The College of Engineering offers undergraduate and graduate programs to prepare students for a broad spectrum of professional careers in engineering. The undergraduate programs of the College are designed to provide students with a sense of human values and the scientific/technical foundation necessary for a lifetime of continued learning.

The programs offered by the College of Engineering to meet the diverse requirements of the future cover the two areas of: Professional Engineering and Professional Science. The specific degrees and services offered are as follows:

- Bachelor of Science in Chemical Engineering (B.S.Ch.E.)
- Bachelor of Science in Civil Engineering (B.S.C.E.)
- Bachelor of Science in Computer Engineering (B.S.Cp.E.)
- Bachelor of Science in Electrical Engineering (B.S.E.E.)
- Bachelor of Science in Industrial Engineering (B.S.I.E.)
- Bachelor of Science in Mechanical Engineering (B.S.M.E.)
- Bachelor of Science in Computer Science (B.S.C.S.)
- Bachelor of Science in Information Systems (B.S.I.S.)

The Accreditation Board for Engineering and Technology, Inc. (ABET) has inspected and accredited the programs of the College of Engineering defined by the Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Industrial Engineering and Mechanical Engineering. The Bachelor of Science in Computer Science is accredited by the Computer Science Accreditation Commission (CSAC) of the Computing Sciences Accreditation Board (CSAB).

The above spectrum of program offerings provides the prospective student with a choice of avenues depending upon individual interests, career objectives, and capabilities for a significant technological contribution. These programs are described in more detail under their respective catalog headings.

Laboratory experience as well as real-world participation in technological problem-solving is a key aspect of a professional engineer's college education. The College of Engineering, in implementing this need, augments its own modern laboratory and research facilities by close contact with the professional societies and the many industries in the metropolitan Tampa Bay area.

Students interested in particular programs offered by the College of Engineering should direct their inquiries to the College of Engineering Office of Advising.

**PROFESSIONAL ENGINEERING**

The College of Engineering recognizes that modern engineering solutions draw on knowledge of several branches of engineering. It also recognizes that future technological and societal developments will lead to shifting of the emphasis on various branches of engineering, triggered by new needs or a reassessment of national goals. For this reason the College's programs include a strong engineering foundation (core) portion, designed to equip the prospective engineer with a broad base of fundamental technical knowledge. To this foundation is added the student's specialization (option) of sufficient depth to prepare him/her to successfully embark on a professional career.

The Bachelor of Science degrees offered in various engineering fields provide the student a broad education with sufficient technical background to effectively contribute in many phases of engineering not requiring the depth of knowledge needed for advanced design or research. However, while the baccalaureate degree is considered the minimum educational experience for participating in the Engineering profession, and as such is the first professional degree, students interested in design and research are strongly encouraged to pursue advanced work beyond the baccalaureate either at this or other institutions. It is becoming increasingly evident that a large segment of today's engineering professionals are involved in some of the most challenging and important problems of tomorrow. Engineers are seeking advanced degrees to obtain the information and training necessary to meet effectively tomorrow's technological challenges. All are faced with the continuing problem of refurbishing and updating their information skills and most are obtaining advanced information by means of formal graduate study, seminars, special institutes and other such systems designed for this purpose.

The Bachelor of Science degree program (in a designated engineering field requires 136 semester hours) and the Master of Science degree in the same field may be pursued simultaneously in a program of 166 semester hours called the 5-Year Program. These programs are specifically designed to prepare an individual for a professional career as an engineer. These programs have as their foundation a core of subject material encompassing Humanities, Social Science, Mathematics, Science, and Engineering which is required of all students. In addition to the core subject material, each student will complete specialization studies in a designated field under the direction of one of the administrative departments of the College.

The engineering programs of the College have been developed with an emphasis on three broad aspects of engineering activity: design, research, and the operation of complex technological systems. Students who are interested in advanced design or research should pursue the 5-Year Program leading to a Master of Science in Engineering degree.

**Preparation for Engineering**

Students planning to attend USF's College of Engineering should familiarize themselves thoroughly with the College's admissions standards and requirements, which are more stringent than the University's minimum entrance requirements.

The high school student anticipating a career in engineering should elect the strongest academic program that is available while in high school. Four years each of English, mathematics and science (preferably including Chemistry and Physics), as well as full programs in the Social Science and Humanities, are most important to success in any engineering college.

Prospective students considering engineering at the University of South Florida who lack certain preparation in high school must elect to follow a program to overcome their deficiencies. One alternative might be that such a student take some remedial work and a less accelerated program as a Pre-Engineering student. The University of South Florida generally offers most required pre-engineering courses every semester. As another alternative, students may wish to avail themselves of the State's system of junior/community colleges which offer a wide range of remedial coursework, and many of which also offer full programs in pre-engineering (first two years' coursework).

Junior/community college students planning to transfer to the University of South Florida must meet the following requirements: To enter the junior level from a State of Florida operated college or university should follow a pre-engineering program leading to an A.A. degree. All transfer students should complete as much of the mathematics, science and engineering core coursework as is available to them. Transfer students should be aware that the Engineering programs of the College have unique admission standards and requirements, which are more stringent than the University's minimum entrance requirements. Junior/community college transfer students should note that in addition to freshman and sophomore level courses, required junior level courses are given each semester thus permitting full continuity in studies for the student. Junior/community college students intending to pursue an engineering program at USF should contact the adviser at their institution and request a course equivalency list.

Although it is not mandatory, the College strongly recommends acquisition or personal access to a personal computer. For further details, contact the Associate Dean of Engineering - Computing Services.

The College of Engineering can assist students who are planning to obtain a bachelor's degree from the University of South Florida and who have started their studies elsewhere in formulating a sound total program. Interested students should contact the College's Advising Office (813/974-2684) furnishing sufficient details to permit meaningful response.
**Undergraduate Admission to the College**

Students may apply to the College of Engineering upon initial entry to the University by declaring Engineering as their intended major on their admissions application. Upon acceptance to the University, engineering will review necessary credentials and notify applicant of Engineering status.

Freshmen may apply through the Advising Office, in the College of Engineering. To be considered for admission to the College, an applicant must be accepted by the University as a degree-seeking student and be academically in good standing.

Applicants whose native language is other than English must submit TOEFL scores to the College of Engineering. The minimum TOEFL score must be 550.

**Engineering Admission Requirements**

1. **Freshmen:**
   a. Test Scores:
      - SAT—composite of 1050 minimum with a minimum quantitative of 550.
      - ACT—composite of 25 minimum and mathematics of 25 minimum.
   b. High School Mathematics: Should include sufficient algebra and trigonometry to enter Engineering Calculus I.
   c. Math Placement Test must be passed to enter Calculus I.
   d. High School Grade Point Average of 2.5/4.0.

2. **Transfer Students:**
   - Transfer students should complete the following prerequisite courses listed below at the lower level prior to entering the University. If these courses are not taken at the community college, they must be completed before the degree is granted. Unless stated otherwise, a grade of “C” is the minimum acceptable grade.
   - CHM X045/X045L General Chemistry I (with lab)
   - CHM X046/X046L General Chemistry II (with lab)
   - PHY X048/X048L General Physics and Laboratory I
   - PHY X049/X049L General Physics and Laboratory II
   - MAP X302 Differential Equations
   - EGS 1113 Introduction to Design Graphics
   - MAC X281 Engineering Calculus I
   - or MAC X311
   - MAC X282 Engineering Calculus II
   - or MAC X312
   - MAC X283 Engineering Calculus III
   - or MAC X313

**Admission to Programs in Engineering**

This program is under revision. Courses indicated with XXXX rather than course numbers will be submitted for approval during 1998-99. See your academic advisor for additional information.

Once a student has been admitted to the College of Engineering, he/she must then seek admission into one of the specific departments.

The minimum requirements for acceptance by the departments administering the Engineering programs in Chemical, Civil, Electrical, Industrial and Mechanical Engineering are:

2. Satisfactory completion of EGN 4930 - Foundations of Engineering.
3. Completion of the following courses with a cumulative grade point average of 2.0 in these courses based on all attempts.
   - EGN 2210 - Computer Tools for Engineers
   - USEN 3311
   - EGN 3343 - Thermodynamics I
   - EGN 3443 - Engineering Statistics I
   - EGN 3373 - Introduction to Electrical Systems I

The minimum requirements for admission to the Computer Engineering program offered by the Computer Science and Engineering Department are completion of sections 1, 2 and 3 above and:

1. Completion of:
   - COP XXXX - Program Design
   - CDA XXXX - Computer Organization
   - COT 3100 - Introduction to Discrete Structures with a minimum of 2.6 based on all attempts
2. The minimum requirements for admission to the Computer Science program offered by the Computer Science and Engineering Department are completion of sections 1 and 2 above and completion of:
   - COP XXXX - Program Design
   - CDA XXXX - Computer Organization
   - Computer Science & Lab with a minimum gpa of 2.6 on all attempts
3. The minimum requirements for admission to the Information Systems program offered by the Computer Science and Engineering Department are completion of:
   - COP XXXX - Program Design
   - CDA XXXX - Computer Organization
   - with a minimum gpa of 2.6 on all attempts

Prior to being admitted to a department, a student may be permitted to take no more than two departmental engineering courses.

A student can have his or her academic records housed in a department and be advised by the department advisor prior to completing requirements for department admission if he or she so chooses. This type of student must still comply with all of the above-listed requirements prior to official acceptance by the department.

**Direct Departmental Admission**

The purpose of Direct Departmental Admission (DDA) is to permit students who have displayed academic potential for completing the rigors of Engineering to accelerate their admissions into a particular department. The student must apply through the Advising Office of the College of Engineering. The requirements for Direct Departmental Admission (DDA) are:

1. Admission to the College of Engineering
2. High School Students: SAT scores of 500 Verbal and 600 Mathematics, a cumulative total of 1100; ACT scores of 26 Mathematics, a combined average score of 26.
3. Transfer Students: Successful completion of the following 17 hours of courses with a minimum grade point average of 3.30. (Grades in these courses must be either "A" or "B" - a student with a "C" or less grade in any one of the below listed courses is not eligible for DDA.)
   - MAC 2281 - Engineering Calculus I
   - MAC 2282 - Engineering Calculus II
   - MAC 2283 - Engineering Calculus III
   - PHY 2048 - General Physics I & Lab
   - PHY 2049 - General Physics II & Lab
   - CHM 2041 - Chemistry & CHM 2045L

**Engineering Advising**

Effective pursuit of engineering and engineering related studies requires careful attention to both the sequence and the type of courses taken. The engineering curriculum differs in key respects from the study plans of other majors - even in the freshmen year. It is, therefore, important, and the College requires, that each student plan his/her academic program and have it approved by a designated adviser in the College of Engineering.

Most students must attend the University’s Orientation program. They are assigned an engineering adviser during this program and receive advisement for their first semester at that time.

The student and adviser jointly work out a plan of study which meets both the student’s career objectives and the College of Engineering’s degree requirements. The advisers maintain the College of Engineering’s student records.
Students not yet meeting departmental admissions requirements may be elected to be advised by the general engineering advising office or the department of their intended specialization.

While the College provides advising services to assist students with academic planning, the responsibility for seeing that all graduation requirements are met rests with the students. A copy of the Student Academic Support System (SASS) report may be had upon request.

The College of Engineering requires all undergraduates to apply for graduation the semester prior to the anticipated graduation term. Necessary forms and instructions can be obtained in the Engineering Advising Office.

**Departments & Programs**

The supervision of the academic programs for the College is the function of the six administrative departments together with several coordinators. The departments are responsible for the professional programs in engineering and engineering science. Each department is responsible for programs, faculty, laboratories, and students assigned to it.

**Chemical Engineering**

This department offers coursework and study in all areas fundamental to Chemical Engineering. Topics included are thermodynamics, fluid flow, heat transfer, mass transfer, separation processes, chemical reactors, instrumentation and process control, economics optimization, computer methods, computer aided design techniques, and process plant design. These courses, together with mathematics, physics, chemistry, other interdisciplinary Engineering fundamentals, English, and liberal arts courses, provide the basis for long range professional progress. Because of the many professional areas available for employment to the chemical engineer, the students are also required to take a number of electives from areas such as biotechnology, materials, and environmental engineering. These electives are designed to broaden the experience, and, therefore, the employment possibilities of our graduates. The department administers the Bachelor of Science in Chemical Engineering (B.S.Ch.E.), the Master of Science in Chemical Engineering (M.S.Ch.E.), the Master in Chemical Engineering (MCHE), the Master of Engineering (M.E.), the Master of Science in Engineering (MSE), and the Doctor of Philosophy (Ph.D.) degrees. The Chemical Engineering Department also offers a sequence of courses in Chemical Engineering Science, biotechnology and biomedical engineering.

A sequence of courses in the engineering aspects of biotechnology is currently available within the Chemical Engineering program. Topics include applied microbiology, fermentation, enzyme technology, and pharmaceutical engineering.

Biomedical Engineering is a highly interdisciplinary program, drawing from all engineering disciplines, biology, physical sciences, biomedical and clinical sciences. An undergraduate Certificate in Biomedical Engineering is available to students in all areas of engineering. This Certificate is designed with two main objectives: 1) to prepare interested students for admission into medical school, and 2) to prepare students for graduate work in either Biomedical Engineering, other engineering disciplines, or the Biomedical Sciences. Opportunities for students to gain research experience exist within the College of Engineering and the Health Sciences Center.

Please see the certificate programs section of this catalog for more information on these programs.

**Civil and Environmental Engineering**

This department offers coursework and study pertinent to Civil Engineering, Engineering Mechanics, Material Science, and Environmental Engineering. Areas of concentration are structural engineering, engineering mechanics, geotechnical engineering, transportation engineering, water resources engineering, materials and corrosion engineering, and environmental engineering. The department has a policy of mandatory academic advising of students for each school term. The department offers the undergraduate degree, Bachelor of Science in Civil Engineering (BSCE) and the following graduate degrees: Master of Science in Civil Engineering (MSCE), Master or Science in Engineering (MSE), Master of Science in Environmental Engineering (MSEV), Master of Civil Engineering (MCE), Master of Engineering (ME), Master of Environmental Engineering (MEVE), and Doctor of Philosophy (Ph.D.).

**Computer Science and Engineering**

This department offers coursework and study in all areas fundamental to Computer Science, Computer Engineering, and Information Systems. Topics dealt with are computer architecture and hardware design, software engineering, computer systems organization, operating systems, algorithms and data structures, computer graphics, user interface, computer networks, database systems, theory of computation and artificial intelligence.

The Department administers the baccalaureate degree programs in Computer Science, Computer Engineering and Information Systems; Master of Science degree programs in Computer Science and in Computer Engineering; and Ph.D. program in Computer Science and Engineering. Our research areas of faculty concentration are 1) computer architecture and VLSI design/testing, 2) artificial intelligence and expert systems, 3) graphics/image processing/computer vision, 4) database, 5) networks.

Computing facilities available to students in the Department include several microcomputer and design laboratories for hardware-oriented students, personal computer laboratory for general use in programming assignments, and networked SUN and DEC workstations for use by majors. The Department also runs a research-oriented network consisting of an Intel Hypercube, a number of SUN, DEC, and IBM workstations, and special purpose image and graphics processors. In addition, the Department has access to a large IBM mainframe facility run by the University Computing Center.

**Electrical Engineering**

This department offers study in all areas fundamental to Electrical Engineering and the electrical sciences: circuit analysis and design, electronics, communications, electromagnetics, controls, solid state, systems analysis, digital circuit design, etc. Basic concepts are augmented with well-equipped laboratories in networks, electronics, digital systems, microwave techniques and communications. In addition, a general purpose computer facility, a microprocessor laboratory and a microelectronics fabrication laboratory are available to undergraduate and graduate students. The department administers the Bachelor of Science in Electrical Engineering (B.S.E.E.) degree program, as well as the Master of Science in Electrical Engineering (M.S.E.E.) program which is also available to evening and off-campus students. As applicable, the department administers the M.E., M.S.E.S. and the Ph.D. in Electrical Engineering programs.

**Industrial and Management Systems Engineering**

This department offers study pertinent to the design, evaluation, and operation of a variety of industrial systems, ranging from the analysis of public systems to the operation of manufacturing plants. Topics include production planning and control, production and plant design, applied statistics, operations research, human factors and productivity, manufacturing, and automation. The department has excellent laboratory facilities which support class projects and research in microcomputer applications, computer-aided manufacturing, automation, and applications of robotics. The department administers the Bachelor of Science in Industrial Engineering (B.S.I.E.) degree program, as well as the Master of Science in Industrial Engineering (M.S.I.E.), Master of Industrial Engineering (M.I.E.) and Ph.D. in Industrial Engineering. Evening and off-campus programs are available through the Master of Science in Engineering Management (M.S.E.M.) program. The department also administers the Industrial option in the M.S.E., M.E., and M.S.E.S. programs, as well as the manufacturing option in the M.S.E. program.
Mechanical Engineering

The department offers courses leading to the degrees of Bachelor of Science in Mechanical Engineering (B.S.M.E.), Master of Science in Mechanical Engineering (M.S.M.E.), Master of Mechanical Engineering (M.M.E.), and Doctor of Philosophy (Ph.D.). Coursework includes basic science and mathematics, thermal and fluid sciences, material science, solid mechanics, dynamics, machine design, vibrations, instrumentation and automatic control.

Graduates of this program are employed in research, design, production, marketing, service, installation (contracting), maintenance and operation in such industries as mining, petroleum, paper, food, power, manufacturing, air-conditioning, defense systems, aerospace, data processing, communications, and automotive.

Laboratories are available for basic instrumentation, thermal and fluid sciences, solid mechanics, data acquisition and control, CAD/CAE, vibrations, and aerodynamics.

Students pursuing the B.S.M.E. degree are required to take the Fundamentals of Engineering examination as the first step towards professional engineering registration.

Engineering Core

Both the four-year and five-year curricula of the College of Engineering Bachelor of Science programs are founded on a common core of coursework which is required of all students. This coursework is designed to give each student a thorough foundation of knowledge on which specialization studies and a professional career can be based. Emphasis is place on five key elements: development of communication skills, familiarity with the social sciences and humanities, a solid base in science and mathematics, a strong foundation in basic engineering sciences and applications and design experience in a field of specialization.

Each degree-granting department has developed a list of courses to provide key elements for the degree offered. While the specific courses will vary slightly from one department to another, the hours in each category will be approximately as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-technical Courses</td>
<td>34 Sem. Hrs.</td>
</tr>
<tr>
<td>(Social Sciences, Humanities, Communications)</td>
<td></td>
</tr>
<tr>
<td>Mathematics, Chemistry and Physics</td>
<td>35 Sem. Hrs. (Minimum)</td>
</tr>
<tr>
<td>Basic Engineering Science (Minimum)</td>
<td>36 Sem. Hrs.</td>
</tr>
<tr>
<td>Department Specialization</td>
<td>31 Sem. Hrs.</td>
</tr>
<tr>
<td></td>
<td>136 Sem. Hrs.</td>
</tr>
<tr>
<td>Special requirements exist for Chemical Engineering, Computer Engineering, Computer Science, Information Systems.</td>
<td></td>
</tr>
</tbody>
</table>

1. Non-Technical Requirements

All students are required to take 45 semester hours to satisfy the complete liberal arts requirements. Thirty-six (36) semester hours will satisfy the general education course requirements and 9 semester hours will satisfy the exit requirements. These requirements are distributed as follows:

**General Education Requirements**

<table>
<thead>
<tr>
<th>Area</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Composition</td>
<td>6</td>
</tr>
<tr>
<td>Quantitative Methods</td>
<td>6</td>
</tr>
<tr>
<td>Natural Sciences</td>
<td>6</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>6</td>
</tr>
<tr>
<td>Historical Perspectives</td>
<td>6</td>
</tr>
<tr>
<td>Fine Arts</td>
<td>3</td>
</tr>
<tr>
<td>African, Latin American, Middle Eastern or Asian Perspectives</td>
<td>3</td>
</tr>
</tbody>
</table>

**Exit Requirements**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Works and Major Issues</td>
<td>6</td>
</tr>
<tr>
<td>Literature and Writing</td>
<td>3</td>
</tr>
</tbody>
</table>

*Courses may be certified in more than one area, but students may use each course in only one (1) area.

Courses in the liberal arts requirements should incorporate the following components whenever they are relevant to the specific discipline: the learning skills of conceptual thinking, analytical thinking, creative thinking, written expression, oral expression, and the dimensions of values and ethics, international perspectives, environmental perspectives, race and ethnicity, and gender. When warranted by the subject matter, each course must incorporate consideration of at least one of the dimensions and one of the thinking skills to meet the liberal arts requirements.

Departments should ensure that courses proposed for the liberal arts have sufficient depth and breadth. These courses will share the substantive rigor and intellectual challenge of courses offered for major credit, with the specific feature of offering an integrative perspective of the discipline and its relationship to academia as a whole. Additionally, such courses will encourage majors to interact with students from other disciplinary backgrounds.

2. Mathematics and Science Core Requirements

The student with a satisfactory high school preparation must take 35 credit hours of mathematics and science coursework. (Some credit towards this core requirement can be obtained by passing applicable CEEB Advanced Placement Tests or CLEP Subject Examinations.)

In mathematics this coursework consists of a Calculus for Engineers sequence (or a calculus sequence of equivalent level), Differential Equations, and additional hours of designated courses supportive of the student’s selective field of specialization, as specified by the department. In the science coursework students must take the Physics with Calculus sequence and the General Chemistry sequence.

Students whose high school preparation is insufficient to enter the Calculus for Engineers are required to take supplementary algebra and trigonometry prior to being considered for acceptance into the College.

3. Engineering Core Requirements

The prospective engineering major must take a minimum of 35 credit hours of engineering core (foundation) coursework drawn from the major disciplines. This coursework is designed to equip the student with a sound technical foundation for later, more advanced specialized coursework and the eventual formation of professional judgment. This coursework includes introductory studies in such areas as engineering analysis and computation, statistics, electrical engineering principles, thermodynamics, statics, dynamics, fluids, and properties of materials.

All but 6 credit hours of the engineering core are common to all areas of the Bachelor of Science in a Designated Engineering Field degree programs. The remaining 6 credit hours of coursework must be chosen with the concurrence of the departmental adviser to fit the field selected by the student. Details on this selection are available in the departmental office of the field selected, or in the College’s Advising Office.

**FOUR-YEAR PROGRAM -- BACHELOR OF SCIENCE IN DESIGNATED ENGINEERING FIELD DEGREE**

These engineering degrees are awarded upon successful completion of a program consisting of the required three areas of core coursework—minimum of 101 credit hours—which are described above, and an additional 35 credit hours of coursework in a designated field of specialization. Details covering specific fields are available on request from the responsible department, or from the College’s Advising Office.

Programs are offered in the following disciplines of Engineering:
1. Chemical Engineering

Students pursuing the Bachelor of Science in Chemical Engineering take coursework in advanced chemistry, thermodynamics, fluids, heat, and mass transfer, separation processes, reacting systems, instrumentation, and control. Students must also satisfactorily complete a design project as part of their program. Students seeking the biotechnology/biomedical certificate are also required to take additional courses in general biology, microbiology, and biochemistry. Special characteristics of the Chemical Engineering curriculum make it imperative that the students retain close contact with their adviser.

Students completing this program normally initiate their careers in process/manufacturing industries. Chemical engineers are found in administrative, technical, and research positions in these industries. Main products of these industries are petrochemicals, polymers, fibers, natural and synthetic fuels, electronic materials, fertilizers, pharmaceuticals, etc.

Solution of modern societal and scientific problems often require the use of chemical engineering skills. A course sequence for chemical majors, (ECH 3702, ECH 4123C and ECH 4415C), as well as physics majors, (ECH 3702, ECH 3264C, and ECH 4265C), is suggested. These courses will add a strong chemical engineering science background to those degrees. Chemical Engineering students are expected to have access to an IBM compatible personal computer during their last two years of study. Those who do not own one will be severely disadvantaged. The course Chemical Engineering Calculus is required for all non-transfer students. Transfer students are encouraged to take this course. The USF course will first be offered during the spring semester of 2000.

The schedule which follows indicates how a serious student who can devote full time to coursework can satisfy requirements in four academic years. Students without a solid foundation and those who cannot devote full time to academics should plan a slower pace.

Bachelor's Curriculum - Chemical Engineering

This program is under revision. Courses indicated with XXXX rather than course numbers will be submitted for approval during 1998-99. See your academic advisor for additional information.

**Social Science Elective**

**Historical Perspectives Elective**

*Chemistry Elective*

*Technical Electives*

*Social Science Elective*

Semester I

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENC 1101</td>
<td>Freshman English I</td>
<td>3</td>
</tr>
<tr>
<td>MAC 2281</td>
<td>Engineering Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>CHM 2041</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>EGN 4930</td>
<td>Foundations of Engineering</td>
<td>3</td>
</tr>
<tr>
<td><em>History Perspectives Elective</em></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Fine Arts Elective</strong></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Semester II

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENC 1102</td>
<td>Freshman English II</td>
<td>3</td>
</tr>
<tr>
<td>MAC 2282</td>
<td>Engineering Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>CHM 2046</td>
<td>General Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHM 2045L</td>
<td>General Chemistry I Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHY 2048</td>
<td>General Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PHY 2048L</td>
<td>General Physics I Lab</td>
<td>1</td>
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<tr>
<td><em>AMEA Perspective Elective</em></td>
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<td>3</td>
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Summer Term

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAC 2283</td>
<td>Engineering Calculus III</td>
<td>3</td>
</tr>
<tr>
<td>EGN 3311</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>CHM 2046L</td>
<td>General Chemistry II Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHY 2049</td>
<td>General Physics II</td>
<td>3</td>
</tr>
<tr>
<td>PHY 2049L</td>
<td>General Physics II Lab</td>
<td>1</td>
</tr>
</tbody>
</table>

Semester III

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAP 2302</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>EGN 3373</td>
<td>Electrical Systems I</td>
<td>3</td>
</tr>
<tr>
<td>EGN 3221</td>
<td>Computer Tools for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>EGN 3343</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>EGN 3443</td>
<td>Statistics</td>
<td>3</td>
</tr>
<tr>
<td><em>Social Science Elective</em></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Semester IV

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGN 4450</td>
<td>Introduction to Linear Systems</td>
<td>2</td>
</tr>
<tr>
<td>EGN 3365</td>
<td>Materials</td>
<td>3</td>
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<td>EGN 3702</td>
<td>Instrument Systems I</td>
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<td>EGN 3023</td>
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<td>ECH XXXX</td>
<td>Chemical Engineering Calculus</td>
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Semester V

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<td>Transport Processes I</td>
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<tr>
<td>ECH 4123C</td>
<td>Phase &amp; Chemical Equilibria</td>
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<td>CHM 2210</td>
<td>Organic Chemistry I</td>
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<td>ECH 4605</td>
<td>Strategies of Process Engineering</td>
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Semester VII

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<tr>
<td>ECH 4415C</td>
<td>Reacting Systems</td>
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<tr>
<td>ECH 4244L</td>
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Semester VIII

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<tr>
<td>MW-MI (Non-Engineering)</td>
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*Approved General Education Requirements
*Not from Chem 2XXX, 3400, 3401, 3402, 4070, 4905, 4932, 4970

Prerequisites (State Mandated Common Prerequisites)

Complete the A.A. degree at the community college. Some courses required for the major may also meet General Education Requirements thereby transferring maximum hours to the university. A minimum of 60 semester hours must be completed at the university. If a student wishes to transfer without an A.A. degree and have fewer than 60 semester hours of acceptable credit, the student must meet the university’s entering freshman requirements including ACT or SAT test scores, GPA, and course requirements.

The following are transferable courses from the Community College that will be accepted in the Math/Science/Engineering areas:

**Math**

<table>
<thead>
<tr>
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<tbody>
<tr>
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<td>MAC 2282</td>
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<td>MAC 2283</td>
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**Chemistry**

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**Physics**

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<tr>
<td>PHY 2049L</td>
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</table>
2. Civil and Environmental Engineering

Students pursuing the Bachelor of Science in Civil Engineering program take designated engineering mechanics, civil, environmental, and environmental engineering courses. These courses are designed to prepare students for careers in either industry, in engineering consulting firms, or in public service at the federal, state, or local level. Initial assignments in the areas of concentration:

- Environmental Engineering - courses in water and wastewater treatment, air pollution control, and environmental unit operations and unit processes.
- Water Resources - courses in water resources engineering, environmental unit operations, and air pollution control.
- Geotechnical/Transportation engineering - courses in soil mechanics, transportation, matrix structural analysis, cement and concrete design, and air pollution control.
- Materials - courses in materials and corrosion.
- Structural engineering - courses in structural engineering and materials.

As a culminating design experience, all students take a Capstone design course relevant to their respective areas of concentration.

To maintain high academic standards, only 2 D grades in engineering courses can be used to fulfill graduation requirements.

Students completing the program may enter the following career areas:

- Engineers in the civil, structural, geotechnical, transportation, environmental, hydraulics, or materials discipline.
- All of these disciplines share the need for knowledge in the areas of engineering mechanics, civil engineering, material science, and environmental engineering. Through choice of the proper area of concentration, a student has the opportunity to channel academic studies specifically towards his/her career choice.

Graduates of the program may commence their engineering careers in either industry, in engineering consulting firms, or in public service at the federal, state, or local level. Initial assignments may include planning, design and implementation of water resources systems; planning and design of transportation and housing systems; regional planning, design, and management for abatement of air, water, and solid waste pollution problems; design of bridges and pipelines; and supervision of construction projects.

The schedule which follows indicates how a serious, well-prepared student who can devote full time to coursework can satisfy degree requirements in four academic years. Students without a solid foundation and those who cannot devote full time to academics should plan on a slower pace.

An additional graduation requirement is that graduating seniors must take the Fundamentals of Engineering Examination.

**Bachelor's Curricula - Civil Engineering Option**

| Semester I | ENC 1101 Freshman English I | 3 |
| MAC 2281 Engineering Calculus I | 3 |
| CHM 2041 General Chemistry I | 3 |
| EGN 4930 Foundations of Engineering | 3 |

| Semester II | ENC 1102 Freshman English II | 3 |
| MAC 2282 Engineering Calculus II | 3 |
| CHM 2046 General Chemistry II | 3 |
| CHM 2045L General Chemistry I Lab | 1 |
| PHY 2048 General Physics I | 3 |
| PHY 2048L General Physics I Lab | 1 |
*Social Science Elective | 3 |

**Summer Term**

| ENG 2210 Computer Tools for Engineers | 3 |
| *Social Science Elective | 3 |
| *Historical Perspectives Elective | 3 |
| *Fine Arts Elective | 3 |

| Semester III | PHY 2049 General Physics II | 3 |
| PHY 2049L General Physics II Lab | 1 |
| MAC 2283 Engineering Calculus III | 3 |
| EGN 3311 Statics | 3 |
*Historical Perspectives Elective | 3 |

| Semester IV | MAP 2302 Differential Equations | 3 |
| EGN 3321 Dynamics | 3 |
| EGN 3343 Thermodynamics I | 3 |
| EGN 3443 Engineering Statistics | 3 |
| EGN 3365 Materials | 3 |

| Semester V | EGN 3353 Fluid Mechanics | 3 |
| EGN 3331 Mechanics of Materials | 3 |
| EGN 3331L Mechanics of Materials Lab | 1 |
| EGN 3373 Intro to Electrical Systems | 3 |
| TTE 4004 Transportation | 3 |
*ALAMEA Perspective Elective | 3 |

| Semester VI | CES 3102 Structures | 3 |
| CWR 4202 Hydraulics | 3 |
| ENV 3001 Environmental Engineering | 3 |
| GLY 3850 Geology for Engineers | 3 |
| EGN 3613 Engineering Economy | 3 |
| ENC 4931 Communication for Engineers | 3 |

| Semester VII | CES 4605 Concepts of Steel Design | 3 |
| CES 4702 Concepts of Concrete Design | 3 |
| CEG 4011 Soil Mechanics | 3 |
| CEG 4011L Geotech Lab | 1 |
| C.E. Concentration Requirement | 3 |
| C.E. Concentration Requirement | 3 |

| Semester VIII | CGN 3021L C.E. Lab | 2 |
*CGN 4122C Professional/Ethical Issues in Eng. (MW/MI) | 3 |
*C.E. Capstone Design Requirement | 3 |
*C.E. Concentration Requirement | 3 |
*MW/MI (Non-Engineering) | 3 |

*Approved General Education Requirements

**Civil Engineering Concentration Requirements**

(A student must complete a minimum of 9 hours, with at least 2 courses from one group.)

**Water Resources**

| ENV 4602 Environmental Unit Operations | 3 |
| ENV 4101 Air Pollution Control | 3 |
| CWR 4103 Water Resources Engineering | 3 |
### Geotechnical/Transportation

<table>
<thead>
<tr>
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<tbody>
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<td>Soil Mechanics II</td>
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<td>TTE 4005</td>
<td>Transportation Engineering II</td>
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<tr>
<td>CGN 4851</td>
<td>Concrete Construction Materials</td>
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<tr>
<td>CES 4141</td>
<td>Matrix Structural Analysis</td>
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<td>ENV 4101</td>
<td>Air Pollution Control</td>
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### Materials

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<td>EMA 4324</td>
<td>Corrosion of Engineering Materials</td>
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<tr>
<td>CGN 4851</td>
<td>Concrete Construction Materials</td>
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### Structural

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<td>CES 4141</td>
<td>Matrix Structural Analysis</td>
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<tr>
<td>CES 4820</td>
<td>Timber &amp; Masonry Design</td>
<td>3</td>
</tr>
<tr>
<td>CES 4851</td>
<td>Concrete Construction Materials</td>
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<td>EMA 4324</td>
<td>Corrosion of Engineering Materials</td>
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<td><strong>CES 4720</strong></td>
<td>Capstone Structural/Materials Design</td>
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<tr>
<td><strong>CES 4740</strong></td>
<td>Capstone Structural/Geotechnical Design</td>
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**If not used to satisfy Capstone Design requirements**

### Civil Engineering Capstone Design Requirements

A student must complete the capstone design course in his/her area of concentration.

### Water Resources

<table>
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### Geotechnical/Transportation

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### Materials

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### Structural

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### Environmental Engineering Concentration Within Civil Engineering

#### Semester I

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<td>EGS 1113</td>
<td>Introduction to Design Graphics</td>
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<td>EGN 4850</td>
<td>Foundations of Engineering</td>
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#### Semester II

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**Historical Perspectives Elective**

#### Summer Term

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#### Semester III

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<td>EGN 3311</td>
<td>Statics</td>
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**Social Science Elective**

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<td>EGN 3343</td>
<td>Thermodynamics I</td>
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### EGN 3373 | Introduction to Electrical Systems I | 3 |
| EGN 3443 | Engineering Statistics I             | 3 |
| EGN 3365L| Materials Engineering I              | 3 |

#### Semester V

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**ALAMAE Perspectives Elective**

#### Semester VI

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<td>Environmental Unit Operation</td>
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<td>EGN 3613</td>
<td>Engineering Economy</td>
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<td>Introduction to Process Engineering</td>
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#### Semester VII

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<td>CES 4606</td>
<td>Concepts of Structural Design</td>
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<td>Engineering Communication</td>
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<td>ENV 4502</td>
<td>Unit Ops. &amp; Processes Lab</td>
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**Approved General Education Requirements**

#### Summer VIII

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<td>Professional/Ethical Issues in Engineering</td>
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<td>ENV 4101</td>
<td>Air Pollution</td>
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<td>ENV 4891</td>
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<tr>
<td><em>MWW/MI (Non-Engineering)</em></td>
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### Prerequisites (State Mandated Common Prerequisites)

Complete the A.A. degree at the community college. Some courses required for the major may also meet General Education Requirements thereby transferring maximum hours to the university. A minimum of 60 semester hours must be completed at the university. If a student wishes to transfer without an A.A. degree and have fewer than 60 semester hours of acceptable credit, the student must meet the university’s entering freshman requirements including ACT or SAT test scores, GPA, and course requirements.

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<th>Math</th>
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<td>PHY 2049 (3)</td>
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This is a limited access program involving special admissions requirements. Please be aware of the immunization, foreign language, continuous enrollment policies of the university, and qualitative standards required.

Engineering Admissions Requirements
Transfer students must have completed the equivalent USF Engineering Calculus sequence with a 2.0 GPA; must have completed one year of equivalent USF General Physics and Chemistry courses with a minimum of 2.0 GPA; must have an overall GPA of 2.0 or better.

3. Computer Science and Engineering
Three undergraduate degree tracks are offered within Computer Science and Engineering. These tracks are Computer Engineering, Computer Science and Information Systems, which leads to the Bachelor of Science in Computer Engineering, in Computer Science and in Information Systems respectively.

The Computer Engineering track emphasizes the application of engineering principles to the design of computer hardware and software. While all department tracks provide coverage of both computer hardware and software, this track allocates more time to issues of computer architecture and hardware design. Students in this program also acquire a broad background in engineering science through the study of the engineering core.

The Computer Science track focuses on the theory of computation and computer organization. Additional course work in programming languages, algorithms, software engineering, and a wide range of electives supplement the core coverage of hardware and software.

The Information Systems track combines a basic coverage of hardware and software with a core of business related courses and additional course work in areas such as networks and database. The emphasis in this track is on the application of computing.

Graduates from these programs follow fruitful careers in either scientific or business application's of computers, as well as in the design of computer systems. They are often involved in the systems level definition of information processing complexes for both manufacturers of computers and for users. A wide and expanding variety of design and applications opportunities characterize this field. The rapid growth and continual change within this field makes it essential for students to acquire a broad foundation in applied mathematics and the physical sciences, and to develop communication skills and to become familiar with the domains of potential computer application in the Humanities and Social Sciences. Research and development opportunities as a computer scientist and engineer, often following graduate education, are present in the areas of computer architecture and VLSI design, artificial intelligence, software engineering, digital data communications, multimedia, robotics, database, networks, user interface, fault-tolerant computing and testing, computer graphics, image processing and computer vision, and simulation.

The schedules which follow indicate how a serious, well prepared student who can devote full time to coursework can satisfy degree requirements in four academic years. Students without a solid foundation and those who cannot devote full time to academics should plan on a slower pace.

Bachelor of Science in Computer Science Curriculum
This program is under revision. Courses indicated with XXX rather than course numbers will be submitted for approval during 1998-99. See your academic advisor for additional information.

### Semester I
- MAC 2281 Engineering Calculus I 3
- ENC 1101 Freshman English I 3
- EGN 4930 Foundations of Engineering 3
- *Science Elective* 3
- *Social Science Elective* 3
- **Total: 15**

### Semester II
- MAC 2282 Engineering Calculus II 3
- PHY 2048 Eng. Physics I 3
- PHY 2048L Eng. Physics I Lab 1
- ENC 1102 Freshman English II 3
- EGN 2210 Computer Tools 3
- **Total: 13**

### Summer Term
- MAC 2283 Engineering Calculus III 3
- PHY 2049 Eng. Physics II 3
- PHY 2049L Eng. Physics II Lab 1
- *Historical Perspectives Elective* 3
- **Total: 10**

### Semester III
- CDA XXXX Computer Organization 3
- COP 4020 Comparison of Prog. Lang. 3
- COP XXXX Program Design 3
- *Historical Perspectives Elective* 3
- **Total: 12**

### Semester IV
- EEL 4851 Data Structures 3
- CDA XXXX Computer Logic Design 3
- CDA XXXXL Computer Logic Design Lab 1
- EGN 4450 Linear Systems 2
- STA 4442 Intro to Probability 3
- *Fine Arts Elective* 3
- **Total: 15**

### Semester V
- CDA XXXX Computer Architecture 3
- COP 4600 Operating Systems 3
- COT 4210 Intro Automata Theory 3
- *Science Elective* 3
- *Social Science Elective* 3
- **Total: 15**

### Semester VI
- COP 4020 Comparison of Prog. Lang. 3
- CEN 4020 Software Engineering 3
- COT 4400 Analysis of Algorithms 3
- Computer Science Elective 3
- **Total: 15**

### Semester VII
- ENC 4931 Engr. Communications 3
- *ALAMEA Elective* 3
- Computer Science Elective 3
- **Total: 13**

### Semester VIII
- CIS 4250 Ethical Issues (MW/MI) 3
- Major Works (out of College) 3
- Computer Science Electives 3
- **Total: 12**

Approved General Education Requirements

Prerequisites (State Mandated Common Prerequisites)
Complete the A.A. degree at the community college. Some courses required for the major may also meet General Education Requirements thereby transferring maximum hours to the university. A minimum of 60 semester hours must be completed at the university. If a student wishes to transfer without an A.A. degree and have fewer than 60 semester hours of acceptable credit, the student must meet the university's entering freshman requirements including ACT or SAT test scores, GPA, and course requirements.

Students should complete the following prerequisite courses listed below at the lower level prior to entering the University. If these courses are not taken at the community college, they must be completed before the degree is granted. Unless stated otherwise, a grade of "C" is the minimum acceptable grade.
In Computer Engineering Curriculum

This program is under revision. Courses indicated with XXX rather than course numbers will be submitted for approval during 1998-99. See your academic advisor for additional information.

Semester I
MAC 2281 Engr. Calculus I 3
ENC 1101 Freshman English I 3
EGN 4930 Foundations of Engineering 3
*Social Science Elective 3
*Historical Perspectives Elective 3
15

Semester II
MAC 2282 Engr. Calculus II 3
ENC 1102 Freshman English II 3
PHY 2048 Physics I 3
PHY 2048L Physics I Lab 1
CHM 2041 General Chemistry I 3
CHM 2045L General Chemistry Lab 1
14

Summer Term
MAC 2283 Engr Calculus III 3
PHY 2049 Physics II 3
PHY 2049L Physics II Lab 1
EGN 2210 Computer Tools 3
10

Semester III
EGN 3311 Statics 3
COT 3100 Intro. to Discrete Structures 3
CDA XXXX Computer Organization 3
COP XXXX Program Design 3
*Science Elective 3
15

Semester IV
EEL 4851 Data Structures 3
EGN 3443 Engineering Statistics 3
EGN 3321 Dynamics 3
EGN 3343 Thermodynamics 3
20

CDA XXXX Computer Logic Design 3
CDA XXXXL Computer Logic Design Lab 1
16

Semester V
EGN 3371 Electrical Systems I 3
EGN 3365L Materials I 3
MAP 4302 Differential Equations 3
CDA XXXX Computer Architecture 3
Advanced CE Core 4
16

Semester VI
EGN 4450 Linear Systems 2
COT 4400 Analysis of Algorithms 3
COP 4600 Operating Systems 3
Advanced CE Core 3
*Science Elective 3
*Fine Arts Elective 3
17

Semester VII
ENC 4931 Communications for Engineers 3
Computer Engineering Elective 8
*Historical Perspectives Elective 3
*ALAMEA Perspective Elective 3
17

Semester VIII
CIS 4910 Senior Project 2
CIS 4250 Ethical Issues (MW/MI) 3
Computer Engineering Elective 8
Major Works (out of College) 3
16

*Approved General Education Requirements

Prerequisites (State Mandated Common Prerequisites)
Complete the A.A. degree at the community college. Some courses required for the major may also meet General Education Requirements thereby transferring maximum hours to the university. A minimum of 60 semester hours must be completed at the university. If a student wishes to transfer without an A.A. degree and have fewer than 60 semester hours of acceptable credit, the student must meet the university's entering freshman requirements including ACT or SAT test scores, GPA, and course requirements.

The following are transferable courses from the Community College that will be accepted in the Math/Science/Engineering areas:

Math

Calculus
USF C/C
MAC 2281 MAC 2311 (3)
MAC 2282 MAC 2312 (3)
MAC 2283 MAC 2313 (3)
Differential Equations
MAP 2302 MAP 2302 (3)

Physics
USF C/C
PHY 2048 PHY 2048 (3)
PHY 2048L PHY 2048L (1)
PHY 2049 PHY 2049 (3)
PHY 2049L PHY 2049L (1)

Science Electives (6)

Fortran
USF C/C
EGN 2210 COP 2202 (3)

This is a limited access program involving special admissions requirements. Please be aware of the immunization, foreign language, continuous enrollment policies of the university, and qualitative standards required.
### Approved General Education Requirements

Transfer students must have completed the equivalent USF Engineering Calculus sequence with a 2.0 GPA; have completed one year of equivalent USF General Physics and Chemistry courses with a minimum of 2.0 GPA; must have an overall GPA of 2.0 or better.

#### Bachelor of Science in Information Systems Curriculum

This program is under revision. Courses indicated with XXXX rather than course numbers will be submitted for approval during 1998-99. See your academic advisor for additional information.

<table>
<thead>
<tr>
<th>Semester I</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MAC 2281 or 2233</td>
<td>Calculus I</td>
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<tr>
<td>ENC 1101</td>
<td>Freshman English I</td>
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<tr>
<td>ACG 2021</td>
<td>Principles Accounting I</td>
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<td>MAC 2282 or 2234</td>
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<td>Eng. Physics I</td>
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<td>PHY 2048L or 2053L</td>
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<td>EGN 2210</td>
<td>Computer Tools</td>
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<tr>
<td>PHY 2049L or 2054L</td>
<td>Eng. Physics II Lab</td>
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<td>ECO 2023</td>
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<td>STA 2023</td>
<td>Intro to Statistics</td>
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<tr>
<td>COT 3100</td>
<td>Intro Discrete Str</td>
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<td>COP XXXX</td>
<td>Program Design</td>
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<td>ECO 2013</td>
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<td>EEL 4851</td>
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<td>MAN 3023</td>
<td>Principles of Management</td>
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<td>*Historical Perspectives Elective</td>
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<tr>
<td>*Science Elective</td>
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<td>Operating Systems</td>
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<td>COP 4020</td>
<td>Comparion of Prog. Lang.</td>
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<td>EGN 4450</td>
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<td>ENC 4931</td>
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<td>EGN 3613</td>
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<td>CEN 4020</td>
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<td>Analysis of Algorithms</td>
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<td>EEL 4781</td>
<td>Dist. Proc. &amp; Networks</td>
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<td>CEN XXXX</td>
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<td>CIS 4259</td>
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<td>Information Systems Elective</td>
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### Prerequisites (State Mandated Common Prerequisites)

Complete the A.A. degree at the community college. Some courses required for the major may also meet General Education Requirements thereby transferring maximum hours to the university. A minimum of 60 semester hours must be completed at the university. If a student wishes to transfer without an A.A. degree and have fewer than 60 semester hours of acceptable credit, the student must meet the university’s entering freshman requirements including ACT or SAT test scores, GPA, and course requirements.

The following are transferable courses from the Community College that will be accepted in the Math/Science/Engineering areas:

#### Math

- **Calculus**
  - USF
    - MAC 2233
  - C/C
    - MAC 2234

- **Statistics**
  - STA 2023
  - C/C
    - STA 2023

#### Physics

- **General**
  - USF
    - PHY 2053
  - C/C
    - PHY 2053

#### Science Electives (6)

- **Business Courses**
  - USF
    - ECO 2033
  - C/C
    - ECO 2023

#### Fortran

- **USF**
  - EGN 2210
  - C/C
    - COP 2202

#### Cobol

- **USF**
  - COP 2120
  - C/C
    - COP 2120

This is a limited access program involving special admissions requirements. Please be aware of the immunization, foreign language, continuous enrollment policies of the university, and qualitative standards required.

### Engineering Admissions Requirements

Transfer students must have completed the equivalent USF Engineering Calculus sequence with a 2.0 GPA; have completed one year of equivalent USF General Physics and Chemistry courses with a minimum of 2.0 GPA; must have an overall GPA of 2.0 or better.

### 4. Electrical Engineering

Students pursuing the Bachelor of Science in Electrical Engineering program take designated coursework in network analysis, electronics, communications, electromagnetic theory, control systems, microelectronics and microprocessors. This coursework is supplemented by electives in many specialized areas of electrical engineering.

Students completing this program normally pursue industrial careers in the power, electrical, electronic, or information industries or in related governmental laboratories and public service agencies. The electrical graduate may apply his/her knowledge to such diverse areas as television, communications, remote guidance, sensing (of people, vehicles, weather, crops, etc.), automation, computer and information systems, electric power generation and transmission, electrically propelled transportation, etc. The graduate may do this by performing needed engineering functions related to research and development (often requires an advanced degree), design, production, operation, sales, or management of these products/services.

The schedule which follows indicates how a serious, well prepared student who can devote full time to coursework can satisfy degree requirements in four academic years.
without a solid foundation and those who cannot devote full time to academics should plan on a slower pace. A minimum departmental GPA of 2.0 is required for graduation.

**Bachelor's Curriculum - Electrical Engineering**

**Semester I**
- ENC 1101 Freshman English I 3
- CHM 2041 General Chemistry I 3
- CHM 2045L General Chemistry Lab 1
- MAC 2281 Engineering Calculus I 3
- EGN 4930 Foundations of Engineering 3
- **Social Science Elective** 3

**Semester II**
- ENC 1102 Freshman English II 3
- CHM 2046 General Chemistry II 3
- PHY 2048 General Physics I 3
- PHY 2049L General Physics I Lab 1
- MAC 2282 Engineering Calculus II 3
- *EGN 2210 Computer Tools for Engineers 3

**Semester III**
- PHY 2049 General Physics II 3
- PHY 2049L General Physics II Lab 1
- MAC 2283 Engineering Calculus III 3
- EGN 3613 Introduction to Electrical Systems I 3
- *EGN 3311 Statics 3
- **Social Science Elective** 3

**Semester IV**
- MAP 2302 Differential Equations 3
- PHY 3101 Modern Physics 3
- *EGN 3473 Introduction to Electrical Systems II 3
- *EGN 3443 Engineering Statistics I 3
- *EGN 3343 Thermodynamics I 3
- **Social Science Elective** 3

**Summer Term**
- EGN 3375 Introduction to Electrical Systems III 3
- ENC 4911 Engineering Communications 3
- EGN 3365L Materials Engineering 3

**Semester V**
- EGN 4450 Intro. to Linear Systems 2
- EEL 4936 Intro to Electromagnetics 3
- EEL 3100 Network Analysis & Design 3
- EEL 3302 Electronics I 3
- ELR 4937 Wireless Cir Sys Des Lab 2
- *ALAMEA Perspective Elective 3

**Semester VI**
- EEL 4102 Linear Systems Analysis 3
- EEL 4351 Semiconductor Devices 3
- EEL 4705 Logic Design 3
- EEL 4705L Logic Design Lab 1
- EEL 4163 Computer Aided Design 2
- ELR 3301L Lab I (Circuits) 1
- *MW/MI (Non-engineering) 3

**Semester VII**
- EEL 4744 Microprocessors 3
- EEL 4743L Microprocessors Lab 1
- ELR 3302L Lab II (Electronics) 1
- EEL 4906 Intro. to Engr. Design 2
- *Fine Arts Elective 3
- Approved Technical Elective 4

**Semester VIII**
- EEL 4936 Design Project 3
- EGN 4831 Technology in Society (MWMI Engr.) 3
- Approved Technical Elective 3
- Approved Technical Elective 3

**Prerequisites (State Mandated Common Prerequisites)**
Complete the A.A. degree at the community college. Some courses required for the major may also meet General Education Requirements thereby transferring maximum hours to the university. A minimum of 60 semester hours must be completed at the university. If a student wishes to transfer without an A.A. degree and have fewer than 60 semester hours of acceptable credit, the student must meet the university's entering freshman requirements including ACT or SAT test scores, GPA, and course requirements.

The following are transferable courses from the Community College that will be accepted in the Math/Science/Engineering areas:

**Math**
- USF  MAC 2281 C/C
- USF  MAC 2282 C/C
- USF  MAC 2283 C/C

**Calculus**
- USF  MAC 2281 MAC 2311 (3)
- USF  MAC 2282 MAC 2312 (3)
- USF  MAC 2283 MAC 2313 (3)

**Differential Equations**
- USF  MAP 2302 MAP 2302 (3)

**Chemistry**
- USF  CHM 2041 C/C
- USF  CHM 2045L C/C
- USF  CHM 2046 C/C

**Physics**
- USF  PHY 2048 C/C
- USF  PHY 2048L C/C
- USF  PHY 2049 C/C
- USF  PHY 2049L C/C

**Fortran**
- USF  EGN 2210 C/C

**Social Science Elective**

**Historical Perspectives Elective**

**History of Science Elective**

**Technical Elective**

**Engineering Admissions Requirements**
Transfer students must have completed the equivalent USF Engineering Calculus sequence with a 2.0 GPA; must have completed one year of equivalent USF General Physics and Chemistry courses with a minimum of 2.0 GPA; must have an overall GPA of 2.0 or better.

5. **Industrial and Management Systems Engineering**

Students pursuing the Bachelor of Science in Industrial Engineering degree program take designated, specialized coursework in industrial processes, work analysis, production control, facilities design, operations research, human factors, computer simulation, quality control, and robotics and automation. This coursework is supplemented by engineering electives and comprehensive industrial engineering design projects.

Students completing this program are prepared for graduate study or for careers in a broad range of industries, business, and public service areas. The strength of industrial engineering lies, in part, in its breadth and the applicability of its common body of knowledge in a wide variety of enterprises. Students may be involved in traditional areas of manufacturing and production, or state-of-the-art functions in automation and robotics. The same engineering principles are also applied to business organizations, service delivery systems, and governmental administration.
The schedule which follows indicates how a serious, well-prepared student who can devote full time to coursework can satisfy degree requirements in four academic years. Students without a solid foundation and those who cannot devote full time to academics should plan on a slower pace.

**Bachelor's Curriculum**

**Industrial and Management Systems Engineering**

**Semester I**
- ENC 1101: Freshman English I 3
- MAC 2281: Engineering Calculus I 3
- CHM 2041: General Chemistry I 3
- EGS 1113: Introduction to Design Graphics 3
- *Fine Arts Elective 3*  
- *Social Science Elective 3*

**Semester II**
- ENC 1102: Freshman English II 3
- MAC 2282: Engineering Calculus II 3
- CHM 2046: General Chemistry II 3
- CHM 2045L: General Chemistry I Lab 1
- PHY 2048: General Physics I 3
- PHY 2048L: General Physics I Lab 1
- EGN 2210: Computer Tools for Engineers 3

**Semester III**
- PHY 2049: General Physics II 3
- PHY 2049L: General Physics II Lab 1
- MAC 2283: Engineering Calculus III 3
- EGN 3365L: Materials Engineering I 3
- EGN 3311: Statics 3
- EGN 3443: Engineering Statistics I 3

**Semester IV**
- MAP 2302: Differential Equations 3
- EGN 3373: Introduction to Electrical Systems I 3
- EGN 3321: Dynamics 3
- EGN 3343: Thermodynamics I 3
- EGN 4930: Foundations of Engineering 3

**Summer Term**
- ENC 4931: Engineering Communications 3
- ENG 3613: Engineering Economy 3
- EGN 4450: Introduction to Linear Systems 2
- *Science Elective 3*

**Semester V**
- EIN 4312L: Work Analysis 3
- EGN 3375: Introduction to Electrical Systems III 3
- EIN 4411L: Manufacturing Processes 3
- EIN 4933: Managerial Cost Accounting 3
- ESI 4312: Deterministic O.R. 3

**Semester VI**
- ESI 4313: Probabilistic O.R. 3
- EIN 4313L: Human Factors 3
- EIN 4601: Automation and Robotics 3
- EIN 4333: Production Control 3
- *Historical Perspectives Elective 3*

**Semester VII**
- ESI 4911: Senior Project 2
- ESI 4224: Design of Experiments 3
- ESI 5423: Industrial Systems Simulation 3
- EIN 4364L: Facilities Design I 3
- *Historical Perspectives Elective 3*

**Semester VIII**
- EIN 4365L: Facility Design II (MW/MI) 3
- ESI 4224L: Industrial Statistics & Quality Control 3
- *ALAMEA Perspectives Elective 3*  
- *Social Science Elective 3*

*MW/MI (Non-Engineering) 3*  
*Approved General Education Requirements 15*

**Prerequisites (State Mandated Common Prerequisites)**
Complete the A.A. degree at the community college. Some courses required for the major may also meet General Education Requirements thereby transferring maximum hours to the university. A minimum of 60 semester hours must be completed at the university. If a student wishes to transfer without an A.A. degree and have fewer than 60 semester hours of acceptable credit, the student must meet the university’s entering freshman requirements, including ACT or SAT test scores, GPA, and course requirements.

The following are transferable courses from the Community College that will be accepted in the Math/Science/Engineering areas:

**Math**
- USF Calculus C/C  
- MAC 2281: MAC 2311 (3)  
- MAC 2282: MAC 2312 (3)  
- MAC 2283: MAC 2313 (3)

**Physics**
- USF Differential Equations C/C  
- MAC 2041: MAC 1045 (3)  
- MAC 2045L: MAC 1045L (1)  
- MAC 2046: MAC 1046 (3)

**Chemistry**
- USF General C/C  
- CHM 2241: CHM 1045 (3)  
- CHM 2046: CHM 1046 (3)

**Graphics**
- USF C/C  
- EGS 1113: EGS 1111 (3)

**Fortran**
- USF C/C  
- EGN 2210: COP 2202 (3)

This is a limited access program involving special admissions requirements. Please be aware of the immunization, foreign language, continuous enrollment policies of the university, and qualitative standards required.

**Engineering Admissions Requirements**
Transfer students must have completed the equivalent USF Engineering Calculus sequence with a 2.0 GPA; must have completed one year of equivalent USF General Physics and Chemistry courses with a minimum of 2.0 GPA; must have an overall GPA of 2.0 or better.

6. **Mechanical Engineering**

Students pursuing the Bachelor of Science in Mechanical Engineering program take coursework in thermodynamics and heat transfer, instrumentation and measurements, energy conversion systems, solid and fluid mechanics, dynamics, machine analysis and design, mechanical design, and controls. This is supplemented by elective coursework in such areas as power plant analysis, refrigeration and air conditioning, mechanical design, advanced mechanics, heat transfer, robotics, propulsion, vibrations, computer-aided design, manufacturing, composite materials, and aerodynamics.

Students completing this program normally enter careers in a wide range of industries which either produce mechanical products or rely on machines, mechanical devices and systems to produce electricity, petroleum products, foods, textiles, building materials, etc. Mechanical Engineering graduates may follow careers in such fields as transportation, power generation, manufacturing, instrumentation, automatic control, ma-
chine design, construction, refrigeration, heating and air conditioning, aerospace, defense and all the process industries (foods, textiles, petrochemicals, pharmaceuticals, etc.). There are abundant career opportunities in a wide range of industries because mechanical equipment is required in every aspect of industrial production.

**Bachelor's Curriculum**

**Mechanical Engineering**

<table>
<thead>
<tr>
<th>Semester I</th>
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<tbody>
<tr>
<td>ENC 1101 Freshman English I</td>
<td>3</td>
</tr>
<tr>
<td>MAC 2281 Engineering Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>CHM 2041 General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHM 2045L Chemistry Lab I</td>
<td>1</td>
</tr>
<tr>
<td>EGS 1113 Intro. to Design Graphics</td>
<td>3</td>
</tr>
<tr>
<td>*Social Science Elective</td>
<td>3</td>
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<table>
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<tr>
<th>Semester II</th>
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<tbody>
<tr>
<td>ENC 1102 Freshman English II</td>
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<tr>
<td>MAC 2282 Engineering Calculus II</td>
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<tr>
<td>CHM 2046 General Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHM 2046L General Chemistry II Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHY 2048 General Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PHY 2048L General Physics I Lab</td>
<td>1</td>
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<tr>
<td>*Historical Perspectives Elective</td>
<td>3</td>
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<tr>
<th>Summer Term</th>
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<tbody>
<tr>
<td>MAC 2283 Engineering Calculus III</td>
<td>3</td>
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<tr>
<td>PHY 2049 General Physics II</td>
<td>3</td>
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<td>PHY 2049L General Physics II Lab</td>
<td>1</td>
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<tr>
<td>EGN 2210 Computer Tools for Engineers</td>
<td>3</td>
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<table>
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<tr>
<th>Semester III</th>
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<tbody>
<tr>
<td>EGN 3311 Statics</td>
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<tr>
<td>EGN 3443 Engineering Statistics</td>
<td>3</td>
</tr>
<tr>
<td>MAP 2302 Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>EGN 3343 Thermodynamics I</td>
<td>3</td>
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<tr>
<td>EGN 3373 Introduction to Electrical Systems I</td>
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<tr>
<th>Semester IV</th>
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<tbody>
<tr>
<td>EGN 4450 Introduction to Linear Systems</td>
<td>3</td>
</tr>
<tr>
<td>EGN 3321 Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EML 4106 Thermal Systems and Economics</td>
<td>3</td>
</tr>
<tr>
<td>EGN 3365L Materials Engineering I</td>
<td>3</td>
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<tr>
<td>*Social Science Electives</td>
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<table>
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<tr>
<th>Semester V</th>
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<tbody>
<tr>
<td>EGN 3433 System Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EML 4041 Computer Methods</td>
<td>3</td>
</tr>
<tr>
<td>EML 3262 Kinematics and Dynamics of Machinery</td>
<td>3</td>
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<tr>
<td>EML 3500 Machine Analysis and Design I</td>
<td>3</td>
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<tr>
<td>*Historical Perspectives Elective</td>
<td>3</td>
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<tr>
<td>*ALAMEA Perspectives Elective</td>
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<tr>
<th>Semester VI</th>
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<tbody>
<tr>
<td>EML 4501 Machine Design</td>
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<tr>
<td>EML 3701 Fluid Systems</td>
<td>3</td>
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<tr>
<td>ENC 4931 Engineering Communications</td>
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<tr>
<td>*Fine Arts Elective</td>
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<tr>
<td>MW/MI (Non-engineering)</td>
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<tr>
<th>Semester VII</th>
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<tbody>
<tr>
<td>EML 4142 Heat Transfer I</td>
<td>3</td>
</tr>
<tr>
<td>EML 3303 Mechanical Engineering Lab I</td>
<td>3</td>
</tr>
<tr>
<td>EML 4551 Capstone Design (MW/MI)</td>
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<tr>
<td>Approved Technical Elective</td>
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<tr>
<th>Semester VIII</th>
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<tbody>
<tr>
<td>EML 4302 Mechanical Engineering Lab II</td>
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<tr>
<td>Controls Elective</td>
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</table>

| Approved Design Elective | 3 |
| Approved Technical Elective | 3 |
| Approved Technical Elective | 1 |

*Approved General Education Requirements*

**Prerequisites (State Mandated Common Prerequisites)**

Complete the A.A. degree at the community college. Some courses required for the major may also meet General Education Requirements thereby transferring maximum hours to the university. A minimum of 60 semester hours must be completed at the university. If a student wishes to transfer without an A.A. degree and have fewer than 60 semester hours of acceptable credit, the student must meet the university’s entering freshman requirements including ACT or SAT test scores, GPA, and course requirements.

The following are transferable courses from the Community College that will be accepted in the Math/Science/Engineering areas:

**Math**

<table>
<thead>
<tr>
<th>USF C/C</th>
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<tbody>
<tr>
<td>MAC 2281 MAC 2311 (3)</td>
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<td>MAC 2282 MAC 2312 (3)</td>
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<td>MAC 2283 MAC 2313 (3)</td>
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**Physics**

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<td>PHY 2048 PHY 2048 (3)</td>
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<td>PHY 2049 PHY 2049 (3)</td>
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<td>PHY 2049L PHY 2049L (1)</td>
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**Chemistry**

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<td>CHM 2041 CHM 1045 (3)</td>
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<td>CHM 2045L CHM 1045L (1)</td>
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<tr>
<td>CHM 2046 CHM 1046 (3)</td>
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<td>CHM 2046L CHM 1046L (1)</td>
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**Graphics**

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<td>EGS 1113 EGS 1111 (3)</td>
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<th>Fortran USF C/C</th>
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<tr>
<td>EGN 2210 COP 2202 (3)</td>
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</table>

This is a limited access program involving special admissions requirements. Please be aware of the immunization, foreign language, continuous enrollment policies of the university, and qualitative standards required.

**Engineering Admissions Requirements**

Transfer students must have completed the equivalent USF Engineering Calculus sequence with a 2.0 GPA; must have completed one year of equivalent USF General Physics and Chemistry courses with a minimum of 2.0 GPA; must have an overall GPA of 2.0 or better.

**College Regulations**

1. **Humanities and Social Science Requirements**

While the Engineering undergraduate student is expected to complete certain requirements during the first two years of study which are directed toward the humanities and social sciences, and which are fulfilled by the completion of the General Education requirements of the University, the College of Engineering expects more of its prospective engineering graduates than this minimum. The engineer must not only be a technically competent individual, but must also be a person who can understand, adjust and contribute to the social environment.

Students who transfer from a State of Florida community college with an Associate of Arts degree and who have met that
college's General Education Requirement will find their General Education coursework satisfies the University General Education Requirements.

All Engineering students must complete the USF Exit Requirements. The Literature and Writing portion can be met by completing ENC 4931 Communication for Engineers.

2. English Requirement

Students who have been admitted to the College of Engineering may be required to take an examination in order to evaluate their preparedness in the use and understanding of the English language. The examination will be administered by the faculty of the University's English program.

Students evidencing an English deficiency will be required to initiate corrective programs, with the assistance of their advisers. It is recognized that such deficiencies can exist even though a student has met the University's minimum English requirements. Correction of any deficiency must commence the term after a student has been notified and must be completed prior to recommendation of the student for graduation by the faculty of the College.

See Continuation and Graduation Requirements below for minimum grade requirements.

3. Mathematics Requirement

Students who are pursuing an engineering program are expected to acquire a facility for the rapid and accurate solution of problems requiring the use of mathematics. This requirement includes the ability to translate physical situations into mathematical models. Students evidencing a lack of manipulative ability or of the ability to apply mathematics will be required to take remedial coursework in engineering analysis and problem solving that is over and above their regular degree requirements. Faculty of the College who encounter students who are deficient in their mathematical ability will refer such cases to the Advising Office.

4. Continuation and Graduation Requirements

The curricula for the programs offered by various departments of the College of Engineering may be divided into four categories: a) General Education (Non-Technical Requirements); b) Basic Science Requirements (i.e., Math, Chemistry and Physics); c) Engineering Core Requirements; d) Program Specialization Requirements. All undergraduate students in the College of Engineering must maintain the minimum grade-point average (GPA) of 2.0 for each category and a 2.0 GPA for all engineering courses attempted. In no case will the minimum GPA for a category be less than 2.0. It is the student's responsibility to make sure she/he meets all departmental requirements. In addition to the completion of the coursework and/or project requirements of the respective program of the College, students must be recommended for their degrees by the faculty of the College.

Students who do not maintain the required minimums of the program pursued in each category are ineligible for further registration in the College unless individually designed continuation programs are recommended by the student's academic adviser and approved by the department chairperson and the Engineering Associate Dean for Academic Affairs. All students who are academically dismissed from the University will be denied readmission to the College of Engineering unless they meet admission requirements in effect at the time readmission is sought and are recommended for readmission by the department and the Associate Dean for Academic Affairs.

Students pursuing College of Engineering degree programs are expected to take their courses on a graded basis (ABCFD). Exceptions require written approval of the department adviser prior to registration.

The College of Engineering requires that a student complete the Basic Science, Engineering Science and Specialization Requirements for the baccalaureate degree within seven years prior to the date of graduation. Any exceptions require approval of the department and Dean's Office.

Each engineering student is required to complete the Application for Graduation - Check List and submit it to the College of Engineering Advising Office by the drop date of the term prior to the semester in which graduation is sought. Completion of this form is a requirement for graduation.

Effective fall of 1987 all students pursuing Bachelor of Science degree programs in Civil or Mechanical Engineering will be required to take the Fundamentals of Engineering Exam of the State Board of Professional Regulation at least one term prior to the term of anticipated graduation. Engineering students in other disciplines are strongly encouraged to do the same. (See the College Advising Office for applications and information.)

5. Transfer Credit

Transfer credit will be allowed by the USF College of Engineering when appropriate if the transferred course has been passed. In some cases credit for a course may be granted, but the hours accepted may be less than the hours earned at another school.

While credit for work at other institutions may be granted subject to the conditions of the previous paragraph, a minimum of thirty semester hours of engineering coursework specified by the degree granting department is required for a baccalaureate degree.

■FIVE-YEAR PROGRAM - LEADING TO BACHELORS AND MASTERS DEGREES

Students who, at the beginning of their senior year, are clearly interested in graduate study are invited to pursue a Five-Year Program of study leading simultaneously to the Bachelor of Science in Engineering or Engineering Science and Master of Science in Engineering or Engineering Science degrees. The keys to this program are:

1. A two-year research program extending through the fourth and fifth year.
2. The opportunity of taking some graduate courses during the fourth year and deferring the taking of some senior courses to the fifth year. The requirements of the combined degrees do not differ from those for the two degrees pursued separately.

Students apply for admission to this program through their adviser, who should be consulted when additional information is needed. General requirements include:

1. Senior standing (90 credits) with at least 16 upper level engineering credits completed at the University of South Florida with a 3.0 GPA.
2. A minimum score of 1000 on the verbal and quantitative portions of the Graduate Records Examination is expected.
3. Above-average performance in the chosen Engineering program is expected.

Certificate Programs

Certificate in Biomedical Engineering

The Certificate in Biomedical Engineering provides students an opportunity to get an introduction to a rapidly developing field of study and to receive recognition for their endeavors. Students in the program must fulfill all the requirements for an Engineering undergraduate degree, such as Bachelor of Science in Chemical Engineering, and also meet the additional requirements of the Certificate program.

Certificate (10 hours minimum)

• BSC 2010 Biology II - Cellular Processes*
• BCH 3023 Biochemistry**
One of the following Organic Chemistry sequences:
CHM 2210 Organic Chemistry I*
CHM 2211 Organic Chemistry II*
CHM 2200 Organic Chemistry***
Other "human sciences" (6 hrs. min.)

One of the following:
PSY 3044 Experimental Psychology**

One of the following:
PET 3310 Kinesiology
PET 3351 Exercise Physiology I
EXP 4104 Sensory Processes
PSB 4013C Neuropsychology
(or approved substitute)

**Engineering (9 hrs. min.****)
EEL 4933 Special Electrical Topics
ECH 5746 Intro to Biomedical Engineering
One or more of the following (to achieve 9 hrs. min. in area):
EIN 4313L Human Factors
EIN 5245 Work Physiology & Biomechanics
ECH 5747 Selected Topics in Chemical Engineering
ECH 5746 Intro to Biomedical Engineering
ECN 5748 Selected Topics in Biomedical Engineering
(or other approved Engineering courses)

*These courses are typically required for Medical School admission. Note that there may be other required courses, such as a course in Human Genetics and the Organic Chemistry laboratories.
**These courses are not normally required for Medical School admission, but are often "highly recommended".
***This is a single semester course in Organic Chemistry. This course does not normally satisfy the admission requirements of most medical schools. It also does not count towards the Chemical Engineering degree (students must take the full year sequence).
****It is important to note that these engineering courses are above and beyond the courses necessary to satisfy the 136 hour requirement. That is, these courses will not also be countable as engineering electives towards the B. S. requirements for any of the departmental degree programs.

Certificate of Enhancement

The Certificate of Enhancement in (designated discipline) provides students an opportunity to gain an enhanced experience in their chosen field while pursuing an engineering degree and to permit them to receive recognition for the same requirements.

Requirements:
1. Enrolled in a Bachelor of Science degree program in a specified engineering discipline.
2. A minimum of 15 hours of additional elective courses, not included as a part of the B. S. degree, from an approved list. Courses must be taken on a letter-grade basis and a minimum of 9 hours must be in engineering courses.
3. A G.P.A. of 2.0 or greater for the additional hours.
4. The student must receive the engineering degree to receive the Certificate of Enhancement.

Please contact the appropriate department chairperson to be accepted in the program.

Computer Service Courses

These courses marked SC are specifically designed for the non-engineering student.

Recognizing that the general purpose digital computer has made significant contributions to the advancement of all elements of the academic community and that it will have an ever greater impact in the future, the College of Engineering offers several levels of credit coursework, both undergraduate and graduate, to serve students of all colleges in order that they may be prepared to meet the computer challenge.

Computer-oriented courses are offered in two broad categories: (1) those courses which are concerned with the operation, organization and programming of computers and computer systems from the viewpoint of examining the fundamental principles involved in computer usage; and (2) those courses which are concerned with computer applications to a variety of different disciplines, by means of user-oriented-languages such as FORTRAN, PLI, COBOL, PASCAL, BASIC, "C" and ADA. Students in engineering, the physical sciences, and mathematics must consult their adviser for suitable computer courses, since these courses are not acceptable to a number of degree programs.

College Facilities

Each of the departments has several modern well-equipped laboratories that are used for undergraduate teaching. Some examples of specialized equipment available are a scanning electron microscope, a gas chromatograph mass spectrometer, a 250,000 lb. material testing machine, several microprocessors based control systems, industrial robots, a low turbulence subsonic wind tunnel, computer numerical controlled machinery, metal organic chemical vapor deposition systems, and integrated circuits design workstations.

College Computing Facilities

The College of Engineering Computing Facilities are used to provide support for specialized engineering calculations above and beyond those which are available at the IBM based Central Florida Regional Data Center (CFRDC).

The College of Engineering operates a cluster of file and computer servers for students and faculty within the College. These consist of SUN servers and four Ardent multiprocessors mini-supercomputers. The networks provide access from offices and laboratories, computer rooms and dial-in facilities. All machines are configured for E-mail, and access to Internet. Conventional asychronous links to the campus central facility will shortly be supplemented with an Ethernet link.

In addition to the network facilities, the College operates open access P.C. labs. Three are available for undergraduate engineering students; a third smaller lab is reserved for graduate students and faculty.

The network facilities provide access either via Ethernet or the ISDN. Connections to offices, laboratories and classrooms are available on request, subject to budget priorities. The FEEDS studies are also networked to provide demonstrations for remote classes.

The College facilities run most of the standard engineering software. Languages include Fortran, Basic, Pascal, C, Ada, several varieties of LISP and Prolog. Applications software includes mathematical libraries, suites of programs for VLSI design, chemical process design, civil and mechanical engineering design, robotics simulation, and circuit simulation and analysis. There are high resolution color terminals for use in conjunction with these activities, and for mechanical design there are four multiple display workstations with joysticks and digitizing pads. Similar arrangements are used for VLSI design.

Additionally, the Computer Science and Engineering Department within the College runs other facilities consisting of an Ethernet with SUN and DEC machines, an Intel Hypercube parallel computer, and extensive microcomputer laboratories.

Cooperative Education Program

A wide variety of industries and government agencies have established cooperative programs for engineering students to provide them with the opportunity to become familiar with the practical aspects of industrial operations and engineering careers. Students in the Career Resource Center’s Cooperative Education (Co-op) program alternate periods of paid employment in their major field with like periods of study. Students following the Co-op program usually encounter no problems in scheduling their program, since required Social Sciences and Humanities, Mathematics and Science, and Engineering Core courses are offered every semester. Students normally apply for participation in this program during their sophomore year and pursue actual Co-op employment during their sophomore and junior
years. The senior year is generally pursued on a full-time study basis, since many specialization courses are not offered every semester. The students receive a Cooperative Education Certificate upon successful completion of a minimum of two work assignments.

### STAC (Southern Technology Applications Center)

The Space Act of 1958 directed NASA “to provide the widest practical and appropriate dissemination of information concerning its activities and results thereof.” In order to pursue this mandate NASA established a network of Industrial Applications Centers (IACS) to disseminate and transfer NASA technology, products and processes to the private sector.

In 1977 NASA and the State University System of Florida combined resources to form the Southern Technology Applications Center which operated a regional IAC in the State of Florida. STAC is a not-for-profit 501.C3 Corporation partially supported by NASA and SUS grants and its effective network of experts and resources are located at the colleges of Engineering at six of the SUS universities.

In December 1991 the NASA IAC Network was reorganized to provide comprehensive technology transfer and economic development services. The new program resulted in a network of six Regional Technology Transfer Centers that link NASA Field Centers, Federal laboratories, Universities and other Technology Transfer networks for more efficient technology transfer.

In January 1992 STAC was appointed the Southeast Regional Technology Transfer Center (RTTC) with responsibility for nine Southeastern states.

Since the early days of its existence STAC has built a reputation for successfully identifying, matching, developing and deploying the critical information and technology needed by business, industry, academic institutions and government. In this way, American companies, especially small firms are able to capitalize rapidly on the results of scientific research and technological innovation and realize the increased productivity necessary to compete in the dynamic marketplace.

The cornerstone of STAC’s technology transfer success is a professional staff trained and experienced in engineering, physical and biological sciences, medicine, social and behavioral sciences, business planning, marketing, training, library science and government. STAC’s Information Research Center accesses an international array of over 2000 databases and 35 document retrieval services. STAC’s hands-on approach enables each client to receive the attention and alternative solutions needed to make the best strategic decisions.

STAC is the connection to access the information technology, inventions, equipment, facilities and expertise that resides within NASA, the other 700+ Federal laboratories and the SUS Universities.

### Army & Air Force R.O.T.C. For Engineering Students

The Engineering curriculum, coupled with involvement in the Army or Air Force R.O.T.C. program, requires a minimum of five (5) years to complete the degree requirements. Army and Air Force R.O.T.C. cadets must take 16 additional hours in either military science or aerospace studies. Additionally, Air Force-sponsored summer training camp is scheduled between the sophomore and junior year for Air Force cadets, and Army cadets attend an Army-sponsored summer training program between the junior and senior years.

### ENGINEERING FACULTY

#### Chemical Engineering


#### Civil and Environmental Engineering


#### Computer Science and Engineering


#### Electrical Engineering


#### Industrial and Management Systems


#### Mechanical Engineering


### ENGINEERING COURSES

#### Basic and Interdisciplinary Engineering

**EGN 2031 HISTORY OF TECHNOLOGY** HP (3) Covers the evolution of technology and its influence on society from prehistoric man to the modern day. Topics include: seven technological ages of man, methods of producing power, materials, transportation, communication and calculation, and technology and society.

**EGN 2210 COMPUTER TOOLS FOR ENGINEERS** (3) PR: MAC 2281. Students will be introduced to computer based engineering tools and their application to the solution of engineering problems. The programming language, FORTRAN, will be the most emphasized tool, but coverage will also be given to other engineering/mathematical tools such as equation solving tools and spreadsheets.

**EGN 3111 STATICS** (3) PR: PHY 2048. Principles of statics, mechanical equilibrium, forces, moments, plane trusses. Lec.-pro.

**EGN 3321 DYNAMICS** (3) PR: EGN 3311. Dynamics of discrete particles; kinematics and kinetics for rigid bodies. Lec.

**EGN 3331 MECHANICS OF MATERIALS** (3) PR: EGN 3311. Stress, strain, Hooke’s Law; torsion, beam, column analysis; combined stresses; inelastic effects, limit design. Lec.

### EGN 3343 THERMODYNAMICS I

### EGN 3353 BASIC FLUID MECHANICS
- PR: EGN 3311, CR: EGN 3321. Fundamental and experimental concepts in ideal and viscous fluid theory; momentum and energy consideration, introduction to hydraulics, pipe flow, methods.

### EGN 3366 MATERIALS ENGINEERING I
- PR: CHM 2046, EGN 3311. Structure and property relationships in engineering materials, i.e., metal, ceramic and polymer systems. Environmental effects are also treated.

### EGN 3373 INTRODUCTION TO ELECTRICAL SYSTEMS I

### EGN 3374 SYSTEM DYNAMICS
- CR: EML 4041; PR: EGN 3321, EGN 4450, PHY 2049. Dynamic analysis of electrical, mechanical, hydraulic and thermal systems; LaPlace transforms; numerical methods; use of computers in dynamic systems.

### EGN 3376 ENGINEERING STATISTICS I
- PR: MAC 2283. An introduction to the basic concepts of statistical analysis with special emphasis on engineering applications.

### EGN 3613C ENGINEERING ECONOMY I
- A study in analyzing the economic limitations imposed on engineering activities using basic models which consider the time value of money.

### EGN 3436 MATERIALS ENGINEERING II
- PR: EGN 3365. Applications and structure property relationships of commonly used engineering materials. Steel, nonferrous alloys and their welding, heat treatment and processing. Introduction to ceramic and polymeric materials.

### EGN 4450 INTRODUCTION TO LINEAR SYSTEMS

### EGN 4831 TECHNOLOGY AND SOCIETY -XMW
- PR: MAC 2282. Applications and structure property relationships of commonly used engineering materials. Steel, nonferrous alloys and their welding, heat treatment and processing. Introduction to ceramic and polymeric materials.

### EGN 4420 NUMERICAL METHODS OF ANALYSIS

### EGN 4450 INTRODUCTION TO LINEAR SYSTEMS

### EGN 4311 TECHNOLOGY AND SOCIETY -XMW
- Non-technical survey of engineering activities: utilities, nuclear power, genetics weaponry, space, etc. Students conduct individual in-depth study of environmental/ethical problem. May be repeated for different topics up to 9 hours.

### EGN 4405 INDEPENDENT STUDY

### EGN 4521 ENGINEERING APPLICATIONS FOR VECTOR ANALYSIS
- PR: MAP 2302. Vector methods of electromagnetism and fluid mechanics. Vector operators, line and flux integrals, potential and transport theorems, applications.

### EGN 4522 ENGINEERING APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

### EGN 4523 MATHEMATICAL ASPECTS OF COMMUNICATION ENGINEERING

### EGN 5424 ENGINEERING APPLICATIONS OF COMPLEX ANALYSIS
- PR: MAC 2302 or CC. Analytic functions, conformal mapping, residue theory, Laurent series, transforms. Applications to various problems in engineering and physics.

### EGN 5425 ENGINEERING APPLICATIONS OF ADVANCED MATRIX COMPUTATIONS
- PR: EGN 4450 and MAP 2302, or CC. Survey of theory and software for matrix computations: factorization methods, least squares and pseudoinverses, eigenvector algorithms. Special matrices and representations for control system and finite element applications.

### EGS 1113 INTRODUCTION TO DESIGN GRAPHICS
- An introduction to the basic principles of engineering design. The course will include the graphic projective systems used in engineering drawing and design. Methods of graphic communication and graphic analysis of engineering design problems will be investigated.

### Chemical Engineering

### ECH 3023 INTRODUCTION TO PROCESS ENGINEERING

### ECH 3264C TRANSPORT PROCESSES I

### ECH 3702 INSTRUMENT SYSTEMS I

### ECH 4123C PHASE AND CHEMICAL EQUILIBRIA
- PR: For majors. ECH 3023; for non-majors ECH 3023 or CHM 4410. Correlation of thermodynamic properties of real systems and solutions. Description of multicomponent, multiphase systems in equilibrium. Applications to separation processes and reactor design. Lecture/laboratory.

### ECH 4244L CHEMICAL ENGINEERING LABORATORY II
- CR: ECH 4415C. PR: ECH 3264C, ECH 3702, EML 3303, or CI. Engineering laboratory experiments in Chemical Engineering Processes: fluid flow, heat transfer, phase and chemical equilibria, and reacting systems.

### ECH 4285C TRANSPORT PROCESSES II
- PR: ECH 3264C. Design, sizing, and selection of mass transfer equipment. Absorption, distillation, extraction, humidification. Lecture/laboratory.

### ECH 4323C AUTOMATIC CONTROL I

### ECH 4415C REACTING SYSTEMS
- CR: ECH 4244L. PH: CHM 4412, ECH 4123C. Equilibrium and rate phenomena in reacting systems. Description of homogeneous chemical reactors for design and control. Lecture/laboratory.

### ECH 4605 STRATEGIES OF PROCESS ENGINEERING

### ECH 4615 PLANT DESIGN AND OPTIMIZATION

### ECH 4905 INDEPENDENT STUDY
- PR: CI. Specialized independent study determined by the student’s needs and interests. May be repeated up to 3 credit hours.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>CES 4720</td>
<td>CAPSTONE STRUCTURAL/MATERIALS DESIGN</td>
<td>3</td>
<td>PR: CES 4702, CES 4605. A capstone materials design experience for seniors in Civil and Environmental Engineering.</td>
</tr>
<tr>
<td>CES 4740</td>
<td>CAPSTONE GEOTECHNICAL/TRANSPORTATION DESIGN</td>
<td>3</td>
<td>PR: CEG 4011 or CI. A capstone geotechnical/transportation design experience for seniors in Civil and Environmental Engineering.</td>
</tr>
<tr>
<td>CES 4746</td>
<td>STRUCTURAL DESIGN STEEL</td>
<td>2</td>
<td>PR: CES 4618. Design of structures made of steel.</td>
</tr>
<tr>
<td>CES 4750</td>
<td>CONCEPTS OF STEEL DESIGN</td>
<td>3</td>
<td>PR: CES 3102. Introduction to steel design and AISC Manual of Steel Construction: Design of tension members; compression members; beams; beam columns; and bolted, welded, and riveted connections.</td>
</tr>
<tr>
<td>CES 4790</td>
<td>SOIL MECHANICS I</td>
<td>3</td>
<td>PR: EGN 3353C. Fundamental and experimental concepts in soil mechanics with emphasis on soil properties, soil moisture, soil structure, and shearing strength.</td>
</tr>
<tr>
<td>ECH 4930</td>
<td>SPECIAL TOPICS IN CHEMICAL ENGINEERING I</td>
<td>(1-4)</td>
<td>PR: CC. May be repeated up to 9 credit hours.</td>
</tr>
<tr>
<td>ECH 4831</td>
<td>SPECIAL TOPICS IN CHEMICAL ENGINEERING II</td>
<td>(1-4)</td>
<td>PR: CC. May be repeated up to 9 credit hours.</td>
</tr>
<tr>
<td>ECH 5285</td>
<td>TRANSPORT PHENOMENA</td>
<td>(3)</td>
<td>PR: Senior or graduate standing in engineering. Basic descriptive equations of fluid, heat, and mass transport. Description and solution to intermediate problems, including unsteady-state and multidimensional systems. Estimation of transport and convective coefficients.</td>
</tr>
<tr>
<td>ECH 5324</td>
<td>AUTOMATIC PROCESS CONTROL</td>
<td>(3)</td>
<td>PR: ECH 4323C or CI. The course covers the root locus and frequency response methods. The techniques of rational, cascade feed forward, selective, override, and multivariable control techniques are discussed in detail. The course also shows how to utilize these techniques to design control systems. Z-transforms and discrete control including PID, Dahlin, and deadline compensations.</td>
</tr>
<tr>
<td>ECH 5740</td>
<td>THEORY AND DESIGN OF BIOPROCESSES</td>
<td>(4)</td>
<td>PR: Senior standing in engineering or CI. Introduction to biotechnology, including applied microbiology, enzyme technology, biochemistry, production, biosensor design, and transport processes in biosystems. Open to majors and non-majors with CI.</td>
</tr>
<tr>
<td>ECH 5742</td>
<td>PHARMACEUTICAL ENGINEERING</td>
<td>(2)</td>
<td>PR: Senior or graduate standing in engineering or CI. Introduction to pharmaceutical engineering, including dosage forms (tablets, capsules, powders, liquids, topical forms, and aerosols), excipients, regulatory issues, clinical studies, and good manufacturing practices.</td>
</tr>
<tr>
<td>ECH 5746</td>
<td>INTRODUCTION TO BIOMEDICAL ENGINEERING</td>
<td>(3)</td>
<td>PR: Senior standing in engineering or CI. Introduction to biomedical engineering, including transport phenomena in biomedical systems, biomaterials, biomedical instrumentation, prosthetics, devices, and clinical engineering. Open to non-engineering students with CI.</td>
</tr>
<tr>
<td>ECH 5747</td>
<td>SELECTED TOPICS IN CHEMICAL ENGINEERING BIOTECHNOLOGY</td>
<td>(1-3)</td>
<td>PR: Senior standing in engineering or CI. Selected topics in chemical engineering biotechnology, including pharmaceutical engineering, immobilized enzyme technology, food engineering, and fermentation. Open to majors and non-majors with CI. May be repeated for credit as subjects vary.</td>
</tr>
<tr>
<td>ECH 5748</td>
<td>SELECTED TOPICS IN BIOMEDICAL ENGINEERING</td>
<td>(1-3)</td>
<td>PR: CI. Selected topics in biomedical engineering, including biomedical materials, biodynamics of circulation, separation processes in biomedical systems, and artificial organ systems. May be taken by non-engineering students with CI. May be repeated for credit as subjects vary.</td>
</tr>
<tr>
<td>ECH 5780</td>
<td>ENVIRONMENTAL REACTING SYSTEMS</td>
<td>(3)</td>
<td>Application of chemical reaction engineering principles to problems in environmental engineering. Basic chemical kinetics and the modeling of batch and continuous systems. Applications will include containment fate and transport and remediation.</td>
</tr>
<tr>
<td>ECH 5820</td>
<td>PRODUCT DEVELOPMENT</td>
<td>(2)</td>
<td>Senior or graduate standing in engineering or CI. An introduction to the development of consumer products, including the history of innovation, creativity development, the product development environment, and a detailed examination of several product areas.</td>
</tr>
<tr>
<td>ECH 5910</td>
<td>DIRECTED RESEARCH IN BIOENGINEERING</td>
<td>(1-3)</td>
<td>PR: CI. Directed research in an area of biomedical engineering or engineering biotechnology. May be repeated up to 4 credit hours.</td>
</tr>
<tr>
<td>ECH 5930</td>
<td>SPECIAL TOPICS III</td>
<td>(1-4)</td>
<td>PR: CI. May be repeated up to 9 credit hours.</td>
</tr>
<tr>
<td>ECH 5931</td>
<td>SPECIAL TOPICS IV</td>
<td>(1-4)</td>
<td>PR: CI. May be repeated up to 9 credit hours.</td>
</tr>
</tbody>
</table>

Civil and Environmental Engineering

CEG 4011 SOIL MECHANICS I | (3) | PR: EGN 3353C. Fundamental and experimental concepts in soil mechanics with emphasis on soil properties, soil moisture, soil structure, and shearing strength. |
Engineering. Design of structures and foundations made of steel and reinforced concrete.

**CWR 4742 CONCEPTS OF STRUCTURAL DESIGN** (3)
PR: CWR 4102, CWR 4702. Fundamentals of structural design, including beams, columns, connections and formwork. Introduction to concrete design including design of beams, walls, columns, and pilasters.

**CWS 4200 CONCRETE AND MASONRY DESIGN** (3)
PR: CWR 4102, CWR 4702. Fundamentals of design concrete and the ACI Building Code Requirements for reinforced concrete, design of flexural reinforcement in beams and slabs, design of shear reinforcement, design of concrete columns, and design of steel beams.

**CWS 5105C ADVANCED MECHANICS OF MATERIALS I** (3)
PR: EGN 3311, MAP 2302. Analytical study of the mechanical behavior of deformable solids. Basic concepts, stress and strain transformations, special topics in beams, introduction to theories of elasticity, and bending of thin plates.

**CWS 5209 STRUCTURAL DYNAMICS** (3)
PR: CWS 3102. Behavior of structural components and systems when subjected to periodic dynamic loads.

**CWS 5715C PRESTRESSED CONCRETE** (3)

**CGN 3021L CIVIL ENGINEERING LABORATORY** (2)
PR: CWS 3102, EGN 3353, EGN 3365. A laboratory experience in departmental facilities including the subject areas of structures, materials, fluids, transportation, soils, engineering mechanics, environmental engineering, and computer assisted data acquisition.

**CGN 4122 PROFESSIONAL AND ETHICAL ISSUES IN ENGINEERING - XMW** (3)
Focus on engineering responsibilities in the technical aspects of preparing contracts and specifications. Objectives are to teach the student their legal and ethical responsibilities in the preparation of contracts and specifications. Make the student aware of technical problems in the preparation of specifications; bid documents and contracts. Emphasis of ethics of engineer-client agreements.

**CGN 4851 CONCRETE CONSTRUCTION MATERIALS** (3)
PR: EGN 3365L. Classifications and production of cements, design and testing of concrete mixes to produce desired properties.

**CGN 4905 INDEPENDENT STUDY** (1-5)
PR: CC. Specialized independent study determined by the students' needs and interests. May be repeated up to 15 credit hours. (S/U only)

**CGN 4911 RESEARCH IN CIVIL ENGINEERING AND MECHANICS** (1-4)
PR: CC.

**CGN 4914 SR ENGINEERING STUDENT** (2-5)
PR: CI. Problem-solving experience and training for seniors in research and/or design projects. Written final reports are required.

**CGN 4933 SPECIAL TOPICS IN CIVIL ENGINEERING AND MECHANICS** (1-5)
PR: CI. New technical topics of interest to civil engineering students.

**CGN 5833 SPECIAL TOPICS IN CIVIL ENGINEERING AND MECHANICS** (1-5)
PR: CI. New technical topics of interest to civil engineering students. May be repeated up to 6 credit hours.

**CWR 4103 WATER RESOURCES ENGINEERING** (3)
PR: CWR 4202. A study of the engineering principles involved in sustaining and managing the quantity and quality of water available for human activities with particular emphasis on surface water and ground water hydrology.

**CWR 4202 HYDRAULICS** (3)
PR: EGN 3353. Fundamental and applied aspects of pipe flows, free surface flow, and unsteady flow for hydraulic systems.

**CWR 4810 HYDRAULIC DESIGN** (2)
PR: CWR 4103, 4202. Design of hydraulic systems, including drainage, water supply, and flood control.

**CWR 4812 CAPSTONE WATER RESOURCES DESIGN** (3)
PR: CWR 4202, CWR 4103. A capstone water resources design experience for seniors in Civil and Environmental Engineering. A design oriented course to design both industrial and domestic water treatment, and water transport systems and hydraulic systems, including drainage, water supply, and flood control.

**EMA 4324 CORROSION OF ENGINEERING MATERIALS I** (3)
PR: EGN 3365L. Principles of electrochemical corrosion and the representation of corrosion processes by polarization diagrams. Origin of prevention and control of the localized forms of corrosion and approaches to corrosion control.

**EMA 4703 FAILURE ANALYSIS AND PREVENTION** (3)

**ENV 3001 ENVIRONMENTAL ENGINEERING** (3)
CR: EGN 3353. An introduction to various aspects of environmental problems faced by today's society. Topics covered are: air pollution, water pollution, noise pollution, solid waste management, ionizing radiation, disease transmission, and food protection.

**ENV 4004L ENVIRONMENTAL ENGINEERING LABORATORY** (1)
PR: ENV 3001, CR: ENV 4502. Laboratory experience in the measuring of environmental parameters.

**ENV 4101 AIR POLLUTION CONTROL** (3)
PR: EGN 3353. Behavior and effects of atmospheric contaminants and the principles of making measurements in the air environment. Basic concepts of meteorology and control technology are discussed. Regulatory aspects and air pollution standards are covered.

**ENV 4400 CHEMICAL ASPECTS OF ENVIRONMENTAL ENGINEERING** (3)
PR: One year general chemistry. Environmental quality and treatment parameters; sampling and sample preservation techniques; selected measurement techniques; interpretation and analysis of data; emphasis on water chemistry principles. Course is restricted to students pursuing the environmental engineering option in Civil Engineering and Chemical Engineering.

**ENV 4417 WATER QUALITY AND TREATMENT** (3)
PR: EGN 3353. An introduction to municipal water supply and waste water treatment. Topics include water requirements and waste volumes, water quality, physical and chemical treatment processes, and advanced wastewater treatment processes.

**ENV 4532 WATER SYSTEMS DESIGN** (2)
PR: EGN 3353. Corequisite ENV 4503. A design oriented course which utilizes the theory obtained in the Unit Operations course to design both industrial and domestic water treatment and water transport systems. It emphasizes the design procedures normally used in engineering practice.

**ENV 4502 ENVIRONMENTAL UNIT OPERATIONS** (3)
PR: EGN 3343, EGN 3353, CR: ENV 3001. The theory and the design of unit operations normally used in the practice of environmental engineering, such as agitation and mixing of liquids, filtration, leaching, gas absorption, sedimentation and clarification, drying, and evaporation.

**ENV 4503 ENVIRONMENTAL UNIT PROCESSES** (3)
PR: EGN 3323, ENV 4002. The theory and design of unit processes normally used in environmental engineering such as coagulation of colloidal materials, water stabilization, water softening and neutralization, ion exchange, adsorption and oxidation processes for removal of iron and magnesium.

**ENV 4531 WASTEWATER SYSTEMS DESIGN** (2)
PR: ENV 4503. Emphasis is placed upon design practice and economics for a comprehensive design of a wastewater system and a collection system.

**ENV 4552L ENVIRONMENTAL UNIT OPERATIONS AND PROCESSES LABORATORY** (1)
PR: EGN 3353, ENV 4004L, CR: ENV 4503. Experimental work of the theory and design practices learned in Unit
Operations and Unit Processes lecture courses. It provides the student familiarity with the development of bench and pilot plant processes and operations used in environmental engineering.

**ENVR 4851 CAPSTONE WATER AND WASTEWATER DESIGN** (3)
PR: EGN 3353 and ENV 4503. A capstone environmental design experience for seniors in Civil and Environmental Engineering. A design oriented course to design both industrial and domestic water treatment and water transport systems and wastewater and collection systems. The course emphasizes the design procedure normally used in engineering practice.

**ENV 5105 AIR RESOURCE MANAGEMENT** (3)
PR: CI. Basic concepts, tools and techniques used in natural language processing. Includes program writing in LISP with emphasis on procedural and data abstraction.

**ENV 5164 ENVIRONMENTAL RISK ANALYSIS** (3)
PR: CI. Study of computer science and systems programming. An introduction to systems programming. Emphasizes the design procedure normally used in engineering practice.

**SUR 3140C ENGINEERING LAND SURVEYING** (3)
Principles of land surveying for engineering practice. Traverses, levels, boundary surveys, route surveys, coordinate geometry, and mapping.

**TTE 4004 TRANSPORTATION ENGINEERING I** (3)
PR: EGN 3321. Principles of surface transportation system development, design, and operations; administration, road design, and engineering impacts of alternate models including bus, air, rail, water, and pipeline facilities and terminals.

**TTE 4821 TRANSPORTATION SYSTEMS DESIGN** (2)
PR: TTE 4005. Comprehensive surface transportation design laboratory experience involving design function, traffic and facility sizing, complete alignments, site surveying & layout plan and quantity preparation with computerized designed applications.

**TTE 4821 TRANSPORTATION PLANNING AND ECONOMICS** (3)
PR: College Algebra & CI. Fundamentals of urban transportation planning; trip generation, trip distribution, modal split, traffic assignment. Introduction to environmental impact analysis, evaluation and choice of transportation alternatives.

**Computer Science and Engineering**

**CAP 5400 DIGITAL IMAGE PROCESSING** (3)
PR: EEL 4851C or Graduate Standing. Image formation, sources of image degradation, image enhancement techniques, edge detection operators, and threshold selection, low-level processing algorithms for vision, image data compression.

**CAP 5621 INTRODUCTION TO ARTIFICIAL INTELLIGENCE** (3)
PR: EEL 4851C. Basic concepts, tools and techniques used to produce and study intelligent behavior. Includes program writing in Lisp with emphasis on procedural and data abstraction.

**CAP 5622 EXPERT AND INTELLIGENT SYSTEMS** (3)
Basic concepts, techniques and tools for the design and implementation of expert and intelligent systems. Knowledge representation, inference methods, knowledge acquisition methods, and some advanced concepts. Tools to facilitate construction of expert and intelligent systems.

**CDA 4100 COMPUTER ORGANIZATION & ARCHITECTURE** (3)
PR: EEL 4705. Elements of computer systems; processors, memories and systems. Register transfer representation of a computer. ALUs and their implementation. The control unit. Memory and I/O. Hardware support of operation system functions.

**CDA 4203 COMPUTER SYSTEM DESIGN** (3)
PR: EEL 4705, EEL 4705L. CR: CDA 4203L. Design Methods, Top-Down design, Building Blocks, and Instruction and addressing models, micromachine design, interfacing.

**CDA 4203L COMPUTER SYSTEM DESIGN LAB** (1)
PR: EEL 4705 and EEL 4705L. CR: CDA 4203. This lab introduces the student to the concept of system design. Several projects are given including building timing circuits, memory-based and communication circuits, and microcomputer-based designs.

**CEN 4020 SOFTWARE ENGINEERING** (3)
PR: EEL 4851C. An overview of software engineering techniques for producing high quality software. Student will participate in a software development team.

**CEN 4721 USER INTERFACE DESIGN** (3)
An examination of factors influencing the usability of a computer system. Topics include input and output devices, graphic and multi-media interfaces, formats for interaction/communication between computer and user, and the evaluation of usability.

**CIS 4250 ETHICAL ISSUES AND PROFESSIONAL CONDUCT** (3)
PR: Senior standing in the Department of Computer Science and Engineering. An introduction to ethical issues arising in the computer sciences, through written analysis and oral presentations of technical situations which involve ethical conflicts.

**CIS 4900 INDEPENDENT STUDY IN COMPUTER SCIENCE** (1-5)
PR: CI. Specialized independent study determined by the needs and interests of the student. May be repeated up to 10 credit hours. (SU only)

**CIS 4910 COMPUTER SCIENCE PROJECT** (2)
Projects intended to develop individual interests and abilities in computer science involving either computer hardware or software aspects of a well defined proposal.

**CIS 4930 SPECIAL TOPICS IN COMPUTER SCIENCE** (1-4)
PR: CI. May be repeated up to 15 credit hours.

**COP 2000L COMPUTER SCIENCE LABORATORY** (1)

**COP 2002 INTRODUCTION TO COMPUTER SCIENCE** (3)
CR: COP 2000L. Introduction to the concepts of algorithmic formulation of problems for computer solution and the general abstract operations used in these formulations.

**COP 2400 COMPUTER SYSTEMS** (3)

**COP 2510 "PROGRAMMING CONCEPTS"** (3)
PR: COP 2000L. An examination of a modern programming language emphasizing programming concepts and design methodology.

**COP 4200 PROGRAMMING LANGUAGES** (3)
PR: EEL 4851C. An introduction to programming languages, survey of language types and design of compilers and interpreters.

**COP 4203 COMPARISON OF PROGRAMMING LANGUAGES** (3)
PR: EEL 4851C. A comparative study of procedural and nonprocedural computer languages, emphasizing the fundamental differences in information binding, string and data structures manipulation, control and I/O structures in different languages.

**COP 4312 SYMBOLIC COMPUTER FOR ARTIFICIAL INTELLIGENCE** (3)
PR: COP 2000L. An examination of the fundamental symbolic computing and its role in artificially intelligent computers. Includes program writing in Lisp with emphasis on procedural and data abstraction.

**COP 4600 OPERATING SYSTEMS** (3)
PR: EEL 4851C. Introduction to systems programming. Design of operating systems. Concurrent processing, synchronization, and storage management policies.
COT 3100 INTRODUCTION TO DISCRETE STRUCTURES (3)
PR: MAC 2281 or equivalent. Introduction to set algebra, propositional calculus and finite algebraic structures as they apply to computer science.

COT 4210 INTRODUCTION TO AUTOMATA THEORY
AND FORMAL LANGUAGES (3)
PR: EEL 4851C. Introduction to the theory and application of various types of computing devices and the languages they recognize.

COT 4403 ANALYSIS OF ALGORITHMS (3)
PR: EEL 4851C. Design principles and analysis techniques applicable to various classes of computer algorithms frequently used in practice.

EEL 4070 LOGIC DESIGN (3)
PR: EGN 3373, CR: EEL 4705L: for CS & E students CR or PR: COP 2002. Binary number systems; truth functions; Boolean algebra; canonical forms; minimization of combinational logic circuits; synchronous logic circuits in computers.

EEL 4705LOGIC LABORATORY (1)
CR: EEL 4705.

EEL 4743L MICROPROCESSOR LABORATORY (1)
CR: EEL 4744. Laboratory for Microprocessor use and evaluation.

EEL 4744 MICROPROCESSOR PRINCIPLES AND APPLICATIONS (3)

EEL 4748 MICROPROCESSOR-BASED SYSTEM DESIGN AND APPLICATION (3)
PR: EEL 4757, EEL 4743L. Study of techniques for design of microprocessor-based systems used in various applications. Includes a project on development of an experimental application system.

EEL 4781C DISTRIBUTED PROCESSING AND COMPUTER NETWORKS (3)
PR: COP 4600, CDA 4100. Design and analysis of distributed processing systems. Covers communication hardware and software, network operating systems, and reliability enhancement techniques.

EEL 4851C DATA STRUCTURES (3)
PR: COP 2002, COP 2000L. Fundamentals of data organization for purposes of program efficiency, clarity and simplicity will be addressed.

EEL 4852C DATA BASE SYSTEMS (3)
PR: EEL 4851C. Fundamentals of data base management systems. CODASYL, network, hierarchical, and relational data base systems are analyzed, and typical applications are presented.

EEL 5771 INTRODUCTION TO COMPUTER GRAPHICS I (3)
PR: CC. An introduction to the evolution of computer graphics including point-plotting, line drawing, two-dimensional transformations and graphics software packages.

Computer Service

COT 2500 SC INTRODUCTION TO COMPUTERS AND PROGRAMMING IN BASIC & A (3)
An overview of computer systems and their role in society. Survey of the evolution of computer hardware and software technology with emphasis on current applications. Introduction to programming using the BASIC language.

COT 3002 COMPUTERS AND SOCIETY (3)
This computer literacy course covers the fundamentals of hardware, software, and programming languages, presents a broad overview of data processing concepts, problems and applications for students with little or no computing background. (For non-engineering majors only.)

COT 3462 SC PASCAL PROGRAMMING (3)
PR: CGS 2060. Structure and programming implemented with the PASCAL language. Emphasis on program structure and data manipulation.

COT 3463 SC GPSS SIMULATION (3)
PR: COP 2200. The development and execution of discrete event simulation models of real world systems using the GPSS language.

CGS 3464 SC SIMSCRIPT SIMULATION (3)

CGS 4260 SC MINI-COMPUTER APPLICATIONS (3)
PR: CGS 4465. Study of mini-computer system components, I-O devices, theory of computer operation.

COP 2120 SC COBOL PROGRAMMING I (3)

COP 2121 SC COBOL PROGRAMMING II (3)
PR: COP 2120. Advanced applications of ANSI Standard COBOL. Development of subroutines, relative I-O and data base applications as used in a comprehensive data processing environment.

COP 2200 SC FORTRAN PROGRAMMING (3)
PR: CGS 2060. Solution of scientifically oriented problems using the FORTRAN language. Particular emphasis is placed on file manipulation and system libraries.

ETG 4931 SPECIAL TOPICS IN TECHNOLOGY I (1-5)
PR: CC.

ETG 4932 SPECIAL TOPICS IN TECHNOLOGY II (1-5)
PR: CC.

ETI 4666 PRINCIPLES OF INDUSTRIAL OPERATIONS I (3)
PR: CC. Application of techniques developed to the operation of an industrial firm through special projects.

Electrical Engineering

EEL 3100 NETWORK ANALYSIS AND DESIGN (3)
PR: EGN 3373. A second course in linear circuit analysis and design. Transient and steady-state responses of passive RLC networks to various functions.

EEL 3302 ELECTRONICS I (3)
PR: EGN 3373. A course in the physical principles of electronic devices with emphasis on semi-conductor electronics. Includes the analysis and design of amplifiers and switching circuits.

EEL 4102 LINEAR SYSTEMS ANALYSIS (3)
PR: EEL 3100. Provides further study in the analysis of linear networks and systems. Includes time and frequency domain points of view. Laplace, Fourier and superposition integrals.

EEL 4163 COMPUTER AIDED DESIGN AND ANALYSIS (2)
PR: EEL 3302, EEL 4705. The emphasis is upon applications and how to use the major CADA programs as effective tools to solve a wide variety of engineering problems. The coverage includes solid state design, systems analysis, digital logic, and transfer function solutions.

EEL 4305 ELECTRONICS II (3)
PR: EEL 3302. Provides further study in electronic circuits. Includes feedback and frequency response techniques in amplifier design.

EEL 4351C SEMICONDUCTOR DEVICES (3)
PR: EEL 3302. An introduction to the fundamentals of semiconductor materials and semiconductor device operation.

EEL 4371 COMMUNICATION ENGINEERING (2)
PR: EEL 4512. Analog telephone network; digitalization. Digital transmission and multiplexing. Digital switching; space division switching, time-division switching, space-time switching; analog environment. Broadcasting and recording (audio and video); television systems, cable and satellite TV.

EEL 4511 COMMUNICATIONS LABORATORY (1)

EEL 4512C INTRODUCTION TO COMMUNICATION SYSTEMS (3)
PR: EEL 3100. Signals and Fourier transforms in continuous time. Analog and digital transmission systems; measure of information in signals. AM, FM, and PM modulation and demodulation systems. Sampling, quantization and PCM. Data communication; terminals, and modems; repeaters, timing circuits, and interfaces. Local networks.
### College of Engineering - 1998/99 Undergraduate Catalog

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEL 4567</td>
<td>ELECTRO-OPTICS</td>
<td>An introduction to the field of electro-optics, including visible and infrared, and fiber optics.</td>
<td>EEL 3301L, EEL 3302L, EEL 3410.</td>
</tr>
<tr>
<td>EEL 4565</td>
<td>LINEAR CONTROL SYSTEMS</td>
<td>Introduction to analysis and design of linear feedback control systems. Covers block diagram, flow charts, Nyquist and root locus techniques.</td>
<td>EEL 3100.</td>
</tr>
<tr>
<td>EEL 4705</td>
<td>LOGIC DESIGN</td>
<td>Non-majors may enroll with CI. Introduction to logic design, digital systems, and computer hardware.</td>
<td>EEL 3373.</td>
</tr>
<tr>
<td>EEL 4706</td>
<td>LOGIC LABORATORY</td>
<td>Laboratory for microprocessor use and evaluation.</td>
<td>CR: EEL 4705.</td>
</tr>
<tr>
<td>EEL 4756</td>
<td>SIGNAL AND IMAGE PROCESSING</td>
<td>Sampling and quantization of signals and images; frequency-domain representations, transforms; filtering, convolution, and correlation; raster scanning and interlacing; color images; multimedia processing; image processing; and information signals.</td>
<td>EEL 4706.</td>
</tr>
<tr>
<td>EEL 4905</td>
<td>INDEPENDENT STUDY</td>
<td>Specialized independent study determined by the student's needs and interests. May be repeated up to 15 credit hours.</td>
<td>(1-5) hours. (S/AU only.)</td>
</tr>
<tr>
<td>EEL 4906</td>
<td>INTRO TO ENGINEERING DESIGN</td>
<td>Introduction to engineering design applications specific to practical engineering problems.</td>
<td>PR: Senior standing.</td>
</tr>
<tr>
<td>EEL 5250</td>
<td>POWER SYSTEM ANALYSIS</td>
<td>Basic concepts in electrical power generation, transmission, distribution, and system control. Analysis techniques for AC power.</td>
<td>EEL 4705 and EEL 4705L. CR: EEL 4743.</td>
</tr>
<tr>
<td>EEL 5344</td>
<td>DIGITAL CMOS/VLSI DESIGN</td>
<td>Design, layout, simulation, and test of custom digital CMOS/VLSI chips, CMOS cell library and state-of-the-art CAD tools.</td>
<td>EEL 4705 or CC.</td>
</tr>
<tr>
<td>EEL 5336</td>
<td>INTEGRATED CIRCUIT TECHNOLOGY</td>
<td>Design, layout, simulation, and test of custom digital CMOS/VLSI chips, CMOS cell library and state-of-the-art CAD tools.</td>
<td>EEL 4512 and EEL 4303 or equivalent. Self-contained.</td>
</tr>
<tr>
<td>EEL 5356</td>
<td>INTEGRATED CIRCUIT TECHNOLOGY</td>
<td>Design, layout, simulation, and test of custom digital CMOS/VLSI chips, CMOS cell library and state-of-the-art CAD tools.</td>
<td>EEL 4351 or CI.</td>
</tr>
<tr>
<td>EEL 5382</td>
<td>MICROELECTRONICS</td>
<td>Quantum mechanics with emphasis on electronic properties in atoms, molecules, and crystals; quantum statistics; energy band theory; crystal structures; defect chemistry; semiconductor properties.</td>
<td>EEL 3410.</td>
</tr>
<tr>
<td>EEL 5437</td>
<td>MICROWAVE ENGINEERING</td>
<td>Antenna theory, theory of passive and active components, devices, and circuits, including transmission lines and waveguides, employed in microwave integrated circuits and systems.</td>
<td>EEL 4411, 4102, or CC.</td>
</tr>
<tr>
<td>EEL 5462</td>
<td>ANTENNA THEORY</td>
<td>Antenna theory.</td>
<td>EEL 4411 or CC.</td>
</tr>
<tr>
<td>EEL 5531</td>
<td>VIDEO AND HIGH DEFINITION TELEVISION</td>
<td>Principles of video transmission and television. Enhanced definition and high definition television.</td>
<td>EEL 4512 or CC.</td>
</tr>
<tr>
<td>EIN 4304</td>
<td>INTRODUCTION TO INDUSTRIAL ENGINEERING</td>
<td>History of industrial engineering. Introduction to basic industrial processes and controls.</td>
<td>Students research specific industries and visit local industrial plants.</td>
</tr>
<tr>
<td>EIN 4312C</td>
<td>WORK ANALYSIS</td>
<td>Operation analysis and design of production systems.</td>
<td>PR: EGN 3613, EGN 3443.</td>
</tr>
<tr>
<td>EIN 4313C</td>
<td>HUMAN FACTORS</td>
<td>Design of machine systems, taking into consideration human and machine capabilities and limitations.</td>
<td>ESI 4312.</td>
</tr>
<tr>
<td>EIN 4333</td>
<td>PRODUCTION CONTROL</td>
<td>Planning and control of production systems. Includes: forecasting and inventory control models, scheduling and sequencing, MRP, CPM/PERT, and resource requirements.</td>
<td>PR: ESI 4312.</td>
</tr>
<tr>
<td>EIN 4364C</td>
<td>FACILITIES DESIGN I</td>
<td>Design and modification of industrial production and material handling facilities. Basic analysis techniques, design computer programs, automated warehousing.</td>
<td>PR: EIN 4312 EIN 4411.</td>
</tr>
<tr>
<td>EIN 4365</td>
<td>FACILITIES DESIGN II - XMM</td>
<td>Design and modification of industrial production and material handling facilities. Basic analysis techniques, design computer programs, automated warehousing.</td>
<td>PR: EIN 4364.</td>
</tr>
<tr>
<td>EEL 4601L</td>
<td>AUTOMATION AND ROBOTICS</td>
<td>Design and modification of industrial production and material handling facilities. Basic analysis techniques, design computer programs, automated warehousing.</td>
<td>PR: EIN 4312 EIN 4411.</td>
</tr>
</tbody>
</table>
| EEL 5933    | SPECIAL TOPICS IN INDUSTRIAL ENGINEERING | Special topics related to economic analysis, optimization,
human factors, manufacturing and automation aspect of industrial systems. Repeatable up to 5 credit hours.

**ESI 5245 WORK PHYSIOLOGY AND BIOMECHANICS (3)**
PR: CC. Human physiological limitations encountered in the workplace are studied. The in-depth examination of man-machine systems.

**ESI 5253 HUMAN PROBLEMS IN AUTOMATION (3)**
The study and analysis of combined human operations, automated processes, and robotics in industrial environments.

**ESI 5310 INDUSTRIAL ENGINEERING CONCEPTS (3)**
PR: CC. Survey of industrial and management engineering methodology. Work measurement, methods, production and inventory control, and facility design.

**ESI 5322 PRINCIPLES OF ENGINEERING MANAGEMENT (3)**
Introduction to the fundamentals of accounting, finance, management, and marketing as needed by engineers, scientists, and other professionals in managerial positions.

**ESI 5357 ENGINEERING VALUE ANALYSIS (3)**
Statistical models for analyzing engineering alternatives from an economic viewpoint. The use of advanced engineering economy concepts in solving industrial problems.

**ESI 5388 TECHNOLOGICAL FORECASTING (3)**
Introduction to forecasting techniques used to plan and schedule production and inventory control functions. Smoothing and decomposition time-series methods, regression methods, and autoregression/moving average methods. Integrating forecasting and planning into the engineering organization.

**ESI 5514 SPECIAL INDUSTRIAL PROJECTS (1-3)**
PR: CC.

**ESI 5236 RELIABILITY ENGINEERING (3)**
PR: EGN 3443 or equivalent. Fundamental concepts of reliability, estimation of reliability of systems and components. Measures of availability, maintainability and reliability, and evaluation of man-machine systems.

**ESI 5306 OPERATIONS RESEARCH FOR ENGINEERING MANAGEMENT (3)**
Linear programming, non-linear programming, queuing, inventory, network analysis. Not open to students who have had ESI 4315.

**ESI 5470 MANUFACTURING SYSTEMS ANALYSIS (3)**
PR: CC. The study of systems of manufacturing entities such as machine tools, robots, and materials handlers. Emphasis is on mathematical description of integrated systems and system optimization.

**ESI 5522 COMPUTER SIMULATION II (3)**

### Mechanical Engineering

**EAS 4121 HYDRO AND AERODYNAMICS (3)**
PR: EML 3701, MAP 2302. Advanced fluid dynamics, ideal and viscous flows, applications to flow around immersed bodies.

**EML 3262 KINEMATICS AND DYNAMICS OF MACHINERY (3)**
PR: MAC 2282, PHY 2048, EGN 3321. Kinematics of machines and mechanisms; position, velocity, and acceleration analysis of mechanisms; cams; gear trains; inertia forces in mechanisms; flywheels. Balancing of rotating masses.

**EML 3303 MECHANICAL ENGINEERING LAB I (3)**

**EML 3350 MACHINE ANALYSIS AND DESIGN I (3)**
PR: EGN 3311, EGN 3365. Stress and deflection analysis of machine parts, variable loads, endurance limits, fasteners, bearings, power transmission, code consideration of pressure and vacuum vessels, elements of design.

**EML 3701 FLUID SYSTEMS (3)**
PR: EGN 3343. Principles of fluid flow; piping and duct systems; fluid machinery; metering of compressible and incompressible flow; boundary layer theory; dimensional analysis; introduction to aerodynamics.

**EML 4041 COMPUTATIONAL METHODS (3)**
PR: EML 2210, EGN 4450. Techniques to solve engineering problems using numerical methods and digital computers. Topics include roots of equations, simultaneous linear equations, numerical integration and differentiation, and curve fitting.

**EML 4106C THERMAL SYSTEMS AND ECONOMICS (3)**
PR: EGN 3443. Power and refrigeration cycles; fuels and combustion; internal combustion engine cycles; co-generation; nuclear energy; methods of economic analysis.

**EML 4142C HEAT TRANSFER I (3)**
PR: EML 3701, EML 4041. Conduction, convection and radiant heat transfer; thermal properties of materials; role of fluid flow in convective heat transfer; design and selection of heat exchangers.

**EML 4174 VISUAL BASIC FOR ENGINEERS AND SCIENTISTS (3)**
PR: EGN 2210. Introduces students to the powerful graphical interface language of Visual Basic. Illustrates the use of the language in engineering and science applications.

**EML 4180C VIBRATIONS (3)**

**EML 4302 MECHANICAL ENGINEERING LABORATORY II (3)**
PR: EML 3303, EML 4142. Continuation of EML 3303 with emphasis on material and energy balances, stress analysis and vibrations. Lec.-lab. The Team-Project-Time Approach.
EML 4312 MECHANICAL CONTROLS (3)  

EML 4419C PROPULSION I (3)  
PR: EML 3701, EML 3500 or CI. Introduction to the design of propulsion systems. Basic analysis of internal combustion, jet and rocket engines. Application to ground and air transportation. Advanced propulsion concepts. Special topics for class discussion.

EML 4501 MACHINE DESIGN (3)  
PR: EML 3500, EML 3262. Continuation of EML 3500. Antifriction bearings, journal bearings, power transmission, shafting.

EML 4551 CAPSTONE DESIGN -XMW (3)  
PR: EML 4501. Comprehensive design or feasibility project requiring application of previously acquired engineering knowledge; use of ANSYS and CAD.

EML 4552 SENIOR MECHANICAL DESIGN (3)  
PR: EML 4551 or CC. Comprehensive design or feasibility study project. In some cases may be a continuation of EML 4551.

EML 4562 INTRODUCTION TO COMPOSITE MATERIALS (3)  
Introduces manufacturing types and applications of advanced composites. Students study micromechanical and macromechanical behavior of a lamina and analyze and design a laminated structure made of advanced composite materials.

EML 4601 AIR CONDITIONING DESIGN (3)  

EML 4905 INDEPENDENT STUDY (1-4)  
PR: CI. Specialized independent study determined by the student's needs and interests. May be repeated up to 15 credit hours.

EML 4930 SPECIAL TOPICS IN MECHANICAL ENGR. (1-4)  
PR: CC. May be repeated up to 9 credit hours.

EML 5105 INTERNAL COMBUSTION ENGINES (3)  
PR: EML 4106C or CI. Application of thermodynamics, chemistry, dynamics of machinery, electronics, and fluid mechanics. Topics covered are: introduction of engines, fuels and combustion, numerical modeling, ignition, fuel systems, balance of reciprocating mechanisms, and emission control of exhaust pollutants.

EML 5225 ACOUSTICS AND NOISE CONTROL (2)  

EML 5245 TRIBOLOGY (3)  

EML 5325 MECHANICAL MANUFACTURING PROCESSES (3)  
PR: CI. Description of mechanical material cutting, forming and fabrication methods, as used in modern industrial manufacturing processes.

EML 5930 SPECIAL TOPICS III (1-4)  
PR: CC. May be repeated up to 9 credit hours.

EML 5931 SPECIAL TOPICS IV (1-4)  
PR: CC. May be repeated up to 9 credit hours.