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 Applied 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), formerly the Engineers’ Council for Professional Development, 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 program 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 relative 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 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 form of post baccalaureate study. Engineers are earning additional degrees to obtain the information 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.

For 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 to meet 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 sciences 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 with full transfer to the University of South Florida’s engineering program at 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 College expects them to meet its admission requirements listed in this section under college regulations for graduation just as it expects its own students to meet these requirements. Junior/community college transfer students should note that in addition to the 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 students acquire 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 an Engineering degree from the University of South Florida and who have started their studies elsewhere in forming a course plan by which they may transfer course work. 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 the admissions application. Upon acceptance to the University, engineering will review necessary credentials and notify applicant of Engineering status. USF students 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. Math Placement Test must be passed to enter Calculus I.
   c. 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.

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</tr>
<tr>
<td>CHM X046/X046L</td>
<td>General Chemistry II (with lab)</td>
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<td>PHY X048/X048L</td>
<td>General Physics and Laboratory I</td>
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<tr>
<td>PHY X049/X049L</td>
<td>General Physics and Laboratory II</td>
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<td>MAP X302</td>
<td>Differential Equations</td>
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<td>EGS 1113</td>
<td>Introduction to Design Graphics</td>
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<td>MAC X281</td>
<td>Engineering Calculus I</td>
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</tr>
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<td>or MAC X313</td>
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</table>

Admission to Programs in Engineering

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, Computer, Electrical, Industrial and Mechanical Engineering are:

2. Satisfactory completion of EGN 1002 - Engineering Orientation.
3. Completion of the following courses with either: a cumulative grade point average of 2.0 in these courses based on all attempts:
   EGN 2210 - Computer Tools for Engineers
   EGN 3311 - Statics
   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 and 2 above and:

1. Completion of:
   COP 2002 & COP 2000L - Intro to Computer Science and Lab
   EGN 3311 - Statics
   EGN 3343 - Thermodynamics I
   EGN 3373 - Introduction to Electrical Systems I
   EGN 3443 - Engineering Statistics I

   with a minimum of 2.0 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:
   COT 3100 - Discrete Structures
   EGN 3373 - Introduction to Electrical Systems I
   STA 4442 - Introduction to Probability
   COP 2002 & COP 2000L - Intro to Computer Science and Lab
3. The minimum requirements for admission to the Information Systems program offered by the Computer Science and Engineering Department are completion of sections 1 and 2 above and the completion of:
   COP 2002 & COP 2001 - Intro to Computer Science and Lab
   COT 3100 - Discrete Structures
   COP 2120 - COBOL I
   EGN 2210- Computer Tools for Engineers
   STA 2023 - Introduction to Statistics

Students who fail to obtain a "C" grade on the first attempt must obtain a cumulative 2.0 G.P.A. based 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.

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.

New 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 elect 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 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 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 of Engineering (M.E.), the Master of Science in Engineering (M.S.E.), and the Doctor of Philosophy (Ph.D.) degree. The Chemical Engineering Department also offers a sequence of courses in Chemical Engineering Science, biotechnology and biomedical engineering.

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 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, operating systems, algorithm design, 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. programs 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 and networks.

Computing facilities available to students in the Department include several microprocessor and design laboratories for hardware-oriented studies, personal computer laboratories 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.) and Master of Electrical Engineering (M.E.E.) programs which are also available to evening and off-campus students. As applicable, the department administers the M.E., M.S.E.E. 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, 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

This 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.), Master of Science in Engineering (M.S.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, de-
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 placed 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:

Non-technical Courses: 34 Sem. Hrs.
- (Social Sciences, Humanities, Communications)
- (Minimum)
- Department Specialization: 31 Sem. Hrs.
- 136 Sem. Hrs.

Special requirements exist for Chemical Engineering. Students selecting this field should make sure they familiarize themselves with these. Detailed information can be obtained from the responsible department or the College's Advising Office.

1. Non-technical Requirements

Prospective Engineering majors must take six hours of Freshman English (ENC 1101, 1102) in their first two semesters.

Additional coursework in the non-technical portion of the General Education requirements is required as specified in the individual curricula printed on pages which follow. In no case will credits be allowed for courses taken on an S/U basis.

A minimum of eight credit hours of non-technical General Education courses must be of 2000-level or higher.

Student should pick at least three hours of work which will satisfy 6A-10.30 (the "Gordon Rule"). It is required that non-technical studies have at least two courses (6 hours) taken in the same subject area, at least one of which must be at the 2000-level or higher, in either Humanities/Fine Arts or Social Sciences. Students transferring from other colleges without the four-year or five-year curricula of the College of Engineering take coursework in advanced chemistry, thermodynamics, statics, dynamics, fluids, and properties of materials.

2. Mathematics and Science Core Requirements

The student with a satisfactory high school preparation must take the 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. All students must take the math placement test.

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.

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 advisor.

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 chemistry 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 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

#### Semester I

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<td>Engineering Calculus I</td>
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<td>CHM 2041</td>
<td>General Chem. I</td>
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<td>Engineering Calculus II</td>
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<td>CHM 2046</td>
<td>General Chem. II</td>
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<td>PHY 2048</td>
<td>General Physics I</td>
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<td>EGN 3311</td>
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<td>MAP 2302</td>
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<td>EGN 3373</td>
<td>Electrical Systems I</td>
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<td>EGN 2210</td>
<td>Computer Tools for Engineers</td>
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<td>EGN 3343</td>
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<td>EGN 3365</td>
<td>Materials</td>
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<td>ECH 3702</td>
<td>Instrument Systems I</td>
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<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>
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#### Semester VII

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<td>ECH 4323C</td>
<td>Automatic Controls I</td>
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<td>ECH 4415C</td>
<td>Reacting Systems</td>
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<td>ECH 4244L</td>
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<td>MW-MI (Engineering)</td>
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<td><strong>Chemistry Elective</strong></td>
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#### Semester VIII

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<td>ECH 4615C</td>
<td>Plant Design and Opt</td>
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<td>Technical Electives</td>
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<td><em>Social Science Elective</em></td>
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<tr>
<td><strong>Approved General Education Requirements</strong></td>
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</table>

#### Program of Study at a Florida Community/Junior College or SUS School for Students Planning to Transfer to USF (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:

<table>
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<tr>
<th>Math Calculus</th>
<th>USF MAC 2281</th>
<th>C/C MAC 2311 (3)</th>
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<td>USF MAC 2282</td>
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<tr>
<td>USF MAC 2283</td>
<td>C/C MAC 2313 (3)</td>
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</table>

- Differential Equations

| USF MAP 2302 | C/C MAP 2302 (3) |

- Chemistry General

| USF CHM 2041 | C/C CHM 1045 (3) |
| USF CHM 2045L | C/C CHM 1045L (1) |
| USF CHM 2046 | C/C CHM 1046 (3) |
| USF CHM 2046L | C/C CHM 1046L (1) |

- Physics

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

- Fortran

| USF EGN 2210 | C/C 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.
Bachelor's Curricula - Civil Engineering Option

Semester I
ENC 1101 Freshman English I 3  
MAC 2281 Engr. Calculus I 3  
CHM 2041 General Chemistry I 3  
EGN 1002 Engr. Orientation 0  
EGS 1113 Intro. Design Graphics 3  
*Social Science Elective 3  

Semester II
ENC 1102 Freshman English II 3  
MAC 2282 Engr. Calculus II 3  
CHM 2046 General Chemistry II 3  
CHM 2045L Gen. Chemistry I Lab 1  
PHY 2048 General Physics I 3  
PHY 2048L Gen. 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  

Semester III
PHY 2049 General Physics II 3  
PHY 2049L Gen. Physics II Lab 1  
MAC 2283 Engr. Calculus III 3  
EGN 3311 Statics 3  
*Historical Perspectives Elective 3  
*Fine Arts Elective 3  

Semester IV
MAP 2302 Differ. Equations 3  
EGN 3321 Dynamics 3  
EGN 3343 Thermodynamics I 3  
EGN 3443 Eng. 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 Engr. 3  
GLY 3850 Geology for Engineers 3  
EGN 3613 Engineering Economy 3  
ENC 4931 Engineering Communication 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 Engr. Contracts Specs. & Ethics (MW/MI) 3  

Procedures for Applying to the College of Engineering

Students should complete and submit an Engineering Admissions Application to the College of Engineering Advising Office. Freshmen and Sophomores must submit copies of high school transcripts, SAT and ACT test scores to the College of Engineering, Advising Office. This is in addition to records requested by the University’s Admissions Office. Transfer applicants must furnish transcripts from previously attended institutions to the College of Engineering, Advising Office. This is in addition to transcripts sent to the University’s Admissions Office. Applicants whose native language is other than English must submit TOEFL scores to the College of Engineering. The minimum TOEFL scores must be 550. Credentials must be received in the Engineering Advising Office 30 days prior to the date of applicable term. Failure to comply will result in the application being denied by the College of Engineering. Credentials will be held for one year. If application is not updated within that year, credentials must be re-submitted.

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.

2. Civil and Environmental Engineering

Students pursuing the Bachelor of Science in Civil Engineering program take designated engineering mechanics, civil engineering, and environmental engineering course work. This course work is supplemented by electives and courses in one of the following 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 matrix structural analysis, timber and masonry design, structural modeling, cement and concrete design, and corrosion of engineering materials.

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

Students completing the program may enter the professor as engineers in the civil, structural, geotechnical, transportation, water resources, environmental, hydraulics, or materials discipline. All of these disciplines share the need for knowledge in the areas of engineering mechanics, civil engineering, materials 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 single and multi-story structures, 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.

Summer Term

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

Semester IV
MAP 2302 Differ. Equations 3  
EGN 3321 Dynamics 3  
EGN 3343 Thermodynamics I 3  
EGN 3443 Eng. 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 Engr. 3  
GLY 3850 Geology for Engineers 3  
EGN 3613 Engineering Economy 3  
ENC 4931 Engineering Communication 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 Engr. Contracts Specs. & Ethics (MW/MI) 3
Civil Engineering Concentration Requirements
(A student must complete a minimum of 9 hours, with at least 2 courses from one group.)

Water Resources
- ENV 4502 Environmental Unit Operations 3
- ENV 4101 Air Pollution Control 3
- CWR 4103 Water Resources Engineering 3

Geotechnical/Transportation
- CEG 4012 Soil Mechanics II 3
- CWR 4103 Transportation Engineering II 3
- CGN 4851 Cement and Concrete Design 3
- CES 4141 Matrix Structural Analysis 3
- ENV 4101 Air Pollution Control 3

Materials
- EGN 4366 Materials Engineering II 3
- EMA 4324 Corrosion of Engineering Materials 3
- CGN 4851 Cement and Concrete Design 3

Structural
- CES 4141 Matrix Structural Analysis 3
- CES 4820 Timber & Masonry Design 3
- CES 4561 Computer Aided Structural Design 3
- CGN 4851 Cement and Concrete Design 3
- EMA 4324 Corrosion of Engineering Materials 3

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

Water Resources
- CWR 4821 Capstone Water Resources Design 3

Geotechnical/Transportation
- CEG 4012 Capstone Geotechnical/Transportation Design 3

Materials
- CES 4650 Capstone Materials Design 3

Structural
- CES 4604 Capstone Structural Design 3

Environmental Engineering Concentration Within Civil Engineering

Semester I
- ENC 1101 Freshman English I 3
- MAC 2281 Engr. Calculus I 3
- CHM 2041 General Chemistry I 3
- EGS 1113 Intro. to Des. Graphics 3
- EGN 1002 Engr. Orientation 0
*Approved Elective 3

Semester II
- ENC 1102 Freshman English II 3
- MAC 2282 Engr. Calculus II 3
- CHM 2046 General Chemistry II 3
- PHY 2048 General Physics I 3
- PHY 2048L General Physics I Lab 1
*Historical Perspectives Elective 3

Summer Term
- ENG 2210 Computer Tools for Engineers 3
*Social Science Elective 3

*Historical Perspectives Elective 3

Semester III
- MAC 2283 Engr. Calculus III 3
- PHY 2049 General Physics II 3
- PHY 2049L General Physics II Lab 1
- EGN 3311 Statics 1
- ENV 4400 Chem. Aspects of Environmental Engineering 3
*Social Science Elective 3

Semester IV
- MAP 2302 Differ. Equations 3
- EGN 3343 Thermodynamics I 3
- EGN 3373 Intro. to Elect. Sys. I 3
- EGN 3443 Engr. Statistics I 3
- EGN 3365L Materials Engr. I 3

Semester V
- EGN 3321 Dynamics 3
- EGN 3331 Mechanics of Materials 3
- EGN 3331L Mech. of Materials Lab 1
- EGN 3353C Basic Fluid Mechanics 3
- ENV 3001 Environmental Engr. 3
*ALAMEA Perspectives Elective 3

Semester VI
- CES 3102 Structures 3
- CWR 4202 Hydraulics 3
- ENV 4502 Environmental Unit Operation 3
- EGN 3613 Engineering Economy 3
- ECH 3023 Intro. to Process Engr. 3
- ENV 4004 Env. Engr. Laboratory 1

Semester VII
- CEG 4011 Soil Mechanics I 3
- CEG 4211 Geotech. Laboratory 1
- CES 4606 Concepts of Structural Design 3
- ENC 4931 Engineering Communication 3
- ENV 4552 Unit Ops. & Processes Lab 1
- ENV 4503 Unit Processes 3
- TTE 4004 Transportation 3

Semester VIII
- CGN 4122C Engr. Contracts Specs. and Ethics 3
- ENV 4101 Air Pollution 3
- ENV 4404 Capstone Design 4
*Fine Arts Elective 3

*Approved General Education Requirements

Program of Study at a Florida Community/Junior College or SUS School for Students Planning to Transfer to USF (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:
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 program emphasizes the design and utilization of computers and has a core of engineering and basic science courses like those of other engineering programs in the college. The Computer Science program focuses on languages, systems, and computation and application. The Information Systems Track emphasizes the understanding and development of software with an emphasis on business and end-user applications.

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 VSLI design, artificial intelligence, software engineering, digital data communications, 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.
EEL 4705L Logic Design Lab 1
COP 4510 Programming Concepts 3
Quantitative Elective 3
*Fine Arts Elective 3

Semester VI
CDA 4100 Computer Organization and Architecture 3
COT 4210 Intro. to Automata Theory 3
*MW/MI (Non-engineering) 3
Computer Science Elective 6

Semester VII
EEL 4744 Microprocessor Principles & Applications 3
EEL 4743L Microprocessor Lab 1
COP 4600 Operating Systems 3
COT 4400 Analysis of Algorithms 3
Computer Science Elective 6

Semester VIII
CEN 4020 Software Engr. 3
CIS 4250 Ethical Issues (MW/MI) 3
Quantitative Elective 3
Computer Science Electives 6
*Approved General Education Requirements

Program of Study at a Florida Community/Junior College or SUS School for Students Planning to Transfer to USF (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 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.

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

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

Physics
USF
COPH 2048 PHY 2048 (3)
PHY 2048L PHY 2048L (1)
PHY 2049 PHY 2049 (3)
PHY 2049L PHY 2049L (1)

Science Electives (6)
Fortran
CDA USF
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.

Procedures for Applying to the College of Engineering
Students should complete and submit an Engineering Admissions Application to the College of Engineering Advising Office. Freshmen and Sophomores must submit copies of high school transcripts, SAT and ACT test scores to the College of Engineering, Advising Office. This is in addition to records requested by the University’s Admissions Office. Transfer applicants must furnish transcripts from previously attended institutions to the College of Engineering, Advising Office. This is in addition to transcripts sent to the University’s Admissions Office. Applicants whose native language is other than English must submit TOEFL scores to the College of Engineering. The minimum TOEFL scores must be 550. Credentials must be received in the Engineering Advising Office 30 days prior to the date of applicable term. Failure to comply will result in the application being denied by the College of Engineering. Credentials will be held for one year. If application is not updated within that year, credentials must be re-submitted.

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.

Bachelor of Science in Computer Engineering Curriculum

Semester I
EGN 1002 Engr. Orientation 0
MAC 2281 Engr. Calculus I 3
CHM 2041 General Chemistry I 3
CHM 2045L General Chemistry I Lab 1
ENC 1101 Freshman English I 3
*Social Science Elective 3
*Historical Perspectives Elective 3

Semester II
MAC 2282 Engr. Calculus II 3
PHY 2048 General Physics I 3
PHY 2048L General Physics I Lab 1
ENC 1102 Freshman English II 3
CHM 2046 General Chemistry II 3
*Social Science Elective 3
*Historical Perspectives Elective 3

Summer Term
PHY 2049 General Physics II 3
PHY 2049L General Physics II Lab 1
MAC 2283 Engr Calculus III 3
*Social Science Elective 3

Semester III
EGN 3373 Elect. Sys. I 3
COT 3100 Intro. to Discrete Structures 3
MAP 2302 Diff. Equations 3
EGN 3343 Thermo I 3
EGN 3311 Statics 3
ENC 4931 Engineering Communications 3

Semester IV
EEL 3302 Electronics I 3
EGN 3321 Dynamics 3
COP 2002 Intro to Computer Science 3
COP 2000L Intro to Computer Science Lab 1
EGN 4450 Intro to Linear Systems 2
EGN 3443 Engr. Statistics I 3

196 COLLEGE OF ENGINEERING UNIVERSITY OF SOUTH FLORIDA - 1997/98 UNDERGRADUATE CATALOG
<table>
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<tr>
<th>Semester V</th>
<th>EGN 3365L Materials Engr. I</th>
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<tr>
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<td>EEL 4851C Data Structures</td>
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<td>EGN 3613 Engr. Economy I</td>
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<td>EEL 4705 Logic Design</td>
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<td>EGN 4705L Logic Design Lab</td>
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<td>EEL 4305 Electronics II</td>
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<td>Semester VI</td>
<td>CDA 4100 Computer Organization &amp; Architecture</td>
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<tr>
<td></td>
<td>COP 2510 Programming Concepts</td>
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<tr>
<td></td>
<td>COT 4210 Intro. to Automata Theory</td>
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<td>Computer Engineering Elective</td>
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<td>Semester VII</td>
<td>EEL 4744 Microprocessor Principles and Applications</td>
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<td>*ALAMEA Perspective Elective</td>
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<td></td>
<td>*MW/MI (Non-engineering)</td>
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<td>Semester VIII</td>
<td>EEL 4748 Microprocessor Based System Design and Application</td>
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<td>CDA 4203 Comp. Sys. Design</td>
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<td>EEL 4303L Computer Sys Design Lab</td>
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<td>CIS 4910 Comp. Engr. Project</td>
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<td>Computer Engineering Elective</td>
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<tr>
<td></td>
<td>CIS 4250 Ethical issues (MW/MI)</td>
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<tr>
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<td>*Approved General Education Requirements</td>
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</tbody>
</table>

### Bachelor of Science in Information Systems Curriculm

#### Semester I
- EGN 1002 Engr. Orientation 0
- ENC 1101 Freshman English I 3
- MAC 2233 Elementary Calculus I 4
- ACG 2001 Elem. Accounting I 3
- *Historical Perspective Elective 3

#### Semester II
- ENC 1102 Freshman English II 3
- MAC 2234 Elementary Calculus II 4
- PHY 2053 or 2048 Physics I 3
- PHY 2053L or 2048L Physics I Lab 1
- ENG 3613 Engineering Economy I 3

#### Summer Term
- PHY 2054 or 2049 General Physics II 3
- PHY 2049L or 2054L Physics II Lab 1
- EGN 2210 Computer Tools for Engineers 3
- *Science Elective 3

#### Semester III
- COT 3100 Intro. to Discrete Structures 3
- COP 2120 COBOL Programming I 3
- ECO 2023 Economic Principles (Microeconomics) 3
- STA 2023 Intro. to Statistics 4
- *Social Science Elective 3

#### Semester IV
- COP 2002 Intro. to Computer Science 3
- COP 2000L Intro. to Computer Science Lab 1
- EGN 4450 Intro. to Linear Systems 2

### 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.
<table>
<thead>
<tr>
<th>Semester I</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO 2023</td>
<td>Economic Principles (Macroeconomics)</td>
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<tr>
<td>*Social Science Elective</td>
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</tr>
<tr>
<td>*Historical Perspectives Elective</td>
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<table>
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<th>Course Code</th>
<th>Course Name</th>
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<td>Data Structures</td>
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</tr>
<tr>
<td>EEL 4705</td>
<td>Logic Design</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MAN 3025</td>
<td>Principles of Mgmt</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CEN 4020</td>
<td>Software Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>COP 2510</td>
<td>Programming Concepts</td>
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<table>
<thead>
<tr>
<th>Semester III</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EEL 4852C</td>
<td>Data Base Systems</td>
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<tr>
<td>ENC 4931</td>
<td>Engineering Communication</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CIS 4930</td>
<td>Software Design Methodologies</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Information Systems Elective</td>
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<table>
<thead>
<tr>
<th>Semester IV</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>COP 4600</td>
<td>Operating Systems</td>
<td>3</td>
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<tr>
<td>EEL 4761C</td>
<td>Dist. Proc. &amp; Computer Networks</td>
<td>3</td>
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</tr>
<tr>
<td>CIS 4930</td>
<td>Applications Development</td>
<td>3</td>
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<tr>
<td>*ALAMEA Perspective Elective</td>
<td>3</td>
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<td></td>
</tr>
<tr>
<td>*Fine Arts Elective</td>
<td>3</td>
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<table>
<thead>
<tr>
<th>Semester V</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEL 4852C</td>
<td>Data Base Systems</td>
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<td>Information Systems Elective</td>
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**Approved General Education Requirements**

- **Program of Study at a Florida Community/Junior College or SUS School for Students Planning to Transfer to USF (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 2233
    - MAC 2234
  - **C/C**
    - MAC 2233 (3)
    - MAC 2234 (3)

  **Statistics**
  - STA 2023
  - **C/C**
    - STA 2023 (3)

  **Physics**
  - **General**
    - PHY 2053
    - PHY 2053L
    - PHY 2054
    - PHY 2054L
  - **USF**
    - PHY 2053
    - PHY 2053L (1)
    - PHY 2054
    - PHY 2054L (1)

  **Science Electives (6)**
  - **USF**
    - ACG 2001
    - ECO 2013
    - **C/C**
  - **ECON**
    - ACG 2001 (3)
    - ECO 2013 (3)

**Bachelor’s Curriculum - Electrical Engineering**

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<tr>
<th>Semester I</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<td>**Historical Perspectives Elective</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.

**Procedures for Applying to the College of Engineering**

- Students should complete and submit an Engineering Admissions Application to the College of Engineering Advising Office. Freshmen and Sophomores must submit copies of high school transcripts, SAT and ACT test scores to the College of Engineering, Advising Office. This is in addition to records requested by the University’s Admissions Office. Transfer applicants must furnish transcripts from previously attended institutions to the College of Engineering, Advising Office. This is in addition to transcripts sent to the University’s Admissions Office. Applicants whose native language is other than English must submit TOEFL scores to the College of Engineering. The minimum TOEFL scores must be 550. Credentials must be received in the Engineering Advising Office 30 days prior to the date of applicable term. Failure to comply will result in the application being denied by the College of Engineering. Credentials will be held for one year. If application is not updated within that year, credentials must be re-submitted.

**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.

**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. Students without a solid foundation and those who cannot devote full time to academics should plan on a slower pace. A minimum of 60 semester hours must be completed within that year, credentials must be re-submitted.

- The Bachelor’s Curriculum - Electrical Engineering...

**Bachelor’s Curriculum - Electrical Engineering**

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<tr>
<td>**Historical Perspectives Elective</td>
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</table>
**Program of Study at a Florida Community/Junior College or SUS School for Students Planning to Transfer to USF (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)

### Chemistry
- General
  - USF C/C
  - CHM 2041 CHM 1045 (3)
  - CHM 2045L CHM 1045L (1)
- Physics
  - USF C/C
  - PHY 2048 PHY 2048 (3)
  - PHY 2048L PHY 2048L (1)
  - PHY 2049 PHY 2049 (3)
  - PHY 2049L PHY 2049L (1)
- 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.

### Procedures for Applying to the College of Engineering

Students should complete and submit an Engineering Admissions Application to the College of Engineering Advising Office. Freshmen and Sophomores must submit copies of high school transcripts, SAT and ACT test scores to the College of Engineering, Advising Office. This is in addition to records requested by the University’s Admissions Office. Transfer applicants must furnish transcripts from previously attended institutions to the College of Engineering, Advising Office. This is in addition to transcripts sent to the University’s Admissions Office. Applicants whose native language is other than English must submit TOEFL scores to the College of Engineering. The minimum TOEFL scores must be 550. Credentials must be received in the Engineering Advising Office 30 days prior to the date of applicable term. Failure to comply will result in the application being denied by the College of Engineering. Credentials will be held for one year. If application is not updated within that year, credentials must be re-submitted.

### 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**

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<tr>
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<tbody>
<tr>
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<td>Freshman English I</td>
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<td>Engr. Calculus I</td>
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<td>CHM 2041</td>
<td>General Chemistry I</td>
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<tr>
<td>EGN 1002</td>
<td>Engr. Orientation</td>
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<tr>
<td>EGS 1113</td>
<td>Intro. to Design Graphics</td>
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<tr>
<td>*Fine Arts Elective</td>
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<td>*Social Science Elective</td>
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<td>EGN 3321</td>
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**Summer Term**

| ENC 4931 | Engineering Communications | 3 |
| ENG 3613 | Engineering Economy | 3 |
| EGN 4450 | Intro. to Linear Systems | 2 |
| *Science Elective | 3 |
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<td>ESI 5423</td>
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- **Program of Study at a Florida Community/Junior College or SUS School for Students Planning to Transfer to USF (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 C/C*  
  - **MAC 2281**  
  - **MAC 2282**  
  - **MAC 2283**  
  - **MAC 2313**  
  - **MAP 2302**

- **Chemistry**
  - *USF C/C*  
  - **THM 2047**  
  - **THM 2048**

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

- **Graphics**
  - *USF C/C*  
  - **EGS 1113**

- **Fortran**
  - *USF C/C*  
  - **EGR 2210**  
  - **COP 2202**

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**Procedures for Applying to the College of Engineering**

Students should complete and submit an Engineering Admissions Application to the College of Engineering Advising Office. Freshmen and Sophomores must submit copies of high school transcripts, SAT and ACT test scores to the College of Engineering, Advising Office. This is in addition to records requested by the University’s Admissions Office. Transfer applicants must furnish transcripts from previously attended institutions to the College of Engineering, Advising Office. This is in addition to transcripts sent to the University’s Admissions Office. Applicants whose native language is other than English must submit TOEFL scores to the College of Engineering. The minimum TOEFL scores must be 550. Credentials must be received in the Engineering Advising Office 30 days prior to the date of applicable term. Failure to comply will result in the application being denied by the College of Engineering. Credentials will be held for one year. If application is not updated within that year, credentials must be re-submitted.

**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, controls, and fluid machinery. 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, machine design, construction, refrigeration, heating and air conditioning, aerospace, defense and all the process industries (pharma, textiles, pharmaceuticals, etc.). There are abundant career opportunities in this 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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**Summer Term**

| MAC 2283                  | Engineering Calculus III                  | 3                                           |                                           |                                          |                                           |                                           |                                           |                                           |
| PHY 2049                  | General Physics II                        | 3                                           |                                           |                                          |                                           |                                           |                                           |                                           |
| PHY 2049L                 | General Physics II Lab                     | 1                                           |                                           |                                          |                                           |                                           |                                           |                                           |
| EGN 2210                  | Computer Tools for Engineers               | 3                                           |                                           |                                          |                                           |                                           |                                           |                                           |

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*Approved General Education Requirements

- **Program of Study at a Florida Community/Junior College** or SUS School for Students Planning to Transfer to USF (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:
1. Humanities and Social Science Requirements

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 normally find that their General Education coursework satisfies the major portion - but not all - of the Social Science and Humanities Core Requirements.

All Engineering students must complete the USF Exit Requirements. The Literature and Writing portion can be met by completing ENC 3210 Technical Writing.

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 the necessary 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 who register for a course three times without receiving a grade "D" or better (i.e., receive grades of W or F) will be denied further enrollment in the College of Engineering unless written permission is obtained from the department chairperson and the College Associate Dean for Academic Affairs.

Students pursuing College of Engineering degree programs are expected to take their courses on a graded basis (ABCD).
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 graduate courses during the fourth year and deferring the taking of 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.

**Chemistry/Biology** (10 hours min.)

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 2220 Organic Chemistry**

Other "human sciences" (6 hrs. min.)

PSY 3044 Experimental Psychology**

One of the following:

PET 3310 Kinesiology
PET 3351 Exercise Physiology I
EXP 4104 Sensory Processes
PSB 4013C Neuropsychology
(9 hrs. min.)*

**Engineering** (9 hrs. min.**)

EEL 4935 Special Electrical Topics
ECH 5747 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 5748 Selected Topics in Biomedical Engineering

(9 hrs. min.****)

*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 is (designated discipline) program (required of all students) 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 even 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, PL/I, COBOL, PASCAL, BASIC, "C" and ADA. Students majoring in 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 microprocessor base 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 compute servers that 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 asynchronous 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. Two are available for undergraduate engineering students; a third smaller lab is reserved for graduate students and faculty. Another open access P.C. lab is operated in conjunction with the Technology program. 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 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 Science 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 Certification 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 throughout 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 sources. 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.
of engineering problems. The programming language, FOR-TRAN, 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 3311 STATICS

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

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

EGN 3331L MECHANICS OF MATERIALS LABORATORY

EGN 3343 THERMODYNAMICS

EGN 3353 BASIC FLUID MECHANICS

EGN 3365 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 INTRODUCTION TO ELECTRICAL SYSTEMS II
PR: EGN 3373. Continuation of EGN 3373.

EGN 3375 INTRODUCTION TO ELECTRICAL SYSTEMS III
PR: EGN 3373. Continuation of EGN 3373 or EGN 3374.

EGN 3443 SYSTEM DYNAMICS
CR: EML 4041. PR: EGN 3321, EGN 4450. Dynamic analysis of electrical, mechanical, hydraulic and thermal systems; LaPlace transforms; numerical methods; use of computers in dynamic systems.

EGN 3443 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 4366 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 4420 NUMERICAL METHODS OF ANALYSIS

EGN 4450 INTRODUCTION TO LINEAR SYSTEMS
PR: MAC 2282. Study and application of matrix algebra, differential equations and calculus of finite differences.

EGN 4831 TECHNOLOGY AND SOCIETY

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

EGN 4920 SPECIAL TOPICS IN ENGINEERING
(1-3) PR: CI. New technical topics of interest to engineering students. May be repeated for different topics up to 9 hours.

EGN 1002 ENGINEERING ORIENTATION
(10)

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 2200 ENGINEERING WITH COMPUTERS
(2) PR: EGN 2210. Fundamental concepts in engineering and computer applications. Examples chosen from various areas of engineering to illustrate design modelling and analysis with computer assistance. Some topics involve laboratory.

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 3311 STATICS

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

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

EGN 3331L MECHANICS OF MATERIALS LABORATORY

EGN 3343 THERMODYNAMICS

EGN 3353 BASIC FLUID MECHANICS

EGN 3365 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 INTRODUCTION TO ELECTRICAL SYSTEMS II
PR: EGN 3373. Continuation of EGN 3373.

EGN 3375 INTRODUCTION TO ELECTRICAL SYSTEMS III
PR: EGN 3373. Continuation of EGN 3373 or EGN 3374.

EGN 3443 SYSTEM DYNAMICS
CR: EML 4041. PR: EGN 3321, EGN 4450. Dynamic analysis of electrical, mechanical, hydraulic and thermal systems; LaPlace transforms; numerical methods; use of computers in dynamic systems.

EGN 3443 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 4366 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 4420 NUMERICAL METHODS OF ANALYSIS

EGN 4450 INTRODUCTION TO LINEAR SYSTEMS
PR: MAC 2282. Study and application of matrix algebra, differential equations and calculus of finite differences.

EGN 4831 TECHNOLOGY AND SOCIETY

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

EGN 4920 SPECIAL TOPICS IN ENGINEERING
(1-3) PR: CI. New technical topics of interest to engineering students. May be repeated for different topics up to 9 hours.
columns, and design of steel beams.

Concrete; design of flexural reinforcement in beams and slabs, design of shear reinforcement, design of concrete columns.


PR: CES 4605. Design of structures made of steel.

PR: EGN 3365 plus ONE of the following courses EGN 4851, EMA 4324 or EGN 4366. A Capstone Materials design experience aimed to design for durability and reliability.

PR: CES 3102. Behavior of structural components and systems when subjected to periodic dynamic loads.

PR: CEG 4011 or CI. Design of retaining walls, earth slopes, foundations to control settlement, soil stabilization and foundations subjected to dynamic loads. Computer applications to soil mechanics will be covered.

PR: CEG 4011. Design of retaining walls, earth slopes, foundations to control settlement, soil stabilization and foundations subjected to dynamic loads. Computer applications to soil mechanics will be covered.

PR: CES 4605, CES 4702. Fundamentals of timber design including beams, columns, connections and formwork. Introduction to masonry design including design of beams, walls, columns, and pilasters.

PR: CES 3102, CES 4702. Fundamentals of timber design including beams, columns, connections and formwork. Introduction to masonry design including design of beams, walls, columns, and pilasters.

PR: CEG 4011, TTE 4004. A capstone geotechnical/trans- portation design experience aimed to design for durability and reliability.

PR: CEG 4011. Design of geotechnical systems including bases, foundations, embankments, and dams.

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PR: CEG 4011. Design of geotechnical systems including bases, foundations, embankments, and dams.

PR: CES 4605. Design of structures made of steel.
CWR 4202 HYDRAULICS
PR: EGN 3353. Fundamental and applied aspects of pipe flow, free surface flow, and unsteady flow for hydraulic systems.

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

CWR 4921 CAPSTONE WATER RESOURCES DESIGN
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
PR: EGN 3365L. Principles of electrochemical corrosion and the representation of corrosion processes by polarization diagrams. Origin and prevention of the localized forms of corrosion and approaches to corrosion control.

EMA 4703 FAILURE ANALYSIS AND PREVENTION

ENV 3001 ENVIRONMENTAL ENGINEERING
CR: ENG 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
PR: ENV 3001, CR: ENV 4502. Laboratory experience in the measuring of environmental parameters.

ENR 4220 AIR POLLUTION CONTROL
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 4417 WATER QUALITY AND TREATMENT
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 4432 WATER SYSTEMS DESIGN
PR: EGN 3353. Corequisite ENV 4503. A design oriented course which addresses 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 4450 CAPSTONE WATER AND WASTEWATER DESIGN
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 4503 ENVIRONMENTAL UNIT PROCESSES
PR: ECH 3023, ENV 4502. 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 4504 WASTEWATER SYSTEMS DESIGN
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
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.

ENV 5105 AIR RESOURCE MANAGEMENT
PR: CI. Air pollution source impacts on ambient air quality, modeling, regulatory approaches, source strategic controls and surveillance.

ENV 5814 ENVIRONMENTAL RISK ANALYSIS
PR: CI. Study of comprehensive application of risk analysis techniques for environmental control and protection purposes.

SUR 3140C ENGINEERING LAND SURVEYING
PR: EGN 3353. Principles of land surveying for engineering practice. Traverses, levels, boundary surveys, route surveys, coordinate geometry, and mapping.

TTE 4004 TRANSPORTATION ENGINEERING
PR: EGN 3353. Principles of surface transportation system development, design, and operations; administration, modal characteristics, capacities, and functional classifications; vehicle kinematics, human factors and minimum design standards; traffic flow theory and queuing, capacity and signalization; transportation planning and economics.

TTE 4005 TRANSPORTATION ENGINEERING II
PR: TTE 4004, CR: SUR 3140. Techniques for the geometric route design of surface transportation systems; horizontal and vertical alignments. Spiral curves, superstructures and earthwork analysis; drainage, soils, and a rigid and flexible pavement design; right-of-way acquisition and Environmental Impacts; site layout & design, and operation of alternate models including bus, air, rail, water, and pipeline facilities and terminals.

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

TTE 5501 TRANSPORTATION PLANNING AND ECONOMICS
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
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 5825 INTRODUCTION TO ARTIFICIAL INTELLIGENCE
PR: EEL 4851C. Basic concepts, tools and techniques used to produce and study intelligent behavior. Organizing knowledge, exploiting constraints, searching spaces, understanding natural languages, problem solving strategies, etc.
COP 4020 PROGRAMMING LANGUAGES (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 AND ARCHITECTURE (3)
PR: EEL 4705. Elements of computer systems; processors, memories and switches. 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, Instruction and addressing models, minicomputer 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 4220 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 -6A -XMW (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. (S/U 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 I (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 4020 PROGRAMMING LANGUAGES (3)
PR: EEL 4851C. An introduction to programming languages, survey of language types and design of translators and interpreters.

COP 4023 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.

COT 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 systems.

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 4400 ANALYSIS OF ALGORITHMS (3)
PR: EEL 4851C. Design principles and analysis techniques applicable to various classes of computer algorithms frequently used in practice.

EEL 4705 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 4705L LOGIC 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: CI. An introduction to the evolution of computer graphics including point-plotting, line drawing, two-dimensional transformations and graphics software packages.

Computer Service

(Credit for Engineering Majors)

CGS 2060 6C INTRODUCTION TO COMPUTERS AND PROGRAMMING IN BASIC -6A (3)
An overview of computer systems and their role in society. Survey of the evolution of computer software and hardware technology with emphasis on current applications. Introduction to programming using the BASIC language.

CGS 3062 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.)

CGS 4362 SC PASCAL PROGRAMMING (3) PR: CGS 2060. Structured programming implemented with the PASCAL language. Emphasis on program structure and data manipulation.

CGS 4364 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 4364 SC SIMSCRIPT SIMULATION (3) PR: COP 2200. The use of the Simscript language in discrete event simulation. Development of simulation models of real world systems.

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

EEL 4163 COMPUTER AIDED DESIGN AND ANALYSIS (2) PR: EEL 4411, EEL 3100. Transmission lines, standing waves, impedance, waveguides.

EEL 4102 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 5451 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.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEL 5437</td>
<td>MICROWAVE ENGINEERING</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: EEL 4411, 4102, or CC. Introduction to passive and active components, devices, and circuits, including transmission lines and waveguides, employed in microwave integrated circuits and systems.</td>
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<tr>
<td>EEL 5462</td>
<td>ANTENNA THEORY</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: EEL 4411 or CC. Antenna theory beginning with fundamental parameter definitions and continuing with mathematical concepts, elemental antennas and arrays.</td>
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<tr>
<td>EEL 5572 C</td>
<td>LOCAL AREA NETWORKS AND INTERFACING</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: EEL 4512. Network components: Communication terminals, PC's telephone, etc. Basics of LAN's, Tx media topologies, access methods, and LAN characteristics. Interfacing of terminals and PC's to LAN's, NAU's and other interfacing devices; interface selection. LAN design issues, repeaters, timing circuits, gateways.</td>
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<tr>
<td>EEL 5631</td>
<td>DIGITAL CONTROL SYSTEMS</td>
<td>(3)</td>
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<tr>
<td>PR: EEL 4657. Sample data and digital control processes</td>
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<tr>
<td>EEL 5754C</td>
<td>MICROPROCESSOR BASED DIGITAL SIGNAL PROCESSING</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: EEL 4705 or CC. Arithmetic systems, processing structures, efficient algorithms. DSP hardware, TI, NEC and other DSP microprocessors, multiprocessing hardware and software. System development. Application to telecommunications and voice processing.</td>
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<tr>
<td>EEL 5935, 5936, 5937</td>
<td>SPECIAL ELECTRICAL TOPICS I, II, III</td>
<td>(1-3 each)</td>
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<tr>
<td>PR: CC.</td>
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<tr>
<td>ELR 3301L LABORATORY 1</td>
<td></td>
<td>(1)</td>
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<tr>
<td>PR: EGN 3373</td>
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<tr>
<td>ELR 3302L LABORATORY 2</td>
<td></td>
<td>(1)</td>
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<tr>
<td>PR: ELR 3301L and EEL 3302, CR: EEL 4305.</td>
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<tr>
<td>ELR 4306L LABORATORY 4</td>
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<td>(1)</td>
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<tr>
<td>PR: ELR 3301L CR: EEL 4411.</td>
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</tbody>
</table>

**Industrial and Management Systems**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIN 4304C</td>
<td>INTRODUCTION TO INDUSTRIAL ENGINEERING</td>
<td>(3)</td>
</tr>
<tr>
<td>History of industrial engineering. Introduction to basic industrial processes and controls. Students research specific industries and visit local industrial plants.</td>
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<tr>
<td>EIN 4312C</td>
<td>WORK ANALYSIS</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: EGN 3613, EGN 3443; CR: AGC 3074. Operation analysis and workspace design, work measurement, standard data, ergonomics, and labor costing.</td>
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<tr>
<td>EIN 4323C</td>
<td>HUMAN FACTORS</td>
<td>(3)</td>
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<tr>
<td>Design of man-machine systems, by taking into consideration both human and machine capabilities and limitations.</td>
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<tr>
<td>EIN 4333</td>
<td>PRODUCTION CONTROL</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: ESI 4312. Planning and control of production systems. Includes: forecasting and inventory control models, scheduling and sequencing, MRP, CPM/PERT, and resource requirements.</td>
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<tr>
<td>EIN 4364C</td>
<td>FACILITIES DESIGN I</td>
<td>(3)</td>
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<tr>
<td>PR: EIN 4312 EIN 4411. Design and modification of industrial production and material handling facilities. Basic analysis techniques, use of computer programs, automated warehousing.</td>
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<tr>
<td>EIN 4365</td>
<td>FACILITIES DESIGN II - XMW</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: EIN 4364. CAD/CIEM, complete design of a plant facility. Course to use computers and software geared toward plant design and operation. A team of students is to be responsible for the complete project.</td>
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<tr>
<td>EIN 4411</td>
<td>MANUFACTURING PROCESSES</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: EGN 3365. The study of basic manufacturing processes and precision assembly. CAD/CAM including NC programming.</td>
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<tr>
<td>EIN 4401L</td>
<td>AUTOMATION AND ROBOTICS</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: EIN 4411. Introduction to the practices and concepts of automation as applied to material handling, inventory storage, material transfer, industrial processes and quality control.</td>
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<tr>
<td>EIN 4933</td>
<td>SPECIAL TOPICS IN INDUSTRIAL ENGINEERING</td>
<td>(1-5)</td>
</tr>
<tr>
<td>Special topics related to economic analysis, optimization, human factors, manufacturing and automation aspect of industrial systems. Repeatable up to 5 credit hours.</td>
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<tr>
<td>EIN 5246</td>
<td>WORK PHYSIOLOGY AND BIOMECHANICS</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: CC. Human physiological limitations encountered in the design, analysis and evaluation of man-machine systems.</td>
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<tr>
<td>EIN 5253</td>
<td>HUMAN PROBLEMS IN AUTOMATION</td>
<td>(3)</td>
</tr>
<tr>
<td>The study and analysis of combined human operations, automated processes, and robotics in industrial environments.</td>
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<tr>
<td>EIN 5301C</td>
<td>INDUSTRIAL ENGINEERING CONCEPTS</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: CC. Survey of industrial and management engineering methodology. Work measurement, methods, production and inventory control, and facility design.</td>
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<tr>
<td>EIN 5322</td>
<td>PRINCIPLES OF ENGINEERING MANAGEMENT</td>
<td>(3)</td>
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<tr>
<td>Introduction to the fundamentals of accounting, finance, management, and marketing as needed by engineers, scientists, and other professionals in managerial positions.</td>
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<tr>
<td>EIN 5357</td>
<td>ENGINEERING VALUE ANALYSIS</td>
<td>(3)</td>
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<tr>
<td>Statistical models for analyzing engineering alternatives from an economic viewpoint. The use of advanced engineering economy concepts in solving industrial problems.</td>
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<tr>
<td>EIN 5388</td>
<td>TECHNOLOGICAL FORECASTING</td>
<td>(3)</td>
</tr>
<tr>
<td>Introduction to forecasting techniques used to plan and schedule production and inventory control functions. Smoothing and decomposition time-series methods, regression models, and autoregression/moving average methods. Integrating forecasting and planning into the engineering organization.</td>
<td></td>
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<tr>
<td>EIN 5914</td>
<td>SPECIAL INDUSTRIAL PROJECTS</td>
<td>(1-3)</td>
</tr>
<tr>
<td>PR: CC.</td>
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<tr>
<td>ESI 4221</td>
<td>INDUSTRIAL STATISTICS AND QUALITY CONTROL</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: EGN 3443. Application of statistical techniques to the control of industrial processes. Control charts, acceptance sampling, design of experiments, analysis of variance and regression.</td>
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<tr>
<td>ESI 4244</td>
<td>DESIGN OF EXPERIMENTS</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: EGN 3443. Activity forecasting models and control. Design and use of inventory control models, both designs applicable to engineering analyses. Analysis of variance and regression.</td>
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<tr>
<td>ESI 4312</td>
<td>DETERMINISTIC O. R.</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: EGN 4450. An introduction to operations research techniques with particular emphasis on deterministic models. Linear programming, dynamic programming, goal programming, integer programming, and PERT/CPM networks are considered.</td>
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<tr>
<td>ESI 4313</td>
<td>PROBABILISTIC O. R.</td>
<td>(3)</td>
</tr>
<tr>
<td>ESI 4516C</td>
<td>COMPUTERS IN INDUSTRIAL ENGINEERING</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: EGN 2210. Use of micro and mini computer systems for industrial engineering applications. Review of available software packages. Use of computers for CAS/CAM system.</td>
<td></td>
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<tr>
<td>ESI 4523</td>
<td>INDUSTRIAL SYSTEMS SIMULATION</td>
<td>(3)</td>
</tr>
<tr>
<td>PR: ESI 4313. A study of the development and analysis of computer simulation models: Monte Carlo, time-slice, and next-event. Introduction to special purpose simulation languages.</td>
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<tr>
<td>ESI 4905</td>
<td>INDEPENDENT STUDY</td>
<td>(1-5)</td>
</tr>
<tr>
<td>PR: CI. Specialized independent study determined by the student's needs and interests. May be repeated up to 15 credit hours. (S/U only.)</td>
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<tr>
<td>ESI 4911</td>
<td>SENIOR PROJECT</td>
<td>(2)</td>
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<td>PR: EIN 4364, CR: EIN 4333, ESI 4523. Analysis and design of systems in a directed project format. Individual or group work consisting of project proposal, project activities, and final report. Student projects are directed by faculty, with chairmen's approval.</td>
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<td>ESI 5219</td>
<td>STATISTICAL METHODS FOR ENGINEERING MANAGERS</td>
<td>(3)</td>
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<td>Study of statistical methods applied to engineering management problems involving estimation and prediction under conditions of uncertainty. Not open to students who have had EGN 3443.</td>
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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 3282 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)
PR: EML 3500, EML 3701, EML 4041. Engineering laboratory measurements. Use of the library and the writing of technical reports. Experiments in the measurement of temperature, pressure, fluid flow, psychrometrics, concentration, viscosity, mass-energy balances of simple systems.

EML 3500 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 NUMERICAL METHODS (3)
PR: EGN 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 3343. Power and refrigeration cycles; fuels and combustion; internal combustion engines. Topics covered are: introduction of engines, thermodynamics, heat transfer, and fluid flow to sizing of HVAC systems. Heating and cooling calculations, air requirements, equipment sizing. Energy Code requirements. Design project.

EML 4105 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 4500 SPECIAL TOPICS IN MECHANICAL ENGR (1-4)
PR: CC. May be repeated up to 9 credit hours.

EML 4501 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 4523 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 5395 MOTOR SELECTION AND CONTROL (3)
PR: EGN 3373, EGN 4343. Standard electrical voltages; power wiring in industrial plants; NEMA motor designs, techniques for estimating motor starting times and temperature rise; motor selection; starting and operating safety interlocks; conventional motor starting and control systems; direct digital (programmable) controls; electrical code requirements for conductors and protective devices.

EML 5930 SPECIAL TOPICS IV (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.