the traditional undergraduate program, as well as those of the graduate program. It emphasizes experiential learning in terms of industrial internships following the sophomore year, and a final capstone project that guides students through a process of design and innovation at the level of a professional engineer. Graduates of the program master the knowledge and tools they need to create the next generation of software solutions to ever more complex technological and societal problems.

#### Changing from Undergraduate to Graduate Status

Students may request a change of status from the undergraduate to the undergraduate/graduate combined plan of study at any point after the following conditions are met:

- Completed 98-102 credits towards the B.S. in Software Engineering
- Completed all required Junior-level (300-level) math and Software Engineering courses specified in the undergraduate catalog.

### Software Engineering Five-Year Dual-Degree BS/MS Program

#### Year 1 - Fall Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MA 145</td>
<td>Calculus I: Engineering &amp; Physics Majors</td>
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<tr>
<td>PS 16</td>
<td>General Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PS 15L</td>
<td>General Physics I Lab</td>
<td>1</td>
</tr>
<tr>
<td>EG 31</td>
<td>Fundamentals of Engineering</td>
<td>3</td>
</tr>
<tr>
<td>PH 101</td>
<td>Introduction to Philosophy</td>
<td>3</td>
</tr>
<tr>
<td>EN 11</td>
<td>Texts and Contexts I</td>
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<tr>
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#### Year 1 - Spring Semester

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<tbody>
<tr>
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<td>Calculus II: Engineering &amp; Physics Majors</td>
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<td>PS 16</td>
<td>General Physics II</td>
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<td>SW 131</td>
<td>Fundamentals of Programming</td>
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<td>RS 101</td>
<td>Exploring Religion</td>
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<td>EN 12</td>
<td>Texts and Contexts II</td>
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#### Year 2 - Fall Semester

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<tbody>
<tr>
<td>MA 245</td>
<td>Calculus III: Engineering &amp; Physics Majors</td>
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<td>MA 231</td>
<td>Discrete Mathematics</td>
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<td>SW 252</td>
<td>Advanced Programming and Data Structures</td>
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<tr>
<td>SW 304</td>
<td>Web Development</td>
<td>3</td>
</tr>
<tr>
<td>EC 11</td>
<td>Intro to Microeconomics</td>
<td>3</td>
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<tr>
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#### Year 2 - Spring Semester

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<tr>
<td>SW 237</td>
<td>Operating Systems and Programming</td>
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<tr>
<td>CR 245</td>
<td>Digital Design I</td>
<td>3</td>
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<tr>
<td>CR 245L</td>
<td>Digital Design I Lab</td>
<td>1</td>
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<td>GE</td>
<td>General Elective I</td>
<td>3</td>
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<tr>
<td>SW EL</td>
<td>Major Elective</td>
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<tr>
<td>EN 100-199</td>
<td>English Core Literature</td>
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### Year 3 - Fall Semester

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<tr>
<td>SW 201</td>
<td>Software Engineering Method</td>
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<tr>
<td>SW 355</td>
<td>Database Management Systems</td>
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<tr>
<td>MA 351</td>
<td>Probability and Statistics</td>
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<td>HI 10</td>
<td>Origins of the Modern World</td>
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<td>SSE</td>
<td>Social Science Elective</td>
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<tr>
<td>PH</td>
<td>Philosophy Elective</td>
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### Year 3 - Spring Semester

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<td>Software Design Methods</td>
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<td>MA EL</td>
<td>Math Elective*</td>
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<td>CR 346</td>
<td>Computer Systems Architecture</td>
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<tr>
<td>SW 399</td>
<td>Algorithms</td>
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<td>Art History Elective</td>
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<td>History Elective</td>
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### Year 4 - Spring Semester

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<td>Software Testing and Maintenance</td>
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<tr>
<td>SW EL</td>
<td>Graduate Elective 1</td>
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<td>CR 320</td>
<td>Computer Networks</td>
<td>3</td>
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<td>SC EL</td>
<td>Science Elective</td>
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<td>RS</td>
<td>Religious Studies Elective</td>
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### Year 5 - Fall Semester

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<td>Graduate Elective 3</td>
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<tr>
<td>SW</td>
<td>Graduate Elective 4</td>
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<td>SW</td>
<td>Graduate Elective 5</td>
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<td>SW 550</td>
<td>Capstone Professional Project I</td>
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### Year 5 - Spring Semester

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<td>SW</td>
<td>Graduate Elective 8</td>
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<td>SW 551</td>
<td>Capstone Professional Project II</td>
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* Math Elective: MA 211, MA 228 or MA 235 recommended

### Major Electives

For Electives see list under the 4-year B.S. program in Software Engineering.
Electrical Engineering

The curriculum for the associate degree in electrical engineering is outlined below. The credits required for this degree amount to approximately one-half of those for the B.S. degree in mechanical engineering.

Year 1 - Spring Semester
MA 145 Calculus I: Engineering & Physics Majors 4
PS 15 General Physics I 3
PS 15L General Physics Lab I 1
EG 31 Fundamentals of Engineering 3
PH 101 Introduction to Philosophy 3
EN 11 Texts and Contexts I 3
Total 17

Year 1 - Fall Semester
MA 146 Calculus II: Engineering & Physics Majors 4
PS 15 General Physics I 3
PS 15L General Physics Lab I 1
EG 31 Fundamentals of Engineering 3
PH 101 Introduction to Philosophy 3
EN 11 Texts and Contexts I 3
Total 17

Year 2 - Spring Semester
MA 245 Calculus III: Engineering & Physics Majors 4
ME 201 Engineering Statics 3
ME 206L Mechanics Lab 1
CH 111 General Chemistry I 3
CH 111L General Chemistry Lab I 1
MF 207 Material Science 3
Hi 10 Origins of Modern World 3
Total 18

Year 2 - Fall Semester
MA 245 Calculus III: Engineering & Physics Majors 4
ME 201 Engineering Statics 3
ME 206L Mechanics Lab 1
CH 111 General Chemistry I 3
CH 111L General Chemistry Lab I 1
ME 308 Strength of Materials 3
ME 307L Dynamics Systems Lab 1
EC 11 Introduction to Microeconomics 3
ME Major Elective 3
GE General Elective 3
Total 16

Year 3 - Spring Semester
ME 201 Kinematics and Dynamics 3
ME 308 Strength of Materials 3
ME 307L Dynamics Systems Lab 1
EC 11 Introduction to Microeconomics 3
ME Major Elective 3
GE General Elective 3
Total 16

Year 3 - Fall Semester
MA 245 Calculus III: Engineering & Physics Majors 4
PS 15 General Physics I 3
PS 15L General Physics Lab I 1
EG 31 Fundamentals of Engineering 3
PH 101 Introduction to Philosophy 3
EN 11 Texts and Contexts I 3
Total 17

Mechanical Engineering

The curricula for the associate degree program in Mechanical Engineering is outlined below. The credits required for this degree amount to approximately one-half of those for the B.S. degree in mechanical engineering.

Year 1 - Fall Semester
MA 145 Calculus I: Engineering & Physics Majors 4
PS 15 General Physics I 3
PS 15L General Physics Lab I 1
EG 31 Fundamentals of Engineering 3
PH 101 Introduction to Philosophy 3
EN 11 Texts and Contexts I 3
Total 17

Year 1 - Spring Semester
MA 146 Calculus II: Engineering & Physics Majors 4
PS 15 General Physics I 3
PS 15L General Physics Lab I 1
EG 31 Fundamentals of Engineering 3
PH 101 Introduction to Philosophy 3
EN 11 Texts and Contexts I 3
Total 17

Year 2 - Fall Semester
MA 245 Calculus III: Engineering & Physics Majors 4
ME 201 Engineering Statics 3
ME 206L Mechanics Lab 1
CH 111 General Chemistry I 3
CH 111L General Chemistry Lab I 1
MF 207 Material Science 3
Hi 10 Origins of Modern World 3
Total 18

Year 2 - Spring Semester
MA 245 Calculus III: Engineering & Physics Majors 4
ME 201 Engineering Statics 3
ME 206L Mechanics Lab 1
CH 111 General Chemistry I 3
CH 111L General Chemistry Lab I 1
ME 308 Strength of Materials 3
ME 307L Dynamics Systems Lab 1
EC 11 Introduction to Microeconomics 3
ME Major Elective 3
GE General Elective 3
Total 16

Year 3 - Fall Semester
MA 245 Calculus III: Engineering & Physics Majors 4
PS 15 General Physics I 3
PS 15L General Physics Lab I 1
EG 31 Fundamentals of Engineering 3
PH 101 Introduction to Philosophy 3
EN 11 Texts and Contexts I 3
Total 17
The recommended four-course sequence for the minor may be chosen from among those listed below, with indicated prerequisites:

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EG 31</td>
<td>Fundamentals of Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CD 211</td>
<td>Engineering Graphics I</td>
<td>3</td>
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<tr>
<td>EE 213</td>
<td>Introduction to Electric Circuits</td>
<td>3</td>
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<td>EE 213L</td>
<td>Electric Circuits Lab</td>
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<td>EE 221</td>
<td>Frequency Domain Circuit Analysis</td>
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</tr>
<tr>
<td>EE 231</td>
<td>Intro to Electronic Circuits &amp; Devices</td>
<td>3</td>
</tr>
<tr>
<td>EE 231L</td>
<td>Electronic Circuits Lab</td>
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</tr>
<tr>
<td>CR 245</td>
<td>Digital Design I</td>
<td>3</td>
</tr>
<tr>
<td>CR 245L</td>
<td>Digital Design I Lab</td>
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</tr>
<tr>
<td>CR 246</td>
<td>Digital Electronics Design II</td>
<td>3</td>
</tr>
<tr>
<td>CR 320</td>
<td>Computer Networks</td>
<td>3</td>
</tr>
<tr>
<td>ME 201</td>
<td>Engineering Statics</td>
<td>3</td>
</tr>
<tr>
<td>ME 203</td>
<td>Kinematics and Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 206L</td>
<td>Mechanics Laboratory</td>
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<tr>
<td>ME 241</td>
<td>Principles of Thermodynamics</td>
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</tr>
<tr>
<td>ME 308</td>
<td>Strength of Materials</td>
<td>3</td>
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<tr>
<td>MF 207</td>
<td>Material Science</td>
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<tr>
<td>MF 250</td>
<td>Programmable Logic Control Systems</td>
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<tr>
<td>MF 250L</td>
<td>Programmable Logic Control Sys. Lab</td>
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<tr>
<td>SW 201</td>
<td>Software Engineering Methods</td>
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<td>EG 210</td>
<td>Nanoscience and Nanotechnology</td>
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<td>EG 212</td>
<td>Nanoscience and Nanotechnology II</td>
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<td>EE 315</td>
<td>Nanoelectronics</td>
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<tr>
<td>CR 333</td>
<td>Biomedical Visualization</td>
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<td>CR 331</td>
<td>Biomedical Signal Processing</td>
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</tr>
<tr>
<td>CR 332</td>
<td>Biomedical Imaging</td>
<td>3</td>
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</table>

*Assuming satisfactory prerequisite*
Course Descriptions

CR 311 Image Processing
This course builds on CR 310, extending the multimedia programming concepts into the area of image processing. Students build image-processing applications, implementing algorithms in areas that include color space conversion, low-level pattern recognition, and theory of two-dimensional in space and time. Students write high-performance image-processing programs with applications in the area of streaming multi-media content. (Prerequisite: CR 310 or permission of the instructor) Three credits.

CR 320 Computer Networks
This course covers principles of networking and network programming. Topics include OSI layers, elementary queuing theory, protocol analysis, multi-threading, command-line interpreters, and monitors. Students write a distributed computing system and check their performance predictions with experiments. (Prerequisite: SW 131 or equivalent) Three credits.

CR 325 Computer Graphics
This course supports the visualization and computer systems domain, offering an introductory treatment to two-dimensional and three-dimensional computer graphics concepts. Students write computer games and employ their knowledge to imbue them with realism. High performance rendering uses the latest in cutting edge hardware-accelerated graphics processors. (Prerequisite: SW 131 or permission of the instructor) Three credits.

CR 331 Biomedical Signal Processing
This course presents an overview of different methods used in biomedical signal processing. Signals with bio-electric origin are given special attention and their properties and clinical significance are reviewed. In many cases, the methods used for processing and analyzing biomedical signals are derived from a modeling perspective based on statistical signal descriptions. The purpose of the signal processing methods ranges from reduction of noise and artifacts to extraction of clinically significant features. The course gives each participant the opportunity to study the performance of a method on biomedical signals. (Prerequisites: SW 131 or CS 142 or SW 408 and MA 145 or MA 172; or permission of the instructor) Three credits.

CR 332 Biomedical Imaging
This course presents the fundamentals and applications of common medical imaging techniques, for example: x-ray imaging and computed tomography, nuclear medicine, magnetic resonance imaging, ultrasound, and optical imaging. In addition, it provides a basis for special imaging, introductory material on general image formation concepts and characteristics are presented, including human visual perception and psychophysics. (Prerequisite CR 331) Three credits.

CR 333 Biomedical Visualization
This course is an introduction to 3-D biomedical visualization concepts and techniques, including UltraSound, MRI, CAT scans, PET scans, etc. Students learn about spatial data structures, computational geometry, and a variety of modeling techniques and applications in 3-D molecule and anatomical modeling. (Prerequisite: SW 131 or equivalent) Three credits.

CR 346 Computer System Architecture
This course introduces the machine language and various components of a computer hardware in modern computer systems. The course focuses on CPU, memory, bus, cache, I/O module, internal data representation, and instruction set design. It also covers pipelining, superscalar architecture, reduced instruction set computers, parallel architectures, and interconnection networks. (Prerequisite: CR 245) Three credits.

CR 382 Independent Studies in Computer Engineering
This course includes supervised reading and research. Available only by pre-arrangement with the instructor. Three credits.

Electrical Engineering Courses

EE 213 Introduction to Electric Circuits
This course introduces engineering students to the analysis of linear electric circuits. The course covers the basic laws of circuit behavior and analysis techniques, including descriptions of circuit elements and electronic variables, circuit theorems and principles for insightful analysis of electrical circuits. The course introduces basic concepts and analysis methods. (Prerequisites: MA 146; PS 16, PS 16L) Three credits.

EE 213L Electric Circuits Lab
Students use common electrical laboratory instruments (oscilloscopes, meters, and signal generators) and elemental circuit components to construct and analyze basic electric circuits. They study the application of circuit theorems and circuit elements (RL and RC); conduct experiments with transient, steady state, and frequency response; and use software applications to simulate and analyze circuit performance. (Co-requisite: EE 213) One credit.

EE 215L Electronics Circuits Lab
Students build and test circuits using diodes, bipolar junction transistors, and MOSFETs. They use the principles developed in EE 231 to analyze, build, and test amplifier and oscillator circuits. (Prerequisite: EE 231L) One credit.

EE 301 Signals and Systems I
This course and classifies continuous and discrete signals and systems. It presents time domain and discrete analysis of signals using the Fourier series, Laplace transforms, and fast Fourier transforms (e.g., discrete convolution, correlation, and spectrum analysis). It also covers applications to signal processing and control systems. (Prerequisites: MA 146, PS 16, PS 16L) Three credits.

EE 315 NanoElectronics
Building on the two introductory courses in nanotechnology, this course is designed for students interested in the minor in nanotechnology. It presents the fundamental principles of nanotechnology and nanoelectronics. It also covers recent advances in the field and how they may be applied to electronics products are discussed. A variety of new devices such as quantum dots, nanowires, and silicon-based devices are presented. It presents the fundamentals of nanoscale electronic materials, devices, and circuits. Students will learn about the basic principles of nanoscale electronics and their applications in emerging technologies. (Prerequisites: MA 175; MA 210; MA 211) Three credits.

EE 215 Introduction to Electronics Circuits and Design I
This first course in electronics teaches basic principles and technologies to understand, analyze, and design electronic circuits. The course reviews the properties of semiconductor materials used in the fabrication of diodes, bipolar junction transistors, and field effect transistors. Students learn amplifier biasing techniques and design circuit models of semiconductor devices that are used to analyze and design electronic circuits. Computer simulations of circuits are used to illustrate the fundamental principles. (Prerequisite: EE 213) Three credits.

EE 331 Image Processing
This course introduces the basic principles and techniques of image processing. The course covers the fundamentals of image formation and characteristics are presented, including human visual perception and psychophysics. (Prerequisite CR 331) Three credits.

EE 333 Biomedical Visualization
This course is an introduction to 3-D biomedical visualization concepts and techniques, including UltraSound, MRI, CAT scans, PET scans, etc. Students learn about spatial data structures, computational geometry, and a variety of modeling techniques and applications in 3-D molecule and anatomical modeling. (Prerequisite: SW 131 or equivalent) Three credits.

EE 346 Computer System Architecture
This course introduces the machine language and various components of a computer hardware in modern computer systems. The course focuses on CPU, memory, bus, cache, I/O module, internal data representation, and instruction set design. It also covers pipelining, superscalar architecture, reduced instruction set computers, parallel architectures, and interconnection networks. (Prerequisite: CR 245) Three credits.

EE 382 Independent Studies in Computer Engineering
This course includes supervised reading and research. Available only by pre-arrangement with the instructor. Three credits.

EE 321 Introduction to Electric Circuits
This course introduces engineering students to the analysis of linear electric circuits. The course covers the basic laws of circuit behavior and analysis techniques, including descriptions of circuit elements and electronic variables, circuit theorems and principles for insightful analysis of electrical circuits. The course introduces basic concepts and analysis methods. (Prerequisites: MA 146; PS 16, PS 16L) Three credits.

EE 313 Digital Design I Laboratory
The lab course covers the practical aspects of digital logic design. Students design and implement logic circuits using simulators and hardware and techniques taught in CR 245. Students use state machines to implement open-ended design problems. (Co-requisite: CR 245) One credit.

EE 324 Digital Electronics Design II
This course examines computer architecture implemented using a hardware design language and programmable logic devices. Students design, implement, and program small reduced-instruction-set-computer and programmable logic devices. Students learn to write, implement, and simulate elementary digital design. Three credits.

EE 345L Digital Design I Laboratory
This course builds on CR 310, extending the multimedia programming concepts into the area of image processing. Students build image-processing applications, implementing algorithms in areas that include color space conversion, low-level pattern recognition, and theory of two-dimensional in space and time. Students write high-performance image-processing programs with applications in the area of streaming multi-media content. (Prerequisite: CR 310 or permission of the instructor) Three credits.

EE 350L Digital Design I Laboratory
This course covers principles of networking and network programming. Topics include OSI layers, elementary queuing theory, protocol analysis, multi-threading, command-line interpreters, and monitors. Students write a distributed computing system and check their performance predictions with experiments. (Prerequisite: SW 131 or equivalent) Three credits.

EE 351 Biomedical Signal Processing
This course presents an overview of different methods used in biomedical signal processing. Signals with bio-electric origin are given special attention and their properties and clinical significance are reviewed. In many cases, the methods used for processing and analyzing biomedical signals are derived from a modeling perspective based on statistical signal descriptions. The purpose of the signal processing methods ranges from reduction of noise and artifacts to extraction of clinically significant features. The course gives each participant the opportunity to study the performance of a method on biomedical signals. (Prerequisites: SW 131 or CS 142 or SW 408 and MA 145 or MA 172; or permission of the instructor) Three credits.

EE 352 Computer Graphics
This course supports the visualization and computer systems domain, offering an introductory treatment to two-dimensional and three-dimensional computer graphics concepts. Students write computer games and employ their knowledge to imbue them with realism. High performance rendering uses the latest in cutting edge hardware-accelerated graphics processors. (Prerequisite: SW 131 or permission of the instructor) Three credits.

EE 353 Biomedical Imaging
This course presents the fundamentals and applications of common medical imaging techniques, for example: x-ray imaging and computed tomography, nuclear medicine, magnetic resonance imaging, ultrasound, and optical imaging. In addition, it provides a basis for special imaging, introductory material on general image formation concepts and characteristics are presented, including human visual perception and psychophysics. (Prerequisite CR 331) Three credits.
EE 316 Nanoelectronics II
This second course in Nanoelectronics emphasizes practical and theoretical aspects of nanotechnology in the various fields of next-generation electronics. The course will discuss topics relevant to electromagnetics at the nanoscale, MEMS/NEMS, nanonano, nano-optics, molecular electronics, and nanoelectronic interfaces with biology. Student teams will survey the available literature on various nanotechnology topics, and present their findings. Teams of students also conceptualize a potential product, design the product, and deliver the same analysis as a core to select a product for analysis in terms of application-specific electronic circuits and performance.

Course Descriptions

EE 321 Electromagnetic Fields
This course uses vector calculus to calculate electric and magnetic fields. Topics include techniques for the computation of fields for given charge distributions; Coulomb’s and Gauss’ law and applications, and the significance of Poisson’s and Laplace equations; solution methods; computation of fields for given charge distributions; Maxwell’s equations in integral and differential form; and electromagnetic radiation and wave propagation.

EE 331 Analog Electronics Design
This advanced course in electronics examines high frequency response of bipolar junction transistor and field-effect transistor amplifiers using hybrid two-port active device models. Students consider the effect of feedback and frequency compensation techniques on the amplifier response and study a variety of analog circuits with respect to their analysis and applications, including active filters, oscillators, waveform generation and shaping, voltage regulator, and communication circuits. The course introduces basic power electronics device components. (Prerequisites: EE 221, EE 231, EE 310, MA245 and MA 321) Four credits.

EE 346 Embedded Microcontrollers
This course covers the architecture of microcontrollers, including how they are constructed internally and how they interface with external circuitry. Applications for microcontrollers in both complex and simple equipment are discussed. Students learn how to apply and how to select a microcontroller for a given application. An accompanying laboratory course covers the programming of microprocessors to do a specific task. This course covers the programming and application of the PIC microcontroller. Students are introduced to microprogramming skills using assembly language and software tools such as MPLAB IDE and MultiSim MCU. These tools are used as a common tool for practical applications such as motor speed control and voltage regulation for power supplies. (Prerequisite: CR 245 or equivalent) Three credits.

EE 346L Microcontroller Laboratory
This laboratory covers the basic operation and applications of a microcontroller. Students learn to program a microcontroller to control applications, such as motor speed, by the use of an emulator connected to a PIC. They design a circuit using a microcontroller for a specific application and write a program to control the circuit. On completion of the program, the student is taught to use the emulator to program an actual microcontroller for use in their circuits. (Co-requisite: EE 346) One credit.

EE 350 Analog Communication Systems
The course focuses on analog communication systems and the effects of noise on the system transfer characteristics. It develops the theory of the effects of various noise sources on systems. Historical design studies and simulation in communication applica-
tions permit students to apply these concepts to meet system requirements. The course clarifies important concepts through simulation of major techniques on multimedia computing systems. (Prerequisite: EE 301) Three credits.

EE 352 Digital Communications
This course is designed to explore current digital communications theory and practice, with an emphasis on network communications between computers. It includes discrete time signals and systems, Z-transforms, discrete Fourier transforms, finite impulse response digital filter design, and random signals. Fundamentals of sampling principles and channel coding are utilized to develop common baseband and digital modulation techniques (ASK, FSK, PSK, PCM, and delta modulation). Transmission over bandwidth constrained channels, and signal detection and equalization are also examined. Multiplexing and multiple access networks are also analyzed. The lecture material is illustrated with practical examples. (Prerequisite: EE 301 or equivalent) Three credits.

EE 360 Power Electronics
This course covers the design and operation of power electronics circuits, such as power supplies and motor controls. Using electronic circuit models for transistors and diodes developed in earlier courses, students analyze and design power circuits. This course uses vector calculus to investigate electric and magnetic fields.

EE 360L Power Electronics Laboratory
This lab applies the theory developed in EE 360 to actual devices, such as anti-fabricate, test, and optimize their designs. They gain practical experience in packaging and cooling power circuits. One credit.

EE 361 Green Power Generation
This course compares various methods of green power generation including solar power, wind power, water power, and several others. This course covers how power is generated from these sources, the associated costs, the efficiency, and the practicality. These methods are compared to the present most common method of using oil and gas to heat water into steam to turn turbines. The student does not necessarily need a background in engineering and any necessary background material will be covered in the understanding of all three credits.

EE 373 Microwave Structures
This course considers the generation and transmission of electromagnetic waves. Maxwell’s equations and the generation of radiation by currents and charges in free space are covered, followed by the propagation of waves in various media. Structures used in microwave propagation, including transmission lines, waveguides, resonators, amplifiers, and antennas are also considered. (Prerequisite: EE 321) Three credits.

EE 382 Advanced Electrical Project
During this course students will have the opportunity to work on applications related to electrical circuits and signal processing. They will be guided by project advisors and will be expected to prepare written reports and present their work in class. The project topics will be selected from a list provided by the instructor. (Prerequisites: EE 231, EE 232, EE 310, EE 316, EE 321, EE 346, EE 350, EE 352, EE 360, EE 361, EE 373, and EE 382) Five credits.

Course Descriptions

EE 392 Digital Control Systems
This course provides an introduction to digital control systems. It covers the theory and application of digital control systems, including digital signal processing, digital control of dynamic systems, and the design of digital controllers. The course includes hands-on laboratory experiments using digital signal processors and microcontrollers. (Prerequisites: EE 331, EE 346, EE 350, EE 352, EE 360, EE 361, EE 373, and EE 382) Three credits.

EE 393 Analog Control Systems
This course provides an introduction to analog control systems. It covers the theory and application of analog control systems, including analog signal processing, analog control of dynamic systems, and the design of analog controllers. The course includes hands-on laboratory experiments using analog signal processors and operational amplifiers. (Prerequisites: EE 331, EE 346, EE 350, EE 352, EE 360, EE 361, EE 373, and EE 382) Three credits.

EE 394 Power Electronics Design
This course provides an introduction to power electronics design. It covers the theory and application of power electronics, including power supplies, motor controls, and electrical drives. The course includes hands-on laboratory experiments using power electronics components and systems. (Prerequisites: EE 331, EE 346, EE 350, EE 352, EE 360, EE 361, EE 373, and EE 382) Three credits.

ME 201 Engineering Statics
This introduction to rigid body mechanics using vector representation covers free body diagrams and static equilibrium in two- and three-dimensional space; solves problems in trusses, frames, and simple mechanisms; and develops methods in problem-solving techniques using computer-based approaches. The course integrates computer-aided design and teaching tools, ensuring relevance to the statics problems. Students perform lab experiments to support lecture theories and prepare professional reports. (Prerequisites: PS 15, PS 15L, MA 146) Three credits.
**Course Descriptions**

**ME 203 Kinematics and Dynamics**
This course covers the principles applied to particles and rigid body elements. Topics include analysis of forces and motion using Newton's second and third laws of motion; theory of kinetics of particles and rigid body motion; curved line and curvilinear motion, vector methods; principles of work, energy, and power; and momentum and impact. The course integrates computer-aided analysis and design tools, ensuring relevance to the kinematics and dynamics fields. (Prerequisites: ME 201, MA 245) Three credits.

**ME 260L Mechanics Laboratory**
Students do mechanics experiments for two- and three-dimensional structures under static loading conditions. Concepts include vectors, equilibrium, moments, thrust analysis, forces, and center of gravity of objects. This course includes topics in engineering materials, such as hardness, toughness, microscopic analysis, machinability and thermal properties. The course introduces strain gages, instrumentation and statistical data analysis. Students perform experiments and prepare laboratory reports. (Co-requisite: ME 201) One credit.

**ME 241 Principles of Thermodynamics**
This course on macroscopic thermodynamics with applications covers conservation of energy for open and closed systems; equations of state and pure substances; first and second law of thermodynamics, including the concepts of internal energy; and enthalpy and entropy as applied to aero-thermal components. Topics include thermodynamic properties, ideal gases and elements of cycle analysis, and applications of thermodynamic cycles, such as Carnot and Rankine, are discussed. Students test their understanding of the concepts and problems presented in class through weekly problem sets. (Prerequisites: PS 15, PS 15L, MA 245) Three credits.

**ME 307L Dynamics Systems Lab**
Students perform experiments covering the concepts of kinematics, dynamics, and mechanisms. Concepts include: Newton's Laws, momentum, mechanical energy, impact, and friction. The course includes concepts in the area of strength of materials, such as stress, strain, loading, modulus of elasticity, and fatigue. It also covers analysis of beams, photoelastic studies, and statistical data analysis. Students complete with lab reports. (Co-requisites: ME 203, ME 308) One credit.

**ME 308 Strength of Materials**
This course examines concepts of two-dimensional stress and strain, factors of safety, thermal strain, static indeterminacy, strain energy, and fatigue including normal and shearing stresses, torsion, direct shear, principal stresses; Mohr's Circle; thin-walled pressure vessels; welded structures; and 3-D stress analysis. (Prerequisites: ME 201, MA 245) Three credits.

**ME 311 Machine Design**
This course applies fundamental concepts of mechanical engineering design to analyze, design, and/or select components typically used in the design of complete mechanical systems. The course covers the design process and analysis of stress and deflection; material properties and loading (steady state and variable) as they relate to failure prevention; and the procedures for design and analysis of common machine elements such as columns, cylinders, fasteners and springs. In team-reverse-engineering projects, students apply the course concepts to real hardware. The course emphasizes computer techniques and responsible design (safety factors and ethics). (Prerequisite: ME 308) Three credits.

**ME 312 Advanced Machine Design**
The advanced study of machine design emphasizes the process of developing creative solutions through conceptual analysis and synthesis in this course that covers topics related to the design of rotating mechanical systems, welded joint design, and fracture mechanics. Students conduct a research project, investigating and reporting on a topic in advanced design, and complete as part of a team in a design development project that applies structured design practices to real hardware. The course emphasizes concept generation and development and responsible design. (Prerequisite: ME 311) Three credits.

**ME 318 Finite Element Analysis**
An introduction to concepts in finite element analysis; this course covers one- and two-dimensional elements, matrix formulation and structural analysis. This finite element analysis is extended to three dimensional problems in dynamic system analysis; design and manufactur- ing, mechanics, and materials, and fluids and thermal systems. This course will provide an overview of the complimentary topics of finite element mechanics: elasticity and plasticity, and dynamics of rigid bodies are also discussed, as well as variational principles: stationary value of a function, Hamilton's principle of least action, and Huygen's principle. (Prerequisites: ME 203 or equivalent) Three credits.

**ME 322 Advanced Dynamics**
The topics in the area of dynamics include degrees of freedom, constraint equations, forces, the prin- ciple of virtual work and D'Alembert's principle. Energy and momentum, frames of reference, orbital motion, Lagrange's equations, and the dynamics of rigid bodies are discussed. The course emphasizes problem solving both manually and with the use of modern computer finite element soft- ware, ANSYS and FLUENT. (Prerequisites: ME 321, CD 211, and ME 308) Three credits.

**ME 319 Applications of Finite Element Analysis**
This course examines applications of finite element analysis in modern engineering including structural analysis, fluid flow and heat transfer. It is an introduc- tion to the concepts of structural analysis. Finite element formulations covering 1-, 2- and 3-dimensional elements as well as energy methods are covered. Students develop their own elements for application of finite element method in structural design, dynamic system response, fluid and thermal analyses. Application of methods in fluid flow is presented. Students solve example and design problems manu- facturing and using modern computer finite element analysis software, ANSYS and FLUENT. (Prerequisites: ME 318) Three credits.

**ME 320 Vibration Analysis**
This course applies fundamental laws of mechanics, free and forced vibration of discrete single and multi- degree-of-freedom systems, periodic and harmonic motion, viscous damping, and measures of energy dissipation. Topics include linear and nonlinear systems, functional methods in vibration analysis, natural frequencies and mode shapes, analytical dynamics and Lagrange's equation, longitudinal, torsional, and flexural vibration of continuous elastic systems (strings, rods, beams) are discussed. (Prerequisites: ME 203, MC 290, or equivalent) Three credits.

**ME 321 Advanced Kinematics**
Topics included in kinematics are spatial mechanisms, classification of mechanisms, basic concepts and defini- tions, mobility criterion, number synthesis of mecha- nisms, kinematic analysis of mechanisms: Raver's method, Hartenberg and Denavit's method, Chace's vector method, general transformation matrix method, dual number quaternion algebra method, method of generated surfaces, method of constant distance equa- tions, and method of train components. Class covers existence criteria and gross-motion analysis of mecha- nisms, kinematic synthesis of mechanisms, function generation synthesis, rigid-body guidance synthesis, and path generation synthesis, coupler curves and cogenets, and Kopp's and Albert's cogenets and spatial coupler curves. (Prerequisite: ME 203) Three credits.

**ME 322 Advanced Dynamics**
The topics in the area of dynamics include degrees of freedom, constraint equations, forces, the prin- ciple of virtual work and D'Alembert's principle. Energy and momentum, frames of reference, orbital motion, Lagrange's equations, and the dynamics of rigid bodies are discussed. The course emphasizes problem solving both manually and with the use of modern computer finite element soft-ware, ANSYS and FLUENT. (Prerequisites: ME 321, CD 211, and ME 308) Three credits.

**ME 327 Applications of Fracture Mechanics in Engineering Design**
This course covers fracture mechanics concepts for design, material selection, and failure analysis. The fundamental principles of fracture parameters and criteria, stress field at the tip of a crack, fracture toughness, thickness effects on crack propagation, and crack growth under cyclic loading and aggressive environment will be presented. Emphasis will be placed on the practi- cal aspects of fracture mechanics; principles of failure by incorporation of design problems and laboratory demonstrations in the course. (Prerequisite: ME 306, or equivalent) Three credits.

**ME 330 Mechanics of Composite Materials**
This course covers structural advantages of composite materials over conventional materials. High strength- to-weight ratios, analysis of fiber-reinforced, laminated and particle materials. 3-D anisotropically constitutive relations. Classical, lamina, and boundary conditions for composite beams, plates and shells. Boundary value problems and solutions for static loads, buckling and vibrations. Higher order theories incorpor- ating shear deflection and layer wise theories. Inter laminar stresses and edge effects. Response of composite structures to static and dynamic loads. Study of thermal and environmental effects and failure criteria. (Prerequisite: ME 207) Three credits.

**ME 342 Applications of Thermodynamics**
This course applies concepts learned in ME 241. Topics include mixtures of ideal gases and vapors; psychrometry; combustion analysis of common power generating, refrigeration, and air conditioning cycles; figures of merit including thermal efficiency; continuity equation, basic energy relations for turbomachinery; fundamentals of compressor and turbine design; and application and synthesis of design using thermody- namic principles. This course contains a lab segment. (Prerequisites: ME 241) Three credits.

**ME 346 Energy Conversion**
This course covers the major topics in energy conver- sion, including fuels used in energy conversion; solar energy; gas turbine engines and applications; internal combustion engines; heat pumps; classic and novel power and refrigeration cycles; system analysis; sys- tems first and second law analysis. This course emphasizes computer simulation of power plant performance to optimize energy conversion efficiency. A research project on one of the emerging sources of energy is an essential part of this course. (Prerequisite: ME 349) Three credits.

**ME 347 Fluid Mechanics**
Topics in this course include incompressible fluids at rest in motion; Bernoulli's theorem and the prin- ciple of similarity flow through orifices, nozzles, and pipes; flow through open channels; energy relationships as applied to pipe lines, pumps, and turbines; acceleration of fluid masses; losses in fluid flow systems; fluid dynamics; the momentum theorem in turbomachinery; and lift and drag forces. The course emphasizes design solutions using computer analysis and synthesis. The course includes a design project of a system that applies the principles of fluid flow. (Prerequisite: ME 303) Three credits.

**ME 348L Thermal and Fluids Lab**
This laboratory learning experience provides the oppor- tunity to explore various components, such as the compressor, condenser, evaporator, for a series of experiments using refrigeration equipment. Students investigate lift and drag in a wind tunnel, pressure losses in duct flow, and heat transfer. Students conduct a research project on the centrifugal pump, plot PV diagrams for the Otto Cycle, and study a Pelton Wheel Hydraulic Turbine. The course emphasizes statistical analysis, computer-aided fluid evaluation, and report writing. (Co-requisites: ME 342, ME 347) One credit.

**School of Engineering**
ME 349: Heat Transfer
This course covers one- and two-dimensional heat conduction, including solutions for finned surfaces and solutions for transient problems; convection heat transfer in laminar and turbulent flows; fundamental radiation concepts; laws of thermal radiation; radiation exchange geometrical factors and network methods; heat exchangers and electrical analogies. The course emphasizes design solutions using computer analysis and synthesis. In the lab, students investigate heat transfer in plane surfaces, enhanced heat transfer in extended surfaces, and heat exchanger effectiveness. This course includes a practical design project of a system that applies the principles of heat transfer. (Prerequisites: ME 342, ME 347) Three credits.

ME 350L: Energy Transfer Lab
A laboratory experience for engineering students utilizing hands-on experiments to explore energy transfer methods related to transmitted forces in vibrating systems, as well as thermal transfer gradients in mechanicaC, electrical, and electronic systems. Students use simulation and modeling software for many experiments, including conduction and convection heat transfer processes. The course emphasizes statistical analysis, instrumentation, and report writing. (Co-requisites: MC 390, ME 349) One credit.

ME 351: Gas Dynamics
This course reviews fundamental concepts and equations of fluid dynamics. One dimensional compressible flow solutions with and without friction are covered. Equations of conservation of mass, rate of strain tensor, Navier-Stokes equations, mechanical and thermal energy equations with derivations are discussed. Eulerian, Lagrangian basis of the viscous and turbulent characteristics, and the role of boundary layers in boundary layer theory is covered. Students will discuss laminar and turbulent viscous flow boundary layers, Couette, & Poiseuille flows. In addition to analytical closed form solutions, an introduction to computational methods is presented. (Prerequisite ME 347 or equivalent) Three credits.

ME 353: Computational Fluid Dynamics
Introduction to computational methods used for the solution of advanced fluid dynamics problems. Emphasis on concepts in finite difference methods as applied to computational fluid dynamics and partial differential model equations in fluid mechanics, fundamentals of spatial discretization, numerical integration, and numerical linear algebra. A focus on the engineering and scientific computing environment. Other topics may include waves, advanced numerical methods (like spectral, finite element, finite volume), using uniform grids, turbulence modeling, and methods complex boundary conditions. (Prerequisite ME 347 or equivalent) Three credits.

ME 354: Heat and Mass Transfer
This course covers the concepts of conduction, convection, and radiation heat transfer as well as mass transfer. Boiling and condensation; design and performance of selected thermal systems (including heat exchangers); and laminar and turbulent flows as related to forced and free convection are all studied. Mathematical modeling of engineering systems using modern analytical and computational solution methods are also covered. This course carries a design/research project. (Prerequisite: ME 349 or equivalent) Three credits.

ME 362: Turbomachinery
The theoretical basis and the fundamentals of modern turbomachinery for aerospace (helicopter, aircraft) and power generation (marine, industrial) applications are studied. Brayton engine cycle analysis and performance improvement are reviewed. Applications of the principles of fluid mechanics and thermodynamics to the design of turbines and compressors are examined, as well as component analysis and velocity diagram for axial compressors, centrifugal compressors and axial turbines. Discussion of combustion and environmental emissions. This course carries a design/research project. (Prerequisite: ME 347 or equivalent) Three credits.

ME 382: Independent Study, Advanced Mechanical Project
During this design course emphasizing individual creativity, students (working with a faculty mentor) develop project objectives and performance specifications. At review meetings, students present progress on the project including analytical and experimental results to date. A final report and presentation demonstrates the accomplishment of the project goals. For a student involved in a realistic engineering development environment, students may take this course as independent study subject to approval by the instructor. (Prerequisites: departmental approval of project proposal following completion of non-elective mechanical engineering courses and at least one major elective.) One to three credits.

Manufacturing Courses

MF 207: Materials Science
This course provides an overview of the various classes of materials, how materials are made, their physical and mechanical properties, and polymers and the role of these materials in service and design applications. Subjects include atomic structure and bonding, the periodic table, crystal structure, microstructure, defects, diffusion, binary phase diagrams, phase transformations, and corrosion. The effects of processing, microstructure, and composition on mechanical, electrical, and thermal properties are discussed. Lab sessions examine mechanical testing methods and microstructure analyses. Students learn sample preparation and metallographic techniques. (Co requisites: CH 111, CH 111L) Three credits.

MF 230: Computer-Aided Manufacturing (CAM)
An introduction to the theory and practice of engineering of computer-aided manufacturing methods, the course provides a comprehensive view of manufacturing planning, design, automation, flexible automation, and computers in manufacturing, utilizing a strong science-based and analytical approach. CNC and tooling for CNC applications are discussed. The course consists of lectures, group discussions, case studies, a term project, computer simulation, and laboratory. (Prerequisites: CD 211, MA 146) Three credits.

MF 240: Computer-Aided Manufacturing (CAM)
The course balances CAD and CAM with up-to-date information on rapid prototyping, NB-based solid modeling systems, and Web-related issues. Complicated mathematical terminology is kept to a minimum; instead, the concepts are explained in an intuitive way as possible. Students are required to have a background only in programming, calculus, and matrix and vector algebra. The course also covers components of CAD/CAM/CAE Systems and CAD/CAM postprocessors development manufacturing systems. The course consists of lectures, group discussions, case studies, a term project, computer simulation, and laboratory. (Prerequisite: MF 230) Three credits.

MF 250: Programmable Logic Control (PLC) Systems
This course introduces the design and implementation of programmable logic controllers for use in industrial areas of automation, manufacturing, and other related applications. It takes an overall look at Programmable Logic Controllers while concentrating on relay ladder logic techniques and how the PLC is connected to the significant external components. An operating PLC control system. State-of-the-art software used includes: MultiSim, LabView, Cosvis, Vee, and RS Logix 500. The students learn about the theory and application of the present process control, timing and counting functions, chaining sequences, and digital logic. The course consists of lectures, group discussions, case studies, a term project, computer simulation, and laboratory. (Prerequisite: PS 16) Three credits.

MF 250L: Programmable Logic Control (PLC) Systems Lab
This course is designed to teach the students to work with the PLC. The student learns to analyze open- and closed-loop control tasks from the field of activities, and to develop structured and PLC-adequate programs for the control of automation systems. Also, topics such as calibration, sensor applications, and process control are part of the curriculum. (PLC) Systems Lab. Introduction to LabView and other data acquisition software is part of the curriculum. (Prerequisite: PS 16) Three credits.

MF 317: Automation Process Design
This course will discuss the criteria for automating manual operations. The intent is to call attention to some of the important considerations which must be given to processes employed using automation principles. Areas of concentration are Transportation, Utilities, Defense, Facility Operations and Home Automation. Information Technology (IT) encompasses a broad spectrum of computer, communication, and control technologies used to create, store, retrieve, and disseminate information. It is in the area of IT where most of the more flexible and non-industry-specific advances are now being made. Manufacturing applications also will be discussed, including Flexible Manufacturing Systems (FMS), Computer Integrated Manufacturing (CIM), Computer-Aided Manufacturing (CAM), Numerically Controlled (NC) equipment. The course will distinguish which processes adapt the specific automation category. Programmable automation and artificial intelligence will be discussed. (Prerequisite: MF 240) Three credits.

MF 325: Automation Logic Design
This course introduces the application of Boolean algebra and Karnaugh maps; how these support the design of digital logic and how this platform transfers to ladder logic; both of which are used in the design and control of automation systems. Use of classic methods of solving digital logic problems is given; also emphasis on simulation and modeling software for many experimental, electrical, and electronic systems.
This course introduces the integration of fluids and mechanics theory to real-world applications. The primary topics include piping, hydraulic fluids, pumps, diverting valves, and system design with safety as a priority. Upon completion, students will have an understanding of how fluid power is applied in automation and developed to satisfy industrial requirements. The course consists of lectures, group discussions, case studies, a term project, computer simulation, and laboratory. (Prerequisite: PS 16) Three credits.

**MF 319 Network Systems Automation**

This course will discuss the networks used in automation, principles of operation, and use of them. Students will be exposed to the five level of automation from device level to enterprise level: fieldbus and profibus; networks detecting machinery faults; networked smart sensors systems; and the peer-to-peer intelligent transducer networks. The course will also introduce students to local area networks and data communication. The course consists of lectures, group discussions, case studies, a term project, computer simulation, and laboratory. (Prerequisite: MF 240) Three credits.

**MF 350 Advanced Programmable Logic Control (PLC) Systems**

This course will give students advanced concepts in programmable logic control systems and their applications and interfacing to industrial controls in the areas of automation, manufacturing, and others. Topics include bit operations, data manipulation, industrial PLC network utilizing Ethernet, ControlNet, and DeviceNet. Data sharing and distributed PLC programming techniques are covered in touch panel programming and operation are studied. State of the art software used: MultiSim, LabView, Cosvis, Veep, Automation Studio, and RS Logic 500. It will include: input/output ports, intermittent and continuous process control, arithmetic and comparison instruction, function block diagrams, indirect and indexed addressing, and sequential function charts. The course consists of: lectures, group discussions, case studies, a term project, and computer simulation. (Prerequisite: MF 250) Three credits.

**MF 350L Advanced Programmable Logic Control (PLC) Systems Lab**

This course will introduce the advance design and implementation of programmable logic controllers for use in industry in the areas of automation, manufacturing, and others. It will take an overall look at Programmable Logic Controllers while concentrating on data handling, editing block diagram, and industrial networks and distributive control. State-of-the-art software used: MultiSim, LabView, Cosvis, Veep, Automation Studio, and RS Logic 500. It will also include: input/output ports, intermittent and continuous process control, arithmetic and comparison instruction, function block diagrams, indirect and indexed addressing, and sequential function charts. (Co-requisite: MF 350) One credit.

**Course Descriptions**

**MF 351 Manufacturing Systems I**

This introduction to general and specific modern manufacturing technologies includes sheet metal fabrication and process, gear manufacturing, hard mold, powder metallurgy, plastic and rubber processes, primary metalworking processes, metal shearing and forming, welding, different machine processes, and material surface treatment. Additional topics include manufacturing techniques such as material selection for quality control process, material properties analysis in common materials and composites, and material selections and applications in modern manufacturing environments. (Prerequisite: MF 207) Three credits.

**MF 352 Manufacturing Systems II**

This course considers several advanced manufacturing technologies. Topics include laser cutting and welding, water-jet cutting and cleaning, plasma cutting and welding; analysis and application of numerical control, computerized numerical control, and programmable logic control systems in manufacturing facilities and modern production systems; robotics; automated assembly lines, and material handling systems. Advanced topics include management of modern automated production lines, design of material handling systems, and selection of control systems in manufacturing applications. (Prerequisite: MF 351) Three credits.

**MF 353 Manufacturing Processes and Materials**

This course will give students advanced concepts in programmable logic control systems and their applications and interfacing to industrial controls in the areas of automation, manufacturing, and others. Topics include bit operations, data manipulation, industrial PLC network utilizing Ethernet, ControlNet, and DeviceNet. Data sharing and distributed PLC programming techniques are covered in touch panel programming and operation are studied. State of the art software used: MultiSim, LabView, Cosvis, Veep, Automation Studio, and RS Logic 500. It will include: input/output ports, intermittent and continuous process control, arithmetic and comparison instruction, function block diagrams, indirect and indexed addressing, and sequential function charts. The course consists of: lectures, group discussions, case studies, a term project, and computer simulation. (Prerequisite: MF 250) Three credits.

**MF 354 Product and Process Design for Manufacturing**

Students learn the principles of product design for optimizing manufacturing and assembly - an essential part of the concurrent engineering process. The course covers a variety of topics: product design and design processes with an emphasis on cost and value, manufacturing and assembly line design, and part manufacturable and design for automation and automated assembly processes. A course project applies these principles. (Prerequisite: MF 350) Three credits.

**MF 355 Product Planning and Forecasting**

This course will consider modern operations of both manufacturing and service sectors of the world economy. Topics to be included are: concepts of planning and control of production systems; design of control systems and operation planning; demand forecasting; inventory control; operations scheduling; dynamic control; production planning of product mixes; economical lot sizes and vendor supplies. Where possible computer models will be used. (Prerequisite: MF 354) Three credits.

**MF 356I Automation and Robotics I**

This course introduces the basic elements of automation, industrial robotics, automated work cells, common information model systems, and the automated factory. Topics include kinematics, dynamics, the classification of robots, types of robots, movements, path planning, and application of robots in manufacturing and automation. (Prerequisite: MF 207) Three credits.

**MF 356II Automation and Robotics II**

This course introduces components of the automated factory. Topics include design of parts and processes for automation, hard and flexible automation, blocks of automation, automatic production and assembly, numeric controllers, computer-aided design/computer-aided manufacturing, industrial logic control systems, programmable logic controllers, and computer applications in automation. (Prerequisite: MF 361) Three credits.

**Mechatronics Courses**

**MC 290 Engineering Systems Dynamics**

This course covers basic engineering vibration analysis with application to control systems including free-damped and undamped vibration of one-degree of freedom systems, forced vibration, response, shock excitation, harmonic analysis, and random vibration, modal vibration, vibration analysis, design and control of systems with distributed mass and elasticity. Automatic control system topics include the simple hydraulic servo, open-loop and closed-loop systems, root-locus to Routh-Hurwitz criterion, Nyquist criterion, and Bode analysis. The course includes applications and case studies, and integrates computer-aided analysis and design tools (MATLAB and Working Model) to ensure relevance to the design and analysis of real-world engineering dynamic and control system problems. (Prerequisites: MA 321, ME 203) Three credits.

**MC 300 Feedback and Control Systems**

This course emphasizes analysis and synthesis of closed-loop control systems using classical and state-space methods and examples in control systems design. The course will cover the design of feedback control systems using classical control methods, state-space control methods, and computer-aided design tools. The course will cover the design of feedback control systems using classical control methods, state-space control methods, and computer-aided design tools. (Prerequisites: MA 321, EE 301) Three credits.

**MC 310 Software Engineering**

This course is the continuation of SW 201 with in-depth projects and further discussions of design and implementation topics. Through the use of case studies and project work that has the student gradually building a large design specification, students will achieve an understanding of how complex applications are designed and built. (Prerequisite: SW 201) Three credits.
SW 204 Software Project Management
This course covers project management principles, fundamentals of project management, and life cycles required for the successful management and development of software. Quality management principles of Personal Software Process (PSP) and Team Software Process (TSP) are introduced and practiced. Students will learn how to develop a project plan, scope a project, identify project activities, create work breakdown structures, estimate and schedule resources, construct and analyze project network diagrams, finalize project schedule and cost based on network analysis, and team members organize and manage a project team, monitor and control progress, understand critical path project management, and have knowledge of both agile and traditional project management methods. (Prerequisite: SW 202) Three credits.

SW 205 Software Testing and Maintenance
This course will cover in-depth methods for software testing, reliability and maintenance of software. Students will learn the principles of software testing and how to apply software testing techniques to the development of quality software and how to deploy software systems. (Prerequisite: SW 202) Three credits.

SW 232 Advanced Programming and Data Structures
This course covers Abstract Data Structures such as Queues, Stacks, Linked Lists, Trees, Graphs, Hash tables and sorting. Students apply data structure concepts in well-formed programming. (Prerequisite: SW 131) Three credits.

SW 304 Web Development
This course introduces the student to developing applications for use on the World Wide Web. Students learn basic concepts for designing distributed applications and gain hands on experience through the construction of web-based applications. The course covers concepts that allow communication over the Web. This includes designing and authoring web pages, markup languages, the client-side document object model, usability, search engine optimization, and client-side dynamic web pages. (Prerequisite: SW 131) Three credits.

SW 314 Network Concepts
This course covers the structure and technologies of computer network architecture including cabling, wiring hubs, file servers, bridges, routers, and network interface cards. It discusses network software and hardware configurations and demonstrates various network concepts such as configuring protocol stacks and connecting a personal computer to a network. The course examines the OSI model, TCP/IP protocol and routing protocols. Students will be able to do subnet of TCP/IP networks. Three credits.

SW 327 Operating Systems and Programming
This course introduces the internal operation of modern operating systems and students learn how to program on non-Windows OS platform. The topics cover a brief history of operating systems, the major components of modern operating systems, and the object-oriented methodology on UNIX-like platform. Various UNIX tools will be used in the course and participants study examples using object-oriented programs as well as large system integration by object-oriented methodology. (Prerequisite: SW 232) Three credits.

SW 348 Server Management
Server Management is a course designed to provide the student with the tools necessary to manage Window Server. The topics include user management, installation and configuration of web server, mail server, FTP server, LDAP and backup, and other routine system and network administration. Three credits.

SW 355 Database Management Systems
This course examines data formats, organizations, representations and structures; design and analysis of searching, sorting, and other algorithms; data management systems; relational database model; domains and relational integrity; structured query language; database design - logical and physical; entity-relationship diagrams; normalization; transaction processing; and database administration. (Prerequisite: SW 232) Three credits.

SW 382 Special Topics in Software Engineering
This course provides an in-depth study of selected topics in software engineering of particular interest to the students and instructor. The course is counted as a major electives/departmental course. The topics and prerequisites will be announced when this course is offered. One to three credits.

SW 383 Independent Study
This course is an individual study under the supervision of the faculty member. The course emphasizes individual creativity. Students work with a faculty mentor in studying and investigating topics of current interest in software engineering. Students may earn from one to three credits for an independent study course. (Prerequisite: permission of the instructor) One to three credits.

SW 399 Algorithms
This course introduces various algorithms and analyzes the complexity and efficiency of the algorithms. Topics cover classic and heuristic algorithms, algorithm analysis, searching, sorting and parsing techniques, and theoretical foundation. Student gains experience of analyzing algorithm efficiency and performance through problem solving and programming projects. (Prerequisite: SW 232) Three credits.

SW 403 Visual C# for Programmers I
This course provides an introduction to programming using Visual C# and the .NET framework. Students learn to create applications using object-oriented programming and learn about Microsoft.NET, Visual Studio.NET, classes and objects, structured program- ming, exception handling, and debugging. Students complete this course understanding how Visual C# interacts with the .NET framework and will be able to build applications using Visual C#. The course is designed for designers and programmers who are developing systems in the Windows environment. Lab included. Three credits.

SW 408 Java for Programmers I
This programming course introduces Java fundamentals. Topics include the Java elements: objects, classes, data types, operators, control structures, and container data structures. The course views object-oriented programming as integral, teaching it throughout. Accordingly, it includes the concepts of encapsulation, inheritance, polymorphism, packages, interfaces, and inner classes. The course teaches design for OOP design and includes data handling concepts such as input from the keyboard, output to the screen, input from files and output to files. The course also introduces the concept of multi-threading in preparation for follow-up studies. Lab included. Three credits.

SW 409 Java for Programmers II
This course covers advanced topic of Java program- ming. Topic covers multithreading, networking, nested references, design patterns, JDBC, persistence, I/O and advanced GUI such as swing. Data structure concepts such as linked list, tree and basic searching and sorting algorithms will be covered. At the completion of this course, students will be able to produce complete Windows and console based applications with Visual C#. Lab included. (Prerequisite: SW 403) Three credits.

SW 508 Data Warehouse Systems
This course examines the tools, techniques, and processes used in the design and development of data warehouses. Students will examine how to successfully gather, structure, analyze, and understand the data to be stored in the data warehouse, discuss techniques for modeling enterprise data warehouse, discuss the ETL process and describe techniques for present- ing and analyzing the data in the warehouse. Capacity planning and performance monitoring will be discussed. Microsoft Analysis Services and Sybase ASIQ will be examined as approaches for implementing a data warehouse. (Prerequisite: SW 402) Three credits.

SW 512 Web Development II with ASP.NET
This course teaches the technical skills and tools students need to create a robust, scalable and data-driven ASP.NET website. Students learn how to create ASP.NET applications using Visual Studio. They learn how to use the Visual Studio IDE, Web forms, validation controls, database con- nectivity, web services, component development, user controls, customization, and best practices. At the end of the course, students are able to create the issues involved in creating an enterprise website, creating and publishing a website, creating interactive content for a website, adding server scripting to a web page using ASP.NET, implementing security in a web site, and reading and writing information to a database from ASP.NET. (Prerequisites: SW 406 or SW 403 or permission of instructor) Three credits.
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2012-13