Parks College of Engineering, Aviation and Technology

Parks College of Engineering, Aviation and Technology prepares students for careers in engineering, aviation, physics and related fields. Satisfying this mission demands excellence in academic programs that integrate the education of the whole person, in the liberal and Jesuit traditions, with classroom and laboratory experiences in the major fields of study. A Parks College education provides opportunities for students to develop intellectually, stay abreast of changing technology, learn more about themselves and the world in which they live, and to prepare for a lifetime of learning.

Accreditation
The Aerospace Engineering, Mechanical Engineering, Electrical Engineering, Computer Engineering, Engineering Physics, and Biomedical Engineering curricula are accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 – telephone: (410) 347-7700. The Flight Science curricula is accredited by the Aviation Accreditation Board International (AABI) 3410 Skyway Drive, Auburn, AL USA 36830. The newly established Civil Engineering (2009), and Physics (2009) degree programs will be seeking accreditation at the next ABET visit. The College also offers an Interdisciplinary Engineering degree that allows students to create a customized study plan in preparation for a wide variety of career paths.

Undergraduate Degrees Offered
Parks College undergraduate programs offer Bachelor of Science degrees with majors in the following areas.

Majors Available:
Aerospace Engineering
Aviation Management
Biomedical Engineering
Civil Engineering
Computer Engineering
Electrical Engineering
Engineering Physics
Flight Science
Interdisciplinary Engineering
Mechanical Engineering

Concentration available in Bioelectronics
Physics

Bachelor of Science - Parks College
Bachelor of Arts - College of Arts & Sciences

Minors Available:
Air Traffic Control
Aerospace Engineering
Parks College, Math, Computer Science, & Physics students only
Biomedical Engineering
Flight Education
Flight Science majors only

Special Admission Requirements
Admission requirements to Parks College of Engineering, Aviation and Technology degree programs are based on a combination of secondary school grades, college admission test scores, co-curricular activities and attempted college course work, as well as other indicators of the applicant’s ability, career focus, and character. This process respects the non-discrimination policy of the University and is designed to select a qualified, competent and diverse student body with high standards of scholarship and character, consistent with the mission of the University.

In addition to the general admission and matriculation requirements of the University, Parks College has the following additional requirements. The recommended minimum academic requirements for admission into particular programs are as follows:

<table>
<thead>
<tr>
<th>Program</th>
<th>Freshman GPA</th>
<th>Transfer GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace Engineering</td>
<td>3.00</td>
<td>2.70</td>
</tr>
<tr>
<td>Biomedical Engineering</td>
<td>3.00</td>
<td>2.70</td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>3.00</td>
<td>2.70</td>
</tr>
<tr>
<td>Computer Engineering</td>
<td>3.00</td>
<td>2.70</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>3.00</td>
<td>2.70</td>
</tr>
<tr>
<td>Engineering Physics</td>
<td>2.50</td>
<td>2.70</td>
</tr>
<tr>
<td>Interdisciplinary Engineering</td>
<td>3.00</td>
<td>2.70</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>3.00</td>
<td>2.70</td>
</tr>
<tr>
<td>Physics</td>
<td>2.50</td>
<td>2.70</td>
</tr>
<tr>
<td>Still Deciding – Engineering</td>
<td>3.00</td>
<td>n/a</td>
</tr>
</tbody>
</table>

For admission into the above programs it is recommended that a student have fifteen units of high school work:

a. Three or four units of English
b. Four or more units of Mathematics - Algebra I and II, Geometry, and mathematics with a focus on trigonometry prior to or during the senior year, such as Pre-Calculus (Algebra II with Trigonometry is not sufficient). Students should be prepared to start the first semester freshmen
year in Calculus I or higher.

c. Three or four units of sciences – General Science, Introduction to Physical Science, Earth Science, Biology, Physics, or Chemistry

d. Two or three units of Social Sciences - History, Psychology, or Sociology

e. Three units of electives

<table>
<thead>
<tr>
<th>Bachelor of Science in Aviation</th>
<th>Freshman GPA</th>
<th>Transfer GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight Science</td>
<td>2.70</td>
<td>2.70</td>
</tr>
<tr>
<td>Aviation Management</td>
<td>2.70</td>
<td>2.70</td>
</tr>
</tbody>
</table>

For admission into the above programs it is recommended that a student have sixteen units of high school work:

a. Three or four units of English
b. Four or more units of Mathematics - Algebra I and II, Geometry, and Pre-Calculus
c. Three or four units of sciences – General Science, Introduction to Physical Science, Earth Science, Biology, Physics, or Chemistry
d. Three units of Social Sciences - History, Psychology, or Sociology
e. Three units of electives

**Admission to Flight Science Program**

Enrollment capacity in the Flight Science program may be limited; therefore, early application is strongly encouraged. In addition to meeting the academic requirements for admission, the applicant to any flight science program must be able to pass a Federal Aviation Administration (FAA) Class II medical examination. This physical examination is an absolute prerequisite for flight training and should be taken prior to the student’s arrival on campus.

For specific information regarding the Class II medical examination, see the FAA website http://www.faa.gov/pilots/amelocator/. This source will provide information about the medical certificate as well as listing of FAA designated Aviation Medical Examiners.

International students will be evaluated for their listening comprehension and spoken ability in addition to meeting regular English requirements. Prior to commencing flight instruction, special training will be required for those students found deficient in this evaluation.

**Math for Entering Students**

Applicants to the engineering or physics programs are encouraged to take mathematics with a focus on trigonometry, such as Pre-Calculus or Analytical Geometry, prior to or during their senior year of secondary school. Students should be prepared to take Calculus I in the first semester of college. Students not prepared to take Calculus I may need to take Pre-Calculus the first semester and Calculus I the second semester, followed by Calculus II and Physics I during the summer, in order to graduate in four years.

**Parks College** utilizes the Math-Index to place students in the appropriate mathematics course. The Math-Index is an equation that includes a student’s ACT and/or SAT test scores, high school GPA, and high school math work to determine the appropriate placement. Additional math assessments may be required of beginning and transfer students who have not completed a college-level transferable mathematics course before coming to Parks College. Math assessments do not result in credit being awarded.

Any student that is admitted or starts with a math course lower than Pre-Calculus will be considered a Parks College Still Deciding student. Students must successfully complete Calculus I, demonstrated by receiving a C- or higher, before they are allowed to declare an engineering major.

**College Level Examination Program**

Parks College accepts successfully completed CLEP results for credit. These, however, must be Subject Examinations. The College does not recognize the General CLEP for credit purposes.

Credit will be granted for CLEP under the following conditions:

1. A maximum of thirty hours can be earned through CLEP.
2. The score on each test must equal or exceed the 50th percentile on the national college sophomore norm.
3. Credit will be awarded in Subject Examinations when approved by the department offering comparable courses. This credit will be awarded on the basis of the number of credit hours in the pertinent courses.
4. Transfer students please note: Acceptance of CLEP Examinations for advanced standing by another college or university does not automatically ensure the transfer of this credit to Parks College. Recording of advanced standing for CLEP courses on the Academic Record is contingent upon the College’s receiving the Educational Testing Service results of all CLEP examinations for which the student is seeking advanced standing.
5. Full-time students may take external examinations for credit, including required departmental CLEP
supplementary examinations, within one calendar year of initial registration at the University.

Special Registration Procedures
Some special registration procedures apply to students enrolled in Parks College.

Pass/No Pass Option
The maximum number of hours that may be taken on a Pass/No Pass basis is eighteen (18), but not more than one course is permitted during any one semester.

These eighteen (18) hours may be taken under the following options:
1. Any hours above the number required for graduation.
2. Any hours within the number required for graduation which are no longer specified due to the results of testing out of courses and/or advanced placement.
3. Any hours within the area of concentration which are not required by the controlling department and for which the student has received the approval of the advisor.

Pass/No Pass hours are not counted towards fulfilling degree requirements. The student must register as a Pass/No Pass member of the class. This status becomes permanent at the time of registration. The student is responsible for seeing that the above conditions are met.

Audit
A student may audit a course offered at Parks College with the following reservations:
1. The student must have approval of the instructor and department chair to sit in that particular class. A course taken for credit may be changed to an audit status until the last day to receive a grade of “W”.
2. The student is eligible to take tests if he or she desires. However, they will not be graded.
3. No grade or credit can be earned by auditing a course and, although an “AU” grade is entered instead of the grades described elsewhere, the course does not count toward fulfilling the degree requirements.
4. An exemption examination cannot be taken for an audited course.

Registration at Another Educational Institution
Classified students at Parks may not register for courses at other educational institutions without prior written approval of the Dean of Parks College.

Flight Instruction at Other Institutions
Once a student has enrolled at Parks College, all subsequent flight instruction must be completed in residence at the College. Flight instruction outside of the College’s FAA-approved pilot instruction curricula is not permitted without prior written approval from the Chair of the department (whether currently enrolled or not). Students who receive flight instruction outside the approved curricula without prior approval are subject to dismissal from the program.

Flight fees will be charged in addition to the regular tuition. Please contact the Aviation Science Department for the current rates.

Students with prior flight experience/certification will be evaluated for proficiency at the corresponding flight certification level. Based on the results of such evaluation, the Director of Flight Training will recommend either some remedial training or continuation to the next level of training. Ground school courses completed at a Part 141 flight school may be transferable; those completed at a Part 61 flight school may not be transferable. Early consultation with the Department Chair and/or the Director of Flight Training is strongly recommended.

TSA Requirements
The Transportation Security Administration (TSA) requires any individual applying for flight training to provide proof of citizenship prior to beginning the training. New student pilots will be unable to begin flight training until the proof of citizenship requirement is met. Pilots typically provide 1) the individual’s valid, unexpired U.S. passport or 2) the individual’s original or government-issued certified U.S. birth certificate, together with a government-issued picture identification of the individual. Other TSA-specified documents may be accepted. Non-U.S. citizens must receive TSA approval prior to beginning any flight training. Please contact the Flight Training Director’s office for additional information.

Special Academic Requirements
Attendance
As a policy, undergraduate students are expected to regularly attend all classes, laboratory sessions and examinations. The implementation of this policy is left to the discretion of the individual instructor with the following exception: no absences are permitted in any course, which is required for the Federal Aviation Administration (FAA) regulated pilot certification courses. FAA regulations specify the number of hours required in the approved programs. Students should
contact the academic departments for details of these regulations.

If any absences occur, it is the student’s responsibility to make up the missed work. Since the student is expected to regularly attend classes, the instructor is not obligated in any way to provide make-up examinations or additional help on material covered when a student is absent.

When, in the judgment of the instructor, a student has accrued an excessive number of absences, the instructor may report this on the appropriate excessive absence form to the student and his/her advisor. This report is, in effect, a warning. At the discretion of the instructor a grade of “AF” (failure due to excessive absence) may be given.

When a student is absent because of an authorized student activity, the instructor, providing that the faculty member directing such student activities secures prior approval from the Dean’s office, may excuse the absence. Any scholastic difficulties resulting from the absence, as well as any assignments and examinations, remain the student’s responsibility.

Minimum GPA for Flight Training
If a student’s GPA drops below a 2.0, that student will not be eligible for a flight slot the following semester.

Academic Categories

Unclassified
Anyone enrolled in Parks College who is not pursuing a program of studies designed to obtain a degree from the college or university but who enrolls in one or more classes will be considered an unclassified student. Unclassified students who subsequently decide to pursue a degree must complete the entire process of applying for admission and must be admitted under the usual guidelines and procedures.

Students in Good Academic Standing
Students with a cumulative grade point average of 2.00 or higher are classified as students in good standing. Such students are classified as part-time if enrolled for less than twelve hours, full-time if enrolled for between twelve and eighteen credit hours, and full-time on overload if enrolled for more than eighteen credit hours.

Students on Supervisory Status
Minimum satisfactory scholastic achievement at Parks College is represented by a 2.00 cumulative grade point average (a C average). Anyone whose current or term grade point average is below 2.00 and whose cumulative grade point average is above a 2.00 will be considered on supervisory status during the term in which they next attend Parks College. Such students must see their Academic Advisor prior to the third day of class of next term of enrollment.

Supervisory conditions include:
1. Student will not hold office in any student organization during the period of supervisory.
2. Student will be restricted to no more than 15 credit hours. The academic advisor may grant exceptions to these rules.
3. After receiving mid-term grades, the student must consult with his/her advisor as to his/her academic performance. If the student fails to do so, a registration hold will be placed on the academic record.

Students on Contract Status
Anyone whose overall grade point average is below 2.00 will be considered on contract status (probation) during the term in which they next attend Parks College. Such students must see their academic advisor prior to the third day of class of next term of enrollment.

Contract conditions include:
1. They may not hold office in any student organization during the period of probation.
2. They will ordinarily be restricted to no more than 15 credit hours.
3. After receiving their mid-term grades, they must consult with their advisor as to their academic performance. If the student fails to do so, a registration hold will be placed on their academic record.
4. Student will be required to sign a contract stating that he or she will decrease the credit point deficiency by a fixed amount (to be determined by Parks College) and acknowledging that failure to satisfy this contract can result in dismissal from Parks College. Parks College may grant exceptions to these rules.

The pre-registration of students on supervisory and contract status will be cancelled if the student fails to see their Academic Advisor prior to the third day of class of next term of enrollment. Students who have not registered and attended classes within the first three days of the semester may not be allowed to enroll. A registration hold will be placed on their academic record.

Dismissed Students
Parks College enforces the university’s policy on academic dismissal. A student may be dismissed if he or she fails to reach a 2.0 cumulative GPA within two semesters subsequent to the assignment of probation
status or reaches a grade point deficiency of more than 15 points. Any student on contract status who does not satisfy the contract he or she signed with Parks College may be dismissed. In addition, any student who fails a course three times can be dismissed from the college.

**Appeal Options for Dismissed Students**

A dismissed student may attempt to again attend Parks College by appealing to the Dean. Information regarding this appeal may be obtained from the Dean’s office.

**Parks College Core Curriculum**

In addition to general requirements specified by the University, all students in degree programs leading to Bachelor of Science degrees must satisfy the Parks College Core Curriculum requirements and additional requirements specified by the individual academic programs.

Parks College of Engineering, Aviation and Technology has established educational objectives for students graduating from Bachelor of Science degree programs. Some objectives are specific and unique to degree programs, while others are broader in scope and may include students and instruction from outside of the degree program and college. The Parks College Core Curriculum describes the educational experiences that the faculty and administration of the college have identified as being “essential” for all Parks College students, and it describes the methods by which selected academic objectives may be accomplished.

**Notice to students:**

Individual degree programs may require specific courses in order to satisfy these requirements. It is recommended that students consult their Academic Advisor, Department Chairperson or Program Director for guidance in choosing core curriculum courses.

**Professional Orientation (minimum of 1 credit)**

One course designed for incoming freshman students providing an orientation to careers in the intended field of study. Also included is presentation of resources available to students from the department, college, and university.

**Jesuit Tradition (minimum of 12 credits)**

- Theology (3 Cr.)
- Philosophy and/or Ethics (3 Cr.)
- Humanistic Values (6 Cr.)

Humanistic value courses shall be chosen from: Philosophy; Theology; Social and Behavioral Sciences including Anthropology, Communications, Economics, Education, Political Science, Psychology, Public Health, Public Policy Studies, Sociology, Social Work; and Humanities including Fine Arts, Literature, History, Foreign Language.

**Knowledge (minimum of 16 credits)**

- Science with laboratory experience (4 Cr.)
- Science courses shall be chosen from: Astronomy, Biology, Chemistry, Engineering Science, Geology, Meteorology, Physics
- Mathematics (3 Cr.)
- Additional experience in Science and/or Mathematics (6 Cr.)
- Science courses shall be chosen from: Astronomy, Biology, Chemistry, Engineering Science, Geology, Meteorology, Physics

**Communication Skills (minimum of 3 credits)**

Written Communication (3 Cr.)

**Cultural Diversity (minimum of 3 credits)**

Cultural diversity courses shall be chosen from the list of courses provided by the College of Arts and Sciences. Students may also satisfy the cultural diversity requirement for an academic semester of study at an institution where the culture is significantly different from the students’ native culture; however, the credit hours will need to be replaced with an additional Humanistic Values course. Students should always consult with their Department Chair prior to the semester of study at another institution.

**Capstone Experience (minimum of 3 credits)**

A senior-level course or sequence of courses providing opportunities for students to use their acquired and accumulated knowledge on a problem or in a setting that is representative of that found in the profession.
Aerospace & Mechanical Engineering

Sridhar Condoor, Ph.D., Department Chair

Faculty:
Lawrence G. Boyer, M.S.
Sridhar Condoor, Ph.D.
Sanjay Jayaram, Ph.D.
Swami N. Karunamoorthy, D.Sc.
Raymond LeBeau, Ph.D.
Phillip Ligrani, Ph.D.
Jianfeng (Jeff) Ma, Ph.D.
Arif Malik, Ph.D.
Mark W. McQuilling, Ph.D.
Krishnaswamy Ravindra, Ph.D., P.E.
Michael Swartwout, Ph.D.
Theodosios Alexander, Sc. D

Emeritus:
Richard M. Andres, Ph.D., P.E., Professor Emeritus
Patricia A. Benoy, Ph.D., Professor Emeritus
Paul A. Czysz, B.S., Professor Emeritus
Marty A. Ferman, Ph.D., P.E., Professor Emeritus
John A. George, Ph.D. Professor Emeritus
Ray N. Nitzsche, Ph.D., P.E., Associate Professor Emeritus

Aerospace Engineering (B.S.)

Program Educational Objectives:
1. To practice the principles of engineering in aerospace or allied organizations.
2. To engage with further learning in aerospace engineering or in allied disciplines.
3. To function as effective engineers with professional knowledge, skills, and values.

Student Outcomes for Aerospace Engineering

Student outcomes describe what students are expected to know and be able to do by the time of graduation. These outcomes prepare graduates to attain the program educational objectives. They are listed below:

(a) An ability to apply knowledge of mathematics, science, and engineering
(b) An ability to design and conduct experiments, as well as to analyze and interpret data
(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) An ability to function on multidisciplinary teams
(e) An ability to identify, formulate, and solve engineering problems
(f) An understanding of professional and ethical responsibility
(g) An ability to communicate effectively
(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) A recognition of the need for, and an ability to engage in life-long learning
(j) A knowledge of contemporary issues
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Program Criteria
The Aerospace Engineering program prepares students to have knowledge of aerodynamics, aerospace materials, structures, propulsion, flight mechanics, stability & control in the area of aeronautics. In the area of astronautics students are prepared to have knowledge of astrodynamics, space environment, space structures, and rocket propulsion.

To this end, the design process, as exemplified by the assignment of open-ended problems, is experienced in nearly all engineering courses. The design experience is developed throughout the program by introduction of problem identifying and solving tasks that are assigned in those courses that precede the two semester capstone design course. The student is instilled with an awareness of the impact of design decisions, not only on vehicle performance, but on society as well. Excellent laboratories emphasize measurements and experimental methods. The students are encouraged to engage in lifelong learning.

With a solid core of mechanics, thermodynamics, fluid dynamics, electrical engineering, and linear control systems, the student is able to progress to the discipline specific areas of structures, flight mechanics, stability and
control, astrodynamics, aerodynamics, and propulsion. There is an emphasis on both aeronautics and astronautics. The humanistic value courses, including Engineering Ethics, provide a well rounded engineering education.

Students are encouraged to participate in the activities of the student chapter of the American Institute of Aeronautics and Astronautics (AIAA) and to enter the regional and national paper competition conducted by the AIAA.

**Degree Requirements**

### Basic Science & Math

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHEM 151 Engineering Chemistry I Lecture</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 165 General Chemistry I Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 161 Engineering Physics I Lecture</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 162 Engineering Physics I Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 163 Engineering Physics II Lecture</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 164 Engineering Physics II Lab</td>
<td>1</td>
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<tr>
<td>MATH 142 Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 143 Calculus II</td>
<td>4</td>
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<tr>
<td>MATH 244 Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 355 Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 370 Advanced Math for Engineers</td>
<td>3</td>
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</table>

### Math/Science Elective  

Choose one 3 credit hour course from the following list.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOL 104 Principles of Biology I</td>
<td></td>
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<tr>
<td>BIOL 106 Principles of Biology II</td>
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<tr>
<td>BIOL 110 Introduction to Biology</td>
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<tr>
<td>BIOL 115 Genetics &amp; Human Diversity</td>
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<tr>
<td>BIOL 215 Genetics &amp; Human Diversity</td>
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<tr>
<td>BIOL 216 Genetics &amp; Social Science</td>
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<tr>
<td>BIOL 236 Concepts of Biology</td>
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<td>BIOL 260 Human Physiology</td>
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<td>BIOL 417 Introduction to GIS</td>
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<tr>
<td>BIOL 419 GIS in Biology</td>
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<tr>
<td>CHEM 164 General Chemistry II</td>
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<td>CHEM 220 Chemistry &amp; Crime</td>
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<tr>
<td>EAS 101 Earth Systems I-The Solid Earth</td>
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<td>EAS 103 Earth's Dynamics Environment II</td>
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<tr>
<td>EAS 105 Introduction to Oceanography</td>
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<td>EAS 107 Understanding the Weather</td>
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<td>EAS 108 Intro to Environmental Science</td>
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<td>EAS 109 Climate and Humankind in History</td>
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<td>EAS 114 Earth History</td>
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<td>EAS 117 Physical Geography</td>
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<tr>
<td>EAS 130 Seismology of Nuclear Explosion</td>
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<td>EAS 131 Water-Our Precious Resource</td>
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<td>EAS 132 Natural Disasters</td>
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<td>EAS 133 Drifting Continents</td>
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<td>EAS 135 Real Meteorology</td>
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<td>EAS 137 Meteor. Aspects of Emergency Response</td>
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<td>EAS 138 Missouri Climate</td>
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<td>EAS 139 Hurricanes and Typhoons</td>
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<td>EAS 142 Foundations of Atmospheric Science</td>
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<tr>
<td>EAS 160 Sustainable Energy</td>
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<tr>
<td>EAS 193 Introduction to Earthquakes</td>
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<td>EAS 217 GIS in Civil Engineering</td>
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<td>EAS 230 Geology for Engineers</td>
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<td>EAS 325 Global Change</td>
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<td>EAS 331 Paleontology</td>
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<td>EAS 405 Petrology</td>
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<td>EAS 417 Introduction to GIS</td>
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<tr>
<td>EAS 419 Geospatial Methods in Environ Studies</td>
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<tr>
<td>EAS 423 Micrometeorology</td>
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<tr>
<td>EAS 453 Principles of Electrical Exploration</td>
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<tr>
<td>EAS 460 Introduction to the Physics of Solid Earth</td>
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<tr>
<td>EAS 462 Intro to Earthquake Seismology</td>
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<tr>
<td>EAS 470 Theory of Vibrating Systems</td>
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<tr>
<td>EAS 472 Seismological Instrumentation</td>
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<tr>
<td>MATH 160 Computer Probability and Statistics</td>
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<tr>
<td>MATH 215 Computational Linear Algebra</td>
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<tr>
<td>MATH 266 Principles of Mathematics</td>
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<tr>
<td>MATH 315 Introduction to Linear Algebra</td>
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<tr>
<td>MATH 311 Linear Algebra for Engineers</td>
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<tr>
<td>MATH 320 Numerical Analysis</td>
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<td>MATH 360 Combinatorics</td>
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<td>MATH 371 Vector Analysis</td>
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<tr>
<td>MATH 401 Elementary Theory of Probability</td>
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<tr>
<td>MATH 403 Probability and Statistics for Engineers</td>
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<tr>
<td>MATH 405 History of Mathematics</td>
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<tr>
<td>MATH 411 Introduction to Abstract Algebra</td>
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<tr>
<td>MATH 421 Intro to Analysis</td>
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<tr>
<td>MATH 441 Foundations of Geometry</td>
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<td>MATH 447 Non-Euclidean Geometry</td>
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<tr>
<td>MATH 448 Differential Geometry</td>
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<tr>
<td>MATH 451 Introduction to Complex Variables</td>
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<tr>
<td>MATH 455 Nonlinear Dynamics and Chaos</td>
<td></td>
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<tr>
<td>MATH 457 Partial Differential Equations</td>
<td></td>
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<tr>
<td>MATH 463 Graph Theory</td>
<td></td>
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<tr>
<td>MATH 465 Cryptography</td>
<td></td>
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<tr>
<td>PHYS 261 Modern Physics</td>
<td></td>
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<tr>
<td>PHYS 311 Classical Mechanics</td>
<td></td>
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<tr>
<td>PHYS 331 Optics</td>
<td></td>
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<tr>
<td>PHYS 341 Thermodynamics and Statistical Mech</td>
<td></td>
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<tr>
<td>PHYS 351 Analog &amp; Digital Electronics</td>
<td></td>
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<tr>
<td>PHYS 401 Topics in Modern Physics</td>
<td></td>
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<tr>
<td>PHYS 421 Electricity &amp; Magnetism I</td>
<td></td>
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<tr>
<td>PHYS 441 General Relativity</td>
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</table>

### Basic Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CSCI 145 Scientific Programming</td>
<td>3</td>
</tr>
<tr>
<td>ECE 200 Electrical &amp; Computer Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ECE 201 Electrical &amp; Computer Engineering Lab</td>
<td>1</td>
</tr>
</tbody>
</table>

### Communications

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 192 Advanced Writing for Professionals</td>
<td>3</td>
</tr>
</tbody>
</table>

### Liberal Arts

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEO 100 Theological Foundations</td>
<td>3</td>
</tr>
<tr>
<td>PHIL 340 Engineering Ethics</td>
<td>3</td>
</tr>
<tr>
<td>Humanistic Values Elective</td>
<td>6</td>
</tr>
<tr>
<td>Cultural Diversity</td>
<td>3</td>
</tr>
</tbody>
</table>
Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core on page 5 for more information.

Humanistic Values courses shall be chosen from: Humanities, Social & Behavioral Science, Philosophy, or Theology.

Humanities courses include: Fine Arts (excludes applied, studio, and performance courses), Literature (ENGL 200-260, 300-395, 410-479), History, and Foreign Languages (excludes English or native language).

Social & Behavioral Sciences courses include: Anthropology, Communication (CMM 100, 401, 402, 403, 406, 407, 409, 461), Communication Disorders (CSDI 100, 254, 470), Economics, Education (EDF 304, 305, 423, 470, EDI 204, 420, 462, 431), Political Science, Psychology, Social Work (SWRK 100, 225, 302, 327), Sociology, Criminal Justice, and Public Policy Studies (excludes field service courses).

**Engineering Science Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESCI 101</td>
<td>Freshmen Engineering</td>
<td>1</td>
</tr>
<tr>
<td>ESCI 102</td>
<td>Intro Computer Aided Design</td>
<td>1</td>
</tr>
<tr>
<td>ESCI 201</td>
<td>Engineering Shop Practice</td>
<td>1</td>
</tr>
<tr>
<td>ESCI 210</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>ESCI 211</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ESCI 220</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ESCI 310</td>
<td>Mechanics of Solids</td>
<td>3</td>
</tr>
<tr>
<td>ESCI 311</td>
<td>Mechanics of Solids Lab</td>
<td>1</td>
</tr>
<tr>
<td>ESCI 322</td>
<td>Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ESCI 323</td>
<td>Fluid Dynamics Lab</td>
<td>1</td>
</tr>
<tr>
<td>ESCI 330</td>
<td>Linear Vibrations</td>
<td>3</td>
</tr>
<tr>
<td>ESCI 430</td>
<td>Linear Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

**Aerospace Engineering Courses**

Courses in bold will be offered only once a year.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AENG 200</td>
<td>Intro to Aero &amp; Astro</td>
<td>3</td>
</tr>
<tr>
<td>AENG 310</td>
<td>Gas Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>AENG 311</td>
<td>Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>AENG 320</td>
<td>Performance</td>
<td>3</td>
</tr>
<tr>
<td>AENG 322</td>
<td>Astrodynamics</td>
<td>3</td>
</tr>
<tr>
<td>AENG 365</td>
<td>Computer Aided Engineering</td>
<td>3</td>
</tr>
<tr>
<td>AENG 401</td>
<td>Flight Vehicle Structures</td>
<td>3</td>
</tr>
<tr>
<td>AENG 410</td>
<td>Propulsion</td>
<td>3</td>
</tr>
<tr>
<td>AENG 411</td>
<td>Aerospace Lab</td>
<td>1</td>
</tr>
<tr>
<td>AENG 420</td>
<td>Stability &amp; Control</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AENG 450</td>
<td>Design I &amp; Lab</td>
<td>3</td>
</tr>
<tr>
<td>AENG 451</td>
<td>Design II &amp; Lab</td>
<td>3</td>
</tr>
<tr>
<td>AENG 455</td>
<td>Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>AENG 477</td>
<td>Senior Engineering</td>
<td>1</td>
</tr>
</tbody>
</table>

**Technical Electives**

Choose 6 credit hours from the list below. Each course is 3 credit hours. Check Self Service Banner to see if the course is currently being offered.

- AENG 414-50 Hypersonics
- AENG 422-50 Flight Simulation
- AENG 423-01 Flight Testing
- AENG 424-01 Helicopter Theory – Performance
- AENG 432-50 Aerelasticity
- AENG 441-01 Orbital Mechanics
- AENG 442-01 Intro to Space Dynamics
- AENG 453-50 Intro. To Comp. Fluid Dynamics

The following technical electives will be offered as AENG 493 (a different section # will be assigned)

Applied Aerodynamics
- Space Mission Design
- Space Dynamics & Control
- Space Mission Failures
- Space Mission Analysis & Design
- Space Mission Integration & Test
- Engineering Entrepreneurship
- AENG 498 Engineering Economics

MGT 300-01 Composite Materials

**Mechanical Engineering (B.S.)**

**Program Educational Objectives:**

1. To practice the principles of engineering in mechanical or allied organizations.
2. To engage with further learning in mechanical engineering or allied disciplines.
3. To function as effective engineers with professional knowledge, skills, and values.

**Student Outcomes for Mechanical Engineering**

Student outcomes describe what students are expected to know and be able to do by the time of graduation. These outcomes prepare

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2 The Mechanical Engineering program is accredited by the Engineering Accreditation Commission of ABET. www.abet.org
experience. The technical electives in the curriculum allow the student to specialize in thermal system, mechanical system, or entrepreneurship. Designing and developing high speed transportation (cars, trains, ships, planes), automated manufacturing, rapid prototyping, advanced robots, energy efficient devices, alternate energy sources, smart materials, and artificial devices for humans are some of the future challenges for a mechanical engineer. This curriculum provides the necessary building blocks and prepares the graduates to be a part of this future.

Students are encouraged to participate in the activities of the student chapter of the American Society of Mechanical Engineers (ASME) and to enter the regional and national technical paper and design competition conducted by the ASME.

**Degree Requirements**

**Basic Science & Math**
- CHEM 151 Engineering Chemistry I Lecture 3
- CHEM 165 General Chemistry I Lab 1
- PHYS 161 Engineering Physics I Lecture 3
- PHYS 162 Engineering Physics I Lab 1
- PHYS 163 Engineering Physics II Lecture 3
- PHYS 164 Engineering Physics II Lab 1
- MATH 142 Calculus I 4
- MATH 143 Calculus II 4
- MATH 244 Calculus III 4
- MATH 355 Diff. Equations 3
- MATH 370 Advanced Math for Engineers 3

**Math/Science Elective** 3
Choose one 3 credit hour course from the following list.

- BIOL 104 Principles of Biology I
- BIOL 106 Principles of Biology II
- BIOL 109 Biodiversity & Conservation
- BIOL 110 Introduction to Biology
- BIOL 115 Genetics & Human Diversity
- BIOL 215 Genetics & Human Diversity
- BIOL 216 Genetics & Social Science
- BIOL 236 Concepts of Biology
- BIOL 260 Human Physiology
- BIOL 417 Introduction to GIS
- BIOL 419 GIS in Biology
- CHEM 164 General Chemistry II
- CHEM 220 Chemistry & Crime
- CHEM 220 Chemistry & Crime
- CHEM 164 General Chemistry II
- CHEM 220 Chemistry & Crime
- CHEM 220 Chemistry & Crime
- CHEM 220 Chemistry & Crime
- CHEM 220 Chemistry & Crime
- CHEM 220 Chemistry & Crime
- CHEM 220 Chemistry & Crime
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- CHEM 220 Chemistry & Crime
- CHEM 220 Chemistry & Crime
- CHEM 220 Chemistry & Crime
EAS 117 Physical Geography
EAS 130 Seismology of Nuclear Explosion
EAS 131 Water-Our Precious Resource
EAS 132 Natural Disasters
EAS 133 Drifting Continents
EAS 135 Real Meteorology
EAS 137 Meteor. Aspects of Emergency Response
EAS 138 Missouri Climate
EAS 139 Hurricanes and Typhoons
EAS 142 Foundations of Atmospheric Science
EAS 160 Sustainable Energy
EAS 193 Introduction to Earthquakes
EAS 217 GIS in Civil Engineering
EAS 230 Geology for Engineers
EAS 325 Global Change
EAS 331 Paleontology
EAS 405 Petrology
EAS 417 Introduction to GIS
EAS 419 Geospatial Methods in Environ Studies
EAS 423 Micrometeorology
EAS 435 Principles of Electrical Exploration
EAS 460 Introduction to the Physics of Solid Earth
EAS 462 Intro to Earthquake Seismology
EAS 470 Theory of Vibrating Systems
EAS 472 Seismological Instrumentation
MATH 160 Computer Probability and Statistics
MATH 215 Computational Linear Algebra
MATH 266 Principles of Mathematics
MATH 315 Introduction to Linear Algebra
MATH 311 Linear Algebra for Engineers
MATH 320 Numerical Analysis
MATH 360 Combinatorics
MATH 371 Vector Analysis
MATH 401 Elementary Theory of Probability
MATH 403 Probability and Statistics for Engineers
MATH 405 History of Mathematics
MATH 411 Introduction to Abstract Algebra
MATH 421 Intro to Analysis
MATH 441 Foundations of Geometry
MATH 447 Non-Euclidean Geometry
MATH 448 Differential Geometry
MATH 451 Introduction to Complex Variables
MATH 455 Nonlinear Dynamics and Chaos
MATH 457 Partial Differential Equations
MATH 463 Graph Theory
MATH 465 Cryptography
PHYS261 Modern Physics
PHYS311 Classical Mechanics
PHYS331 Optics
PHYS341 Thermodynamics and Statistical Mech
PHYS351 Analog & Digital Electronics
PHYS401 Topics in Modern Physics
PHYS421 Electricity & Magnetism I
PHYS441 General Relativity

Basic Engineering
CSCI 145 Scientific Programming 3
ECE 200 Electrical & Computer Engineering 3
ECE 201 Electrical & Computer Engineering Lab 1

Communications
ENGL192 Advanced Writing for Professionals 3

Liberal Arts
THEO 100 Theological Foundations 3
PHIL 340 Engineering Ethics 3
Humanistic Values Elective 6
Cultural Diversity 3

Courses in bold will be offered only once a year
MENG 200 Foundation to Engineering Design 3
MENG 225 Manufacturing Process/Lab 3
MENG 235 Applied Thermodynamics 3
MENG 333 Mechanical Engineering Lab 1
MENG 339 Measurements 3
MENG 345 Machine Design 3
MENG 351 Material Science 3
MENG 365 Computer Aided Engineering 3
MENG 445 Principles of Mechatronics 3
MENG 450 Design I & Lab 3
MENG 451 Design II & Lab 3
MENG 455 Heat Transfer 3
MENG 477 Senior Engineering 1

Engineering Science Courses
ESCI 101 Freshmen Engineering 1
ESCI 102 Intro Computer Aided Design 1
ESCI 201 Engineering Shop Practice 1
ESCI 210 Statics 3
ESCI 211 Dynamics 3
ESCI 220 Thermodynamics 3
ESCI 310 Mechanics of Solids 3
ESCI 311 Mechanics of Solids Lab 1
ESCI 322 Fluid Dynamics 3
ESCI 323 Fluid Dynamics Lab 1
ESCI 330 Linear Vibrations 3
ESCI 430 Linear Systems 3

Mechanical Engineering Courses
Courses in bold will be offered only once a year
MENG 200 Foundation to Engineering Design 3
MENG 225 Manufacturing Process/Lab 3
MENG 235 Applied Thermodynamics 3
MENG 333 Mechanical Engineering Lab 1
MENG 339 Measurements 3
MENG 345 Machine Design 3
MENG 351 Material Science 3
MENG 365 Computer Aided Engineering 3
MENG 445 Principles of Mechatronics 3
MENG 450 Design I & Lab 3
MENG 451 Design II & Lab 3
MENG 455 Heat Transfer 3
MENG 477 Senior Engineering 1

Technical Electives
Choose 6 credit hours from the list below. Each course is 3 credit hours. Check Self Service Banner to see if the course is currently being offered. AENG 453-01 Intro to Comp. Fluid Dynamics

ESCI 433 Composite Materials

The following technical electives will be offered as MENG 493 (a different section # will be assigned)
Engineering Entrepreneurship
Experimental Methods in Fluid Dynamics
Viscous Flows
Introduction to Turbulence
Finite Element Analysis - I
Finite Element Analysis – II
Multidisciplinary Optimization
Structural Reliability
Fracture Mechanics & Plasticity
MENG 470 Creativity, Innovation & Sustainability
MENG 498 Special Topics

MGT 300-01 Management Theory & Practice
MGT 320-01 Entrepreneurship

MATH 311 Linear Algebra for Engineers
MATH 315 Linear Algebra
MATH 451 Introduction to Complex Variables
MATH 454 Applied Partial Differential Equations
MATH 473 Fourier Series & Rel Boundary Value Probs
MATH 493 Numerical Analysis

Bachelor-Master’s Degree Option
Bachelor-Master’s Degree Option:
The Bachelor’s-Master’s degree option allow for a student to earn both degrees in a unified sequence. Students interested in this program can apply for admission to the graduate program in their junior year. Admitted students are then allowed to take graduate courses up to six credits towards their M.S. degree in their senior year and these courses cannot be used to satisfy undergraduate degree requirements.

The bachelor’s-master’s option requires completion of the standard requirements for a M.S. degree in addition to completion of the standard requirements of a B.S. degree. The M.S. degree requires 30 credit hours course work, of which up to 9 hours may be research credit. Up to 9 credits may be course work at the 400 level; the remaining course credits must be at the 500 level or above. For course only option, 30 credits of course work is required. Specific programs of study for each student are developed under the guidance of a faculty mentor.

Double Major Option:
The double major option allows a student, to take additional courses, to complete a Bachelor’s degree with both Aerospace and Mechanical Engineering majors. The student must complete the standard requirements for one of these majors (the primary major). In addition, the student must complete an additional 25 credits in the other field (the secondary major). Students pursuing this option are responsible for creating a schedule that allows them to finish all these courses in a timely fashion while meeting all pre- and co-requisite requirements.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEN G 225</td>
<td>Manufacturing Processes</td>
<td>AEN G 200</td>
<td>Intro to Aero &amp; Astro</td>
</tr>
<tr>
<td>MEN G 235</td>
<td>Applied Thermodynamics</td>
<td>AEN G 310</td>
<td>Gas Dynamics</td>
</tr>
<tr>
<td>MEN G 333</td>
<td>ME Lab</td>
<td>AEN G 311</td>
<td>Aerodynamics</td>
</tr>
<tr>
<td>MEN G 339</td>
<td>Measurements</td>
<td>AEN G 310</td>
<td>Performance</td>
</tr>
<tr>
<td>MEN G 345</td>
<td>Machine Design</td>
<td>AEN G 322</td>
<td>Astrodynamics</td>
</tr>
<tr>
<td>MEN G 351</td>
<td>Material Science</td>
<td>AEN G 401</td>
<td>Flight Vehicle Structures</td>
</tr>
<tr>
<td>MEN G 445</td>
<td>Principles of Mechatronics</td>
<td>AEN G 410</td>
<td>Propulsion</td>
</tr>
<tr>
<td>MEN G 450</td>
<td>ME Design I/Lab</td>
<td>AEN G 411</td>
<td>Aerospace Lab</td>
</tr>
<tr>
<td>MEN G 451</td>
<td>ME Design II/Lab</td>
<td>AEN G 420</td>
<td>Stability &amp; Control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AEN G 450</td>
<td>AE Design I/Lab</td>
</tr>
</tbody>
</table>

*Student must take either Gas Dynamics or Aerodynamics to fulfill dual major requirements.

Minor in Aerospace Engineering

Students pursuing a Bachelor’s degree in Mathematics, Computer Science, Physics, Electrical
Engineering, Computer Engineering, and Biomedical Engineering programs may earn a minor in Aerospace Engineering. The Minor in Aerospace Engineering requires at least 18 credits of coursework that include a course in Introduction to Aeronautics and Astronautics (AENG 200) and at least five AENG and ESCI courses at 200 level or above. The grades in all AENG/ESCI courses must be C or better.

**Minor in Mechanical Engineering**

Students pursuing a Bachelor’s degree in Mathematics, Computer Science, Physics, Electrical and Computer Engineering, and Biomedical Engineering programs may earn a minor in Mechanical Engineering. The Minor in Mechanical Engineering requires at least 18 credits of coursework that include a course in Foundations to Engineering Design (MENG 200) and at least five MENG and ESCI courses at 200 level or above. The grades in all MENG/ESCI courses must be C or better.
Aviation Science

Stephen M. Belt, Ph.D., Chair

Faculty:
Jennifer Ashley, M.S.
Stephen M. Belt, Ph.D.
Michael Frette, B.S., Chief Flight Instructor
Bruce D. Hoover, M.S.
William Irwin, M. P. A.
Terrance Kelly, M.S.
Stephen Magoc, M.B.A.
Manoj S. Patankar, Ph.D.
Saul Robinson, M.S.

Mission of the Department
The mission of the Department is to actively engage in the fulfillment of the University’s mission so that our students are formed as global citizens who are intellectually, technically and ethically prepared to be responsible leaders in the aviation profession and their community.

Degree Programs - Undergraduate
The Department of Aviation Science offers a Bachelor of Science in Aeronautics degree program with concentrations in Aviation Management and Flight Science. Aviation Management (AMGT) prepares the graduate to pursue a variety of careers as a non-flying aviation professional. Flight Science (FSCI) is intended for those students who wish to pursue a career as a professional pilot.

Degree Programs – Graduate
The Department of Aviation Science offers a Master of Science and Doctor of Philosophy in Aviation. The Master of Science includes alternate tracks for the Aviation Professional including Aviation Safety, Flight Operations Administration and Collegiate Flight Education. The Ph.D. program allows for a customized curriculum in which the student works with their Advisory Committee to identify a plan of study that compliments their scholarly and professional goals. Please see the graduate programs catalog for additional information regarding the M.S. and Ph.D. in aviation degrees.

Undergraduate Programs

Flight Science (B.S. in Aeronautics)
Parks College is the first federally certificated flight school in the country and is the only Jesuit University with a flight program. Students in our Flight Science program have the opportunity to experience state-of-the-art learner-centric instruction; be trained in a performance-based flight instruction environment, earn flight instruction experience prior to graduation, and minor in a variety of other disciplines. Upon graduation, our alumni become part of a community of leaders who are dispersed around the world working as aviation professionals.

The Flight Science program offers flight training integrated within a curriculum of science and advanced aviation subjects intended to prepare the graduates for entry-level positions in charter, corporate, or airline flight operations. Flight instruction within the program is regulated by the Code of Federal Regulations, Part 141. The goal of the Flight Science program is to combine world-class flight training with an academic experience intended to diversify your professional skillset and serve as the foundation, not only to be leaders in the aviation industry, but to be individuals who make a positive difference in our world as well.

Global Flight Science Option
A majority of nations across the globe adhere to either Federal Aviation Administration (FAA) or European Aviation Safety Agency (EASA) standards for certification of flight crews. By preparing students to meet both FAA and EASA knowledge requirements, the Global Flight Science program intends to prepare students for professional flight careers in most nations across the world. Following the freshman year in Madrid, students arrive in St. Louis for the sophomore, junior and senior year. While in St. Louis, students work toward FAA flight ratings including the Private, Instrument and Commercial Multi-Engine pilot. Upon graduation from the program in St. Louis, students have the option of returning to Madrid or other global regions for additional transition training leading to international certification.

While in Madrid, students will enroll in ground school coursework and an introduction to European aviation standards and regulations. All coursework is delivered in English while students experience the diversity of a major European metropolitan area. The Global Flight Science option provides the student with a multicultural experience in preparation for careers as globally qualified flight crew members.

For further information regarding the Global Flight Science option, please contact Mr. Saul Robinson at robinssd@slu.edu

**Minor/Approved Emphasis Area**
Students enrolled in the Flight Science program are encouraged to diversify their educational experience and explore areas outside of their major. The Flight Science program requires all students to complete a university minor or grouping of affiliated electives (approved emphasis area). For example, Flight Science students may enroll in the Certificate in Business program offered by Saint Louis University’s John Cook School of Business.

For those students interested in an aviation minor, the department offers the following:

- Minor in Air Traffic Control (Open to all university students)
- Minor in Flight Education (Flight Science students only)
- Minor in Flight Science (Non Flight Science majors only)

**Degree Requirements**

**Flight Science Concentration (121 credit hours)**

**Professional Orientation (3 credit hours)**
- ASCI 101 Professional Orientation 2
- EDH 101 Enhancing 1st Yr. Success 1

**Jesuit Tradition (12 credit hours)**
- PHIL 105 Introduction to Philosophy 3
- PHIL 205 Ethics 3
- PSY 101 General Psychology 3
- THEO 100 Theological Foundations 3

**Knowledge (16 credit hours)**
- ITM 200 Intro to Info Tech 3

*Students should complete one of the two math sequences.*

- MATH 120 College Algebra 3
- MATH 132 Survey of Calculus 3

*Or*

- MATH 141 Pre-Calculus 3
- MATH 142 Calculus I 4
- PHYS 135 Aviation Physics I/Lab 4

**Communication Skills (12 credit hours)**
- CMM 120 Public Speaking 3
- ENGL 150 The Process of Composition 3
ENGL 190 Adv Str Rhetoric and Research 3
ENGL 200 English 200 or higher 3

Cultural Diversity (3 credits)
Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core for more information.

Cultural Diversity 3

Aviation Science (38 credits)
ASCI 220 Concepts in Aerodynamics 3
ASCI 301 Jet Transport Systems I 3
ASCI 302 Jet Transport Systems II 3
ASCI 306 Turbine Aircraft Transition 2
ASCI 310 Air Carrier Operations 3
ASCI 365 Applied Statistics 3
ASCI 401 Jet Flying Techniques I 3
ASCI 402 Jet Flying Techniques II 3
ASCI 405 Human Factors 3
ASCI 425 Professional Ethics and Standards 3
ASCI 435 Team Resource Management 3
FSCI 130 Aviation Weather 3
FSCI 445 Aviation Law 3

Flight Science (19 credit hours)
All flight training must be completed at Saint Louis University. Students with prior flight experience or certification will be evaluated for proficiency at the corresponding flight certification level. More information is available in the Parks College General Information section of this catalog. Note: additional flight fees apply to all flight courses—contact the Department for current rates.

FSCI 115 Flight 1 2
FSCI 125 Basic Flight Foundations 3
FSCI 155 Flight 2 2
FSCI 215 Flight 3 2
FSCI 225 Instrument Flight Foundations 3
FSCI 255 Flight 4 2
FSCI 265 Navigation Flight Foundations 3
FSCI 355 Flight 5 2

Approved Emphasis Area (18 credit hours)
Emphasis areas may consist of SLU minors, certificate programs or any other concentrated area of study approved by the Aviation Science Department.

Certificate, minor or affiliated electives 18

Total Credit Hours 121

Aviation Management (B.S. in Aeronautics)

The Aviation Management program prepares the graduate for entry-level positions within the aviation and space industries, and/or government agencies. Career opportunities for graduates include: management and supervisory positions with commercial airlines, the aircraft/aerospace industry, airports and governmental agencies, as well as positions as contract negotiators, budget analyst, project administrators, personnel directors and positions in sales, marketing and advertising.
The goal of the Aviation Management program is to not only prepare our graduates to manage aviation operations, but also to prepare them as socially responsible leaders who have a strong foundation in technical skills and are equipped with sufficient breadth of experience in liberal arts and sciences to make a difference in both their professional and personal lives.

The Aviation Management program places a strong emphasis on the safety and business aspects of aviation. From air carrier to manufacturing to airport management, the Aviation Management curriculum includes the necessary coursework and experience to serve the business and safety needs in aviation.

The Aviation Management program is offered as a residential program (on-campus) as well as a distance program (on-line). The programs are identical in course content and quality with the distance program geared toward the working professional.

**Distance Education Option – Aviation Management**

Students who are unable to attend class in St. Louis may wish to consider the Distance Option for the Aviation Management program. In partnership with the Saint Louis University School for Professional Studies (SPS), the Distance Aviation Management program offers the same aviation coursework taught by the same faculty as the on-ground program. Non-aviation coursework is provided by the School for Professional Studies, a pioneer in distance education here at Saint Louis University.

The Distance Aviation Management Program maintains the same level of academic rigor and expectations of the on-ground program. The Distance Aviation Management Program is especially well-suited for military personnel and dependents, including retirees receiving G.I. benefits.

**Degree Requirements**

**Aviation Management Concentration (120 credit hours)**

<table>
<thead>
<tr>
<th>On-Ground</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Professional Orientation (3 credit hours)</strong></td>
<td><strong>Professional Orientation (3 credit hours)</strong></td>
</tr>
<tr>
<td>ASCI 101 Professional Orientation</td>
<td>2</td>
</tr>
<tr>
<td>EDH 100 Enhancing 1st Yr. Success</td>
<td>1</td>
</tr>
<tr>
<td><strong>Jesuit Tradition (12 credit hours)</strong></td>
<td><strong>Jesuit Tradition (12 credit hours)</strong></td>
</tr>
<tr>
<td>PHIL 105 Introduction to Philosophy</td>
<td>3</td>
</tr>
<tr>
<td>PHIL 205 Ethics</td>
<td>3</td>
</tr>
<tr>
<td>PSY 101 General Psychology</td>
<td>3</td>
</tr>
<tr>
<td>THEO 100 Theological Foundations</td>
<td>3</td>
</tr>
<tr>
<td><strong>Knowledge (16 credit hours)</strong></td>
<td><strong>Knowledge (16 credit hours)</strong></td>
</tr>
<tr>
<td>ITM 200 Intro to Information Tech Management</td>
<td>3</td>
</tr>
</tbody>
</table>

*Students should complete one of the two math sequences.*

<table>
<thead>
<tr>
<th>On-Ground</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 120 College Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 132 Survey of Calculus</td>
<td>3</td>
</tr>
<tr>
<td>Or</td>
<td></td>
</tr>
<tr>
<td>MATH 141 Pre-Calculus</td>
<td>3</td>
</tr>
<tr>
<td>MATH 142 Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 135 Aviation Physics I &amp; Lab</td>
<td>4</td>
</tr>
<tr>
<td>FSCI 130 Aviation Weather</td>
<td>3</td>
</tr>
<tr>
<td><strong>Communication Skills (12 credit hours)</strong></td>
<td><strong>Communication Skills (12 credit hours)</strong></td>
</tr>
<tr>
<td>CMM 120 Public Speaking</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 150 The Process of Composition</td>
<td>3</td>
</tr>
</tbody>
</table>
### ENGL 190 Advanced Strategies Rhetoric/Research 3
ENGL 200 English 200 or higher 3

### Cultural Diversity (3 credit hours)
Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core for more information.

- Cultural Diversity Elective 3

### Communications

#### Liberal Arts
- Cultural Diversity Elective 3

### Aviation Science Core (18 credit hours)
- ASCI 195 Safety Management Systems 3
- ASCI 310 Air Carrier Operations 3
- ASCI 405 Human Factors 3
- ASCI 435 Team Resource Management 3
- ASCI 425 Professional Ethics and Standards 3
- FSCI 445 Aviation Law 3

### Aviation Management Concentration (30 credit hours)
- AMGT 480 International Aviation 3
- AMGT 490 Senior Seminar (Capstone) 3
- ECON 190 Principles of Economics 3
- ENGL 400 Business & Professional Writing 3
- FSCI 465 Economics of Air Transportation 3
- MGMT 300 Management Theory and Practice 3
- MGMT 310 Management of Human Resources 3
- OPM 207 Introduction to Statistics 3
- OPM 305 Introduction to Management Science 3
- ASCI 475 Internship with Industry 3

### Approved Emphasis Area (27 credit hours)

Emphasis areas may consist of SLU minors, certificate programs or any other concentrated area of study approved by the Aviation Science Department.

- Certificate, minor or affiliated electives 27

**Total Credit Hours 120**

---

**Minor in Air Traffic Control (Open to All University Students)**
The Minor in Air Traffic Control is intended to prepare with the foundational skills associated with the practice of Air Traffic Control. Lecture content is combined with a state of the art Adacel Air Traffic Control simulator to provide students with both foundational theory and practical application of techniques. (Not available via distance)

### Air Traffic Control Minor
- FSCI 130 Aviation Weather 3
### Minor in Flight Education
(For Flight Science Majors Only)
Students majoring in Flight Science may obtain a minor in Flight Education by completing the following courses. These courses enable the students to obtain their Flight Instructor certificates and pursue one year of practicum study (provide instruction under the supervision of fulltime instructors). (Not available via distance)

<table>
<thead>
<tr>
<th>Flight Education Minor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PP 310 Flight Instructor Prep I</td>
<td>2</td>
</tr>
<tr>
<td>PP 320 Principles of Flight Instruction I</td>
<td>3</td>
</tr>
<tr>
<td>PP 350 Flight Instructor Prep II</td>
<td>2</td>
</tr>
<tr>
<td>PP 360 Principles of Flight Instruction II</td>
<td>3</td>
</tr>
<tr>
<td>PP 410 CFI Practicum I</td>
<td>3</td>
</tr>
<tr>
<td>PP 450 CFI Practicum II</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credit Hours** 16

### Minor in Flight Science
(Open to All University Students)
All University majors (including those who have not declared a specific major or are pursuing pre-professional programs such as pre-law and pre-medicine) are eligible to obtain a minor in Flight Science. This minor will enable the students to obtain Private Pilot Certificate, Instrument Rating, Commercial Pilot Certificate, and Multiengine Rating. The following courses are required. Note: additional fees apply to all flight courses—contact the Department for current rates. (Not available via distance)

<table>
<thead>
<tr>
<th>Flight Science Minor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FSCI 115 Flight 1</td>
<td>2</td>
</tr>
<tr>
<td>FSCI 125 Basic Flight Foundations</td>
<td>3</td>
</tr>
<tr>
<td>FSCI 155 Flight 2</td>
<td>2</td>
</tr>
<tr>
<td>FSCI 215 Flight 3</td>
<td>2</td>
</tr>
<tr>
<td>FSCI 225 Instrument Flight Foundations</td>
<td>3</td>
</tr>
<tr>
<td>FSCI 255 Flight 4</td>
<td>2</td>
</tr>
<tr>
<td>FSCI 265 Navigation Flight Foundations</td>
<td>3</td>
</tr>
<tr>
<td>FSCI 355 Flight 5</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total Credit Hours** 19
Biomedical Engineering

J. Gary Bledsoe, Ph.D., Chair

Faculty:
Gary Bledsoe, Ph.D.
Cecil W. Thomas, Ph.D.
Silviya P. Zushiak, Ph.D.
Scott Sell, Ph.D.

The Department of Biomedical Engineering (BME) offers an undergraduate degree program that combines math, chemistry, and physics, as well as biology-physiology to form a unique engineering discipline. The first two years build a strong foundation of basic sciences and liberal arts, with introductory engineering. In the next two years, courses and labs build on the basic sciences and math to provide a focus of integrative courses in Biomedical Engineering. The BME courses span a range of subspecialties, including biomechanics, biomaterials, biosignals, biomasurements, and biotransport. Within these courses, topics may address problems in areas like cardiology, orthopedics, neurobiology, biology, or psychology. Students develop research and design skills in courses and laboratories throughout the curriculum, but the senior project provides a culminating experience by focusing on a specific yearlong problem that may be done individually or in teams.

The undergraduate degree program offers considerable flexibility, allowing time for electives within and outside the Department. The curriculum is designed for students whose post-baccalaureate career plans are graduate school, industry, or professional schools. The courses and laboratory experiences provide a broad fundamental preparation for any of the three career paths. At the same time, students can choose advanced courses, senior project, and lab experience to define their specific areas of interest. For students seeking an even broader engineering experience, the Department offers an Interdisciplinary Engineering degree that combines the fundamentals of engineering with a variety of enrichment areas selected by the student in consultation with the faculty mentor.

Program Mission
The mission of the Department of Biomedical Engineering is to prepare students for careers in health care delivery, ranging from fundamental research to the direct application of knowledge, to problem solving and improving the quality of life for humanity.

Program Educational Objectives
The undergraduate program is designed to meet the following specific objectives in order to fulfill the Departmental and Institutional missions.

1: Graduates will have established themselves as practicing engineers in biomedical engineering and health related positions in industry, government and academia.
2: Graduates will have acquired advanced degrees or be engaged in advanced study in biomedical engineering or other fields related to their long term career goals.
3: Graduates will attain a major milestone in their career development within the first five to seven years.

Program Outcomes
Graduates of the BME program at Saint Louis University will demonstrate:

a. an ability to apply knowledge of mathematics, science, and engineering;
b. an ability to design and conduct experiments, as well as to analyze and interpret data;
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
d. an ability to function on multi-disciplinary teams;
e. an ability to identify, formulate, and solve engineering problems;

1 The Biomedical Engineering program is accredited by the Engineering Accreditation Commission of ABET. www.abet.org
f. an understanding of professional and ethical responsibility;
g. an ability to communicate effectively;
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context;
i. a recognition of the need for, and an ability to engage in life-long learning;
j. a knowledge of contemporary issues;
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;
l. an understanding of biology and physiology, and the capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology;
m. an ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems.

**Biomedical Engineering (B.S.)**

The Biomedical Engineering curriculum satisfies the SLU and Parks College requirements, and includes the flexibility, through electives, to tailor the curriculum for each individual student.

All BME courses with the exception of BME 100 have prerequisites that require a “C” or better. The prerequisites for BME courses are available in the Department office. Any waiver of a specified prerequisite for a course must be approved by the BME Faculty member offering that course.

The minimum curriculum includes:

**Basic Science & Math**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 163 General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 165 General Chemistry I Lab</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 164 General Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 166 General Chemistry II Lab</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 104 Biology I &amp; Lab</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 106 Biology II &amp; Lab</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 260 Human Physiology</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 161 Engineering Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 162 Engineering Physics I Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 163 Engineering Physics II</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 164 Engineering Physics II Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 341 Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 142 Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 143 Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 244 Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 355 Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 403 Probability &amp; Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Basic Engineering**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BME 320 Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>ECE 200 Electrical &amp; Computer Eng</td>
<td>3</td>
</tr>
<tr>
<td>ECE 201 Electrical &amp; Computer Eng Lab</td>
<td>1</td>
</tr>
<tr>
<td>ESCI 201 Engineering Shop Practice</td>
<td>1</td>
</tr>
</tbody>
</table>

**Communications**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 190 Adv Strategies of Rhet &amp; Research</td>
<td>3</td>
</tr>
</tbody>
</table>

One credit hour of the four credit hour Parks College Core requirement for written and oral communication will be satisfied by BME 100 Orientation, BME 101 Intro, or CMM293 Small Group Presentations.

**Liberal Arts**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEO 100 Theological Foundations</td>
<td>3</td>
</tr>
</tbody>
</table>
PHIL 205 Ethics 3
Humanities 3
Cultural Diversity 3
Social & Behavioral Sciences 3
Non-Technical Elective 3

Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core on page 5 for more information.

Humanities courses include: Fine Arts (excludes applied, studio, and performance courses), Literature (any beyond composition), History, and Foreign Languages (excludes English or native language).

Social & Behavioral Sciences courses include: Anthropology, Communication (CMM 100, 200, 280), Communication Disorders (CSDI 100, 470), Economics, Education (EDF 424, 462, 431), Political Science, Psychology, Social Work (SWRK 100, 225, 302, 327), Sociology, Criminal Justice, Public Health (HMP 130, PUBH 201, PUBH 365, or by approval), and Public Policy Studies (excludes field service courses).

Non-Technical Elective shall be chosen from: Philosophy, Theology, Humanities, or Social & Behavioral Sciences.

### Biomedical Engineering Core

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BME 100</td>
<td>BME Orientation</td>
<td>1</td>
</tr>
<tr>
<td>BME 101</td>
<td>BME Introduction</td>
<td>1</td>
</tr>
<tr>
<td>BME 200</td>
<td>BME Computing</td>
<td>3</td>
</tr>
<tr>
<td>BME 310</td>
<td>Signals</td>
<td>3</td>
</tr>
<tr>
<td>BME 330</td>
<td>Transport Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>BME 340</td>
<td>Materials Science</td>
<td>3</td>
</tr>
<tr>
<td>BME 395</td>
<td>Junior Lab</td>
<td>1</td>
</tr>
<tr>
<td>BME 405</td>
<td>Biomedical Instrumentation</td>
<td>3</td>
</tr>
<tr>
<td>BME 495/496</td>
<td>Senior Project I &amp; II</td>
<td>6</td>
</tr>
</tbody>
</table>

### Required Related Courses:

Students must take 18 credit hours from the Advanced Biomedical Engineering area and an additional 9 credit hours among BME-Related General Electives.

#### A. Advanced Biomedical Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BME 410</td>
<td>Biomedical Signals</td>
<td>3</td>
</tr>
<tr>
<td>BME 415</td>
<td>Sensory Systems</td>
<td>3</td>
</tr>
<tr>
<td>BME 420</td>
<td>Biomechanics</td>
<td>3</td>
</tr>
<tr>
<td>BME 430</td>
<td>Biotransport</td>
<td>3</td>
</tr>
<tr>
<td>BME 431</td>
<td>Advanced Topics in Biotransport</td>
<td>3</td>
</tr>
<tr>
<td>BME 440</td>
<td>Biomaterials</td>
<td>3</td>
</tr>
<tr>
<td>BME 450</td>
<td>Numerical Methods in BME</td>
<td>3</td>
</tr>
<tr>
<td>BME 460</td>
<td>Quantitative Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BME 441</td>
<td>Tissue Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BME 442</td>
<td>Tissue/Material Interfaces</td>
<td>3</td>
</tr>
<tr>
<td>BME 498</td>
<td>Independent Research</td>
<td>3</td>
</tr>
</tbody>
</table>

#### B. BME-Related General Electives

BME-Related general electives should be selected in accordance with the student’s long-term educational and career goals. Often, students use these credits for advanced work in math, science, and engineering. However, students may also select courses designed to broaden their education in areas such as liberal arts or business. In all cases the permission of the academic advisor and Department Chairperson is required. Under no circumstances can prerequisite courses be used as general electives, e.g., Pre-Calculus (MATH141) or The Process of Composition (ENGA150).

Minimum BS Credits (BME) 128
Minor in Biomedical Engineering

The Minor in Biomedical Engineering requires 18 credits of coursework including a course in physiology (e.g., BIOL 260 or PPY254 Human Physiology) and at least five BME courses. At least three of the BME courses must be selected at the 400-level, i.e., from the Advanced BME courses. The grades in all BME courses must be C or better.

To initiate a Minor in BME, a student should file a "Minor in BME" plan with the BME Department after meeting with a BME Faculty member to discuss the minor courses and their prerequisites. The "Minor in BME" form serves as a planning tool and will be on file in the BME Department and with the student's academic advisor in the major area. The completion of a Minor in BME must be certified by the Chair of the BME Department as part of the graduation check.

Interdisciplinary Engineering (B.S.)

The Interdisciplinary Engineering (IDE) curriculum offers a new option and a new approach to the study of engineering. The IDE program is based in science, engineering, and liberal arts, and is tailored to the individual student’s interests. Students define their own Study Plan, in preparation for careers that build on a broad foundation.

A student’s Study Plan need not focus on an academic department. Instead, each student will identify a career goal, build a career plan, and define a unique Study Plan. While the program offers great flexibility, it does set some boundaries and constraints. Primarily in the first two years, all IDE students take a set of common courses in science, engineering, and liberal arts. The common courses provide a common foundation and knowledge base for all IDE students.

After the common courses, each individual student will define a Focus Area that will be the topic of the Senior thesis, and will include courses that provide the necessary depth of knowledge in the general area of the Senior thesis. The Focus Area may reflect the interest of an individual faculty member, but more likely will require the expertise of several faculty members. A Focus Area may be unique to a single student, or it may involve multiple students. The IDE program has mentors who will assist students in exploring options for Focus Areas and with finding other faculty members with the appropriate expertise.

The minimum IDE curriculum includes:

Basic Science & Math
CHEM 163 General Chemistry I 3
CHEM 165 General Chemistry I Lab 1
CHEM 164 General Chemistry II 3
CHEM 166 General Chemistry II Lab 1
PHYS 161 Engineering Physics I 3
PHYS 162 Engineering Physics I Lab 1
PHYS 163 Engineering Physics II 3
PHYS 164 Engineering Physics II Lab 1
PHYS 341 Thermodynamics 3
MATH 142 Calculus I 4
MATH 143 Calculus II 4
MATH 244 Calculus III 4
MATH 355 Differential Equations 3
MATH 403 Probability & Statistics 3

Communications & Liberal Arts
ENGL 190 Adv Strategies of Rhet & Research 3
THEO 100 Theological Foundations 3
PHIL 205 Ethics 3
Humanities 3
Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core on page 5 for more information.

Humanities courses include: Fine Arts (excludes applied, studio, and performance courses), Literature (any beyond composition), History, and Foreign Languages (excludes English or native language).

Social & Behavioral Sciences courses include: Anthropology, Communication (CMM 100, 200, 280), Communication Disorders (CSDI 100, 470), Economics, Education (EDF 424, 462, 431), Political Science, Psychology, Social Work (SWRK 100, 225, 302, 327), Sociology, Criminal Justice, Public Health (HMP 130, PUBH 201, PUBH 365, or by approval), and Public Policy Studies (excludes field service courses).

Non-Technical Elective shall be chosen from: Philosophy, Theology, Humanities, or Social & Behavioral Sciences.

**Engineering Core**
- BME 100 BME Orientation 1
- BME 101 BME Introduction 1
- BME 200 BME Computing 3
- ECE 200 Electrical & Computer Eng 3
- ECE 201 Electrical & Computer Eng Lab 1
- ESCI 220 Thermodynamics 3
- BME 310 Signals 3
- BME 320 Mechanics 3
- BME 330 Transport Fundamentals 3
- BME 340 Materials Science 3

Substitution of other core engineering courses may be approved by the faculty mentor.

**Enrichment**
- Elective courses 15
  Courses selected for breadth and career building.

**Focus Area**
- Focus courses 20
- IDE 495/496 Senior Thesis I & II 6
  Courses directly related to preparation and completion of the senior thesis.

**Minimum BS Credits (IDE) 120**
Civil Engineering

Riyadh Hindi, Ph.D., P.Eng. Chair (rhindi@slu.edu)

Faculty:
Amanda Cox, Ph.D., P.E.
Riyadh Hindi, Ph.D., P.Eng.
Will Lindquist, Ph.D., P.E.
John Woolschlager, Ph.D.

Civil Engineering (B.S.)

Program educational objectives are broad statements that describe what graduates are expected to attain within a few years of graduation. The program objectives are that our graduates will:

1. Be employed as engineers or be enrolled in engineering or professional graduate school;
2. Demonstrate their commitment to life-long learning and professional development through seeking professional licensure, pursuing graduate studies, or participating in other professional continuing education activities;
3. Advance into leadership roles in their profession and in service to their communities; and
4. Create design solutions that address economic, social, and environmental factors in their professional engineering practice

The Civil Engineering program at Saint Louis University is future focused – incorporating the latest trends in the Civil Engineering to address the current and future needs of the profession and our society. Our graduates will be well prepared to enter professional practice and will have the comprehensive skill set and leadership background needed to address society’s needs at local, regional, and global scales. The Civil Engineering curriculum emphasizes professional practice preparation using project-based, hands-on learning methods.

Modern and well-equipped laboratories emphasize experimental methods and measurement techniques. The Civil Engineering laboratory facilities include a variety of equipment. In addition to the existing laboratory facilities in Oliver Hall, such as universal testing machines, vibration apparatus, and a fluid dynamics laboratory, a state-of-the-art soil mechanics laboratory and concrete laboratories. Students in the Civil Engineering program may specialize in areas such as infrastructure evaluation and design, transportation analysis and planning, and green engineering and sustainable design.

Degree Requirements

Basic Science & Math
CHEM 163 General Chemistry I Lecture 3
CHEM 165 General Chemistry I Lab 1
PHYS 161 Engineering Physics I Lecture 3
PHYS 162 Engineering Physics I Lab 1
MATH 142 Calculus I 4
MATH 143 Calculus II 4
MATH 244 Calculus III 4
MATH 355 Diff. Equations 3
MATH 403 Probability and Statistics 3

Math/Science Electives 7
Choose 7 credit hours in Math or Science. The Math and Science elective cannot be a prerequisite course for required courses in the curriculum. Contact the Faculty Mentor for approval of the Math/Science Electives choices.

Communications
ENGL192 Advanced Writing for Professionals 3
CMM 293 Small Group Presentation 1

Earth &Atmospheric Science Courses
EAS 217 GIS in Civil Engineering 3

Liberal Arts
THEO 100 Theological Foundations 3
PHIL 340 Engineering Ethics 3
Humanistic Values Elective 6
Cultural Diversity 3

Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core on page 5 for more information.

Humanistic Values courses shall be chosen from: Humanities, Social & Behavioral Science, Philosophy, or Theology.

Humanities courses include: Fine Arts (excludes applied, studio, and performance courses), Literature (ENGL 200-260, 300-395, 410-479), History, and Foreign Languages (excludes English or native language).

Social & Behavioral Sciences courses include: Anthropology, Communication (CMM 100, 401, 402, 403, 406, 407, 409, 461), Communication Disorders (CSDI 100, 254, 470), Economics, Education (EDF 304, 305, 423, 470, EDI 204, 420, 462, 431), Political
Science, Psychology, Social Work (SWRK 100, 225, 302, 327), Sociology, Criminal Justice, and Public Policy Studies (excludes field service courses).

**Basic Engineering**
ECE 200 Electrical & Computer Engineering 3
ECE 201 Electrical & Computer Engineering Lab 1

**Engineering Science Courses**
ESCI 210 Statics 3
ESCI 211 Dynamics 3
ESCI 310 Mechanics of Solids 3
ESCI 311 Mechanics of Solids Lab 1
ESCI 322 Fluid Dynamics 3
ESCI 323 Fluid Dynamics Lab 1

**Civil Engineering Courses**
All of the following courses will be offered only once a year.
CVNG 101 Freshman Engineering I 1
CVNG 102 Freshman Engineering II 1
CVNG 150 Civil Engineering Computing 3
CVNG 203 Sustainability & Environmental Engr. 3
CVNG 204 Sustainability & Envir. Engr. Lab 1
CVNG 301 Structural Analysis 3
CVNG 302 Structural Analysis Lab 1
CVNG 303 Civil Engineering Materials 2
CVNG 305 Introduction to Surveying 1
CVNG 307 Engineering Project Management 2
CVNG 309 Geotechnical Engineering 3
CVNG 310 Geotechnical Engineering Lab 3
CVNG 311 Transportation Engineering 3
CVNG 312 Transportation Engineering Lab 1
CVNG 313 Hydraulic Engineering 3
CVNG 314 Hydraulic Engineering Lab 1
CVNG 315 Introduction to Structural Design 3
CVNG 401 Senior Engineering 1
CVNG 450 Capstone Design I 3
CVNG 451 Capstone Design II 3

**Professional Development Electives** 12
Professional Development Electives are not required to be engineering courses, but must support professional development goals. Courses can be selected from pre-approved elective tracks or students can develop individualized plans with departmental approval. A minimum of 6 hours must be upper division courses.

Minimum 12
Electrical and Computer Engineering
Huliyar S. Mallikarjuna, Ph.D., Chair
(mallikhs@slu.edu)

Faculty:
Will Ebel, Ph.D. (ebelwj@slu.edu)
Roobik Gharabagi, Ph.D. (gharabr@slu.edu)
Armineh Khalili, M.S.E.E. (khalili@shtslu.edu)
Kyle Mitchell, Ph.D. (mitchekk@slu.edu)
Habib Rahman, Ph.D. (rahmanmh@slu.edu)
Jason Frittts, Ph.D. (jfritts@slu.edu) secondary appointment

The Department of Electrical and Computer Engineering offers two undergraduate programs leading to the degree of Bachelor of Science in Electrical Engineering or Computer Engineering. The department provides programs that incorporate analysis, design and development of electrical, electronic, and computer systems, and prepares graduates for entry into the profession as productive and effective engineers.

Electrical Engineering (B.S.)

The program is directed toward sequential development of course work to provide breadth and depth in engineering. It provides instructions to cover broad areas that include electronics, communication systems, computer systems, control systems, power systems, electromagnetics and signal processing. The program is intended to develop the ability of graduates to apply knowledge of mathematics, sciences and engineering. It ensures that graduates have an opportunity to work on multi-disciplinary teams, and also develop effective communication skills. In addition to a strong focus on computer skills and computer software, the program provides a design experience, which is developed and integrated throughout the program by introducing fundamental elements of design process in course work. The program includes a two-semester design sequence to provide a meaningful, major engineering design experience that also focuses on professional practice. Several modern laboratories in the program provide “hands-on” experience. There is a strong emphasis on the studies of humanities and social sciences that serve not only to fulfill an objective appropriate to the engineering profession but also to meet Saint Louis University’s educational objectives. The overall program provides an integrated educational experience and training to maintain professional competency through life-long learning.

Students also have the option to receive B.S. in Electrical Engineering with concentration in Bioelectronics. (Emphasis in Engineering or Pre-Med)

Electrical and Computer Engineering Programs are accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org

Students are highly encouraged and assisted to seek internship and co-op opportunities with local and national companies. Qualified students are also invited to join department faculty to carry out cutting edge research.

Student professional organizations such as the Institute of Electrical and Electronics Engineers (IEEE), Society of Women Engineer (SWE) and others are active and very successful in local and national competitions such as “Black Box”, Hardware Design, Robotics, and Ethics.

Program Mission
Within the context of Saint Louis University and Parks College of Engineering and Aviation, the mission of the Electrical Engineering Program is to adequately prepare graduates to enter into the engineering professions, especially in the areas of analysis, design, and development of electrical and/or computer systems and components.

Objectives and outcomes apply to concentrations with Electrical Engineering.

Program Educational Objectives

- Our graduates will have acquired advanced degrees or are engaged in advanced study in engineering, business, law, medicine, or other appropriate fields.
- Our graduates will have established themselves as practicing engineers in electrical, computer or related engineering fields.
- Our graduates will be filling the technical needs of society by solving engineering problems using Electrical or Computer engineering principles, tools, and practices.

Student Outcomes

Program outcomes are consistent with the mission statements of the department, the college, and the university. Program outcomes are given below.

a. An ability to apply knowledge of mathematics, science, and engineering.
b. An ability to design and conduct experiments, as well as to analyze and interpret data.
c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d. An ability to function on multi-disciplinary teams.

e. An ability to identify, formulate, and solve engineering problems.

f. An understanding of professional and ethical responsibility.

g. An ability to communicate effectively.

h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context.

i. A recognition of the need for, and an ability to engage in life-long learning.

j. A knowledge of contemporary issues.

k. An ability to use techniques, skills, and modern engineering tools necessary for engineering practice.

l. Knowledge and application of probability, statistics, and advanced math.

m. Knowledge of mathematics and the basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic systems which may include hardware and software.

n. Knowledge of discrete mathematics.

### Liberal Arts Requirements (15 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHIL 340 Ethics and Engineering</td>
<td>3</td>
</tr>
<tr>
<td>THEO 100 Theological Foundations</td>
<td>3</td>
</tr>
<tr>
<td>Cultural Diversity</td>
<td>3</td>
</tr>
<tr>
<td>Humanities</td>
<td>3</td>
</tr>
<tr>
<td>Social &amp; Behavioral Science</td>
<td>3</td>
</tr>
</tbody>
</table>

Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core on page 5 for more information.

Humanities courses include: Fine Arts (excludes applied, studio, and performance courses), Literature (ENGL 200-260, 300-395, 410-479), History, and Foreign Languages (excludes English or native language).

Social & Behavioral Sciences courses include: Anthropology, Communication (CMM 100, 401, 402, 403, 406, 407, 409, 461), Communication Disorders (CSDI 100, 254, 470), Economics, Education (EDF 304, 305, 423, 470, EDI 204, 420, 462, 431), Political Science, Psychology, Social Work (SWRK 100, 225, 302, 327), Sociology, Criminal Justice, and Public Policy Studies (excludes field service courses).

### Electrical Engineering Core Requirements (50 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 101 Intro to ECE</td>
<td>1</td>
</tr>
<tr>
<td>ECE 102 Intro to ECE II</td>
<td>1</td>
</tr>
<tr>
<td>ECE 202 Engineering Circuits I</td>
<td>3</td>
</tr>
<tr>
<td>ECE 203 Engineering Circuits II</td>
<td>3</td>
</tr>
<tr>
<td>ECE 204 Electrical Science Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 205 Digital Design</td>
<td>3</td>
</tr>
<tr>
<td>ECE 206 Digital Design Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 310 Electric Energy Conversion</td>
<td>3</td>
</tr>
<tr>
<td>ECE 325 Microprocessors</td>
<td>3</td>
</tr>
<tr>
<td>ECE 326 Microprocessors Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 330 Semiconductor Devices</td>
<td>3</td>
</tr>
<tr>
<td>ECE 331 Electronic Circuit Design</td>
<td>3</td>
</tr>
<tr>
<td>ECE 332 Electronic Circuit Design Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 340 Electromagnetic Fields</td>
<td>3</td>
</tr>
<tr>
<td>ECE 350 Signals &amp; Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECE 351 Signals &amp; Systems Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 390 Junior Design</td>
<td>1</td>
</tr>
<tr>
<td>ECE 420 Automatic Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECE 440 Electromagnetic Waves</td>
<td>3</td>
</tr>
<tr>
<td>ECE 460 Communication Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECE 490 ECE Design I</td>
<td>3</td>
</tr>
<tr>
<td>ECE 491 ECE Design II</td>
<td>3</td>
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</tbody>
</table>

### Degree Requirements

#### Basic Science & Math Requirements (36 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 163 General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 165 General Chemistry I Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 161 Engineering Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 162 Engineering Physics I Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 163 Engineering Physics II</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 164 Engineering Physics II Lab</td>
<td>1</td>
</tr>
<tr>
<td>MATH 135 Discrete Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 142 Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 143 Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 244 Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 311 Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 355 Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 403 Probability and Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Communications Requirements (6 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 190 Advance Strategies Rhetoric &amp; Research</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 400 Business &amp; Professional Writing</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Computer Requirement

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 145 Intro to Scientific Programming</td>
<td>3</td>
</tr>
</tbody>
</table>
ECE Electives for EE majors:
Students are required to take at least six (6) credit hours from the following list. Please check with ECE Dept. for a complete list of approved electives.

- ECE317 Computer Architecture
- ECE400 Sustainable Energy
- ECE410 Systems Engineering
- ECE420 Image Processing
- ECE426 Robotics Design
- ECE430 Analog IC
- ECE435 Digital IC
- ECE441 Radar Systems
- ECE445 Computer Networks
- ECE450 Filter Design
- ECE451 Digital Signal Processing
- ECE461 Spacecraft Communications
- ECE462 Cellular Communications
- ECE470 Energy Technologies I
- ECE510 Power Systems Analysis II
- ECE498 Special Topics
- MATH465 Cryptography

One Open Elective
One course of three credits satisfying another minor or major or should be treated as technical elective.

Two Technical Electives
2 approved course (3 hours) selected from courses in science, mathematics, or engineering, at the 200-level or higher, or Computer Science at 180 or higher. This course must not be used to satisfy other curriculum requirements.

Internship and Co-op
Although not required, students are encouraged to participate in an internship or cooperative experience before graduation.

- ECE 275 Co-op 0-3
- ECE 375 Co-op 0-3
- ECE 475 Co-op 0-3
- ECE 276 Internship 0-3
- ECE 376 Internship 0-3
- ECE 476 Internship 0-3

Minimum BS Credits 125

Bioelectronics Concentration (B.S. in Electrical Engineering)

The newly established Bioelectronics concentration is a joint effort by the Electrical and Computer Engineering Department and the Biomedical Engineering Department of Parks College. The course of study combines science and engineering, incorporating courses in biology, chemistry, math, biomedical engineering, electrical and electronic engineering, and others. Students in the Bioelectronics track will pursue either of two emphases, engineering or pre-med, and will graduate with a B.S. in Electrical Engineering and a minor in Biomedical Engineering.

While pursuing the degree, the students can expect to spend a good deal of their time in our well-equipped laboratories, complementing classroom instruction with hands-on experience. Design experience is well integrated throughout the four-year curriculum; student begins to conduct laboratory experiments immediately, starting from the freshman year. The program culminates with a full-year senior design experience in which students work in interdisciplinary teams to carry out major projects. Students are also welcome to work with faculty to carry out research and further enhance their educational experience. Faculty members strongly encourage students to bolster their learning experience by seeking internship and co-op opportunities locally and nationally within the bioengineering industry.

When students graduate from the program with the Electrical Engineering Degree with Bioelectronics concentration in hand, they will find a wealth of career opportunities open to them as effective engineers in bioengineering industries. Graduates can find employment with hospitals’ Clinical Engineering Divisions, medical equipment and medical device manufacturers, healthcare R&D centers, healthcare services companies, medical laboratories, university laboratories, and equipment vendors. Degree-holders could also choose to work in the electrical engineering and biomedical engineering industries. Graduates will be able to provide much needed training and support in the use of highly sophisticated medical equipment to researchers, clinicians, medical doctors, and other healthcare professionals.

Students pursuing pre-med emphasis are well prepared to enter a highly challenging and rewarding field of medicine. Bioelectronics with pre-med emphasis provides an excellent opportunity for future medical doctors to be well versed in technological advances. It allows for much greater integration and innovation of technology in medicine. Technological advances such as MRI, CAT scan, and many others are clear examples of such innovative integration.

Degree Requirements

Basic Science & Math (51 credits)
- BIOL 104 Biology I & Lab 4
- BIOL 106 Biology II & Lab 4
- BIOL 260 Human Physiology 3
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 163</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 165</td>
<td>General Chemistry I Lab</td>
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<tr>
<td>CHEM 164</td>
<td>General Chemistry II</td>
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</tr>
<tr>
<td>CHEM 166</td>
<td>General Chemistry II Lab</td>
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</tr>
<tr>
<td>PHYS 161</td>
<td>Engineering Physics I</td>
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</tr>
<tr>
<td>PHYS 162</td>
<td>Engineering Physics I Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 163</td>
<td>Engineering Physics II</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 164</td>
<td>Engineering Physics II Lab</td>
<td>1</td>
</tr>
<tr>
<td>MATH 135</td>
<td>Discrete Math</td>
<td>3</td>
</tr>
<tr>
<td>MATH 142</td>
<td>Calculus I</td>
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<tr>
<td>MATH 143</td>
<td>Calculus II</td>
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<td>MATH 311</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 355</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 403</td>
<td>Probability and Statistics</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 190</td>
<td>Advance Strategies Rhetoric &amp; Research</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 400</td>
<td>Business &amp; Professional Writing</td>
<td>3</td>
</tr>
</tbody>
</table>

Liberal Arts (15 credits)
- PHIL 340 Ethics and Engineering: 3 credits
- THEO 100 Theological Foundations: 3 credits
- Cultural Diversity: 3 credits
- Humanities: 3 credits
- Social & Behavioral Science: 3 credits

Communications (6 credits)
- ENGL 190: 3 credits
- ENGL 400: 3 credits

Electrical Engineering Core Requirements (41 credits)
- ECE 101: 1 credit
- ECE 102: 1 credit
- ECE 202: 3 credits
- ECE 203: 3 credits
- ECE 204: 1 credit
- ECE 205: 3 credits
- ECE 206: 1 credit

ECE 325 Microprocessors: 3 credits
ECE 326 Microprocessors Lab: 1 credit
ECE 332 Semiconductor Devices: 3 credits
ECE 331 Electronic Circuit Design: 3 credits
ECE 332 Electronic Circuit Design Lab: 1 credit
ECE 340 Electromagnetic Fields: 3 credits
ECE 350 Signals & Systems: 3 credits
ECE 351 Signals & Systems Lab: 1 credit
ECE 390 Junior Design: 1 credit
ECE 420 Automatic Control Systems: 3 credits
ECE 490 ECE Design I: 3 credits
ECE 491 ECE Design II: 3 credits

Biomedical Engineering Core (12 credits)
- BME 200: 3 credits
- BME 405: 3 credits
- BME 410: 3 credits
- BME 415: 3 credits

Biomedical, Electrical, Computer Engineering Elective
- Select one 3 credit hour course from a list of approved ECE or BME courses at 300 level or higher.

Internship and Co-op
- Although not required, students are encouraged to participate in an internship or cooperative experience before graduation.
- ECE 275 Co-op: 0-3 credits
- ECE 375 Co-op: 0-3 credits
- ECE 475 Co-op: 0-3 credits
- ECE 276 Internship: 0-3 credits
- ECE 376 Internship: 0-3 credits
- ECE 476 Internship: 0-3 credits

Minimum BS Credits 128

Bioelectronics Concentration (B.S. in Electrical Engineering) Pre-Med Emphasis

Degree Requirements

Basic Science & Math (59 credits)
- BIOL 104: 4 credits
- BIOL 106: 4 credits
- BIOL 302: 3 credits
- CHEM 163: 3 credits
- CHEM 165: 3 credits
- CHEM 166: 3 credits
- CHEM 342: 3 credits
- CHEM 344: 3 credits
- CHEM 343: 3 credits
- CHEM 345: 3 credits
- PHYS 161: 3 credits

Liberal Arts and Communications: 15 credits

Electrical Engineering Core: 41 credits

Electrical Engineering Electives: 12 credits

Internship and Co-op: 0-3 credits

Minimum BS Credits: 128
PHYS 162 Engineering Physics I Lab 1
PHYS 163 Engineering Physics II 3
PHYS 164 Engineering Physics II Lab 1
MATH 135 Discrete Math 3
MATH 142 Calculus I 4
MATH 143 Calculus II 4
MATH 244 Calculus III 4
MATH 311 Linear Algebra 3
MATH 355 Differential Equations 3
MATH 403 Probability and Statistics 3

Communications (6 credits)
ENGL 190 Advance Strategies Rhetoric & Research 3
ENGL 400 Business & Professional Writing 3

Liberal Arts (15 credits)
PHIL 340 Ethics and Engineering 3
THEO 100 Theological Foundations 3
Cultural Diversity 3
Humanities 3
Social & Behavioral Science 3

Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core on page 5 for more information.

Humanities courses include: Fine Arts (excludes applied, studio, and performance courses), Literature (ENGL 200-260, 300-395, 410-479), History, and Foreign Languages (excludes English or native language).

Social & Behavioral Sciences courses include:
Anthropology, Communication (CMM 100, 401, 402, 403, 406, 407, 409, 461), Communication Disorders (CSDI 100, 254, 470), Economics, Education (EDF 304, 305, 423, 470, EDI 204, 420, 462, 431), Political Science, Psychology, Social Work (SWRK 100, 225, 302, 327), Sociology, Criminal Justice, and Public Policy Studies (excludes field service courses).

Electrical Engineering Core (41 credits)
ECE 101 Intro to ECE 1
ECE 102 Intro to ECE II 1
ECE 202 Engineering Circuits I 3
ECE 203 Engineering Circuits II 3
ECE 204 Electrical Science Lab 1
ECE 205 Digital Design 3
ECE 206 Digital Design Lab 1
ECE 325 Microprocessors 3
ECE 326 Microprocessors Lab 1
ECE 330 Semiconductor Devices 3
ECE 331 Electronic Circuit Design 3
ECE 332 Electronic Circuit Design Lab 1
ECE 340 Electromagnetic Fields 3
ECE 350 Signals & Systems 3
ECE 351 Signals & Systems Lab 1
ECE 390 Junior Design 1
ECE 420 Automatic Control Systems 3
ECE 490 ECE Design I 3
ECE 491 ECE Design II 3

Biomedical Engineering Core
BME 200 BME Computing 3
BME 405 Biomedical Instrumentation 3

Biomedical, Electrical, Computer Engineering Option
Select one 3 credit hour course from a list of approved ECE or BME courses at 300 level or higher.

Minimum BS Credits 127

Computer Engineering (B.S.)
The Computer Engineering degree program is directed toward sequential development of course work to provide breadth and depth in electrical engineering and computer science. It provides instructions to cover broad areas that include analog and digital electronics, signal processing, computer systems, Computer Architecture, Operating Systems, Advanced Digital Design, Computer Networks and others. The program is intended to develop the ability of graduates to apply knowledge of mathematics, sciences, engineering and computer science. It ensures that graduates have an opportunity to work on multi-disciplinary teams, and also develop effective communication skills. In addition to a strong focus on computer skills and computer software, the program provides a design experience which is developed and integrated throughout the program by introducing fundamental elements of design process in course work. The program also includes a two-semester design sequence to provide a meaningful, major engineering design experience that also focuses on professional practice. Several modern laboratories in the program provide “hands-on” experience. There is also a strong emphasis on the studies of humanities and social sciences that serve not only to fulfill an objective appropriate to the engineering profession but also to meet Saint Louis University’s educational objectives. The overall program provides an integrated educational experience and training to maintain professional competency through life-long learning.

Students are highly encouraged and assisted to seek internship and co-op opportunities with local and national companies. Qualified students are also invited to join department faculty to carry out cutting edge research.
Student professional organizations such as the Institute of Electrical and Electronics Engineers (IEEE), Society
of Women Engineers (SWE), and others are active and very successful in local and national competitions such as “Black Box”, Hardware Design, Robotics, and others.

Program Mission
Within the context of Saint Louis University and Parks College of Engineering and Aviation, the mission of the Electrical Engineering Program is to adequately prepare graduates to enter into the engineering professions, especially in the areas of analysis, design, and development of electrical and/or computer systems and components.

Objectives and outcomes apply also to Computer Engineering with pre-law minor.

Program Educational Objectives

• Our graduates will have acquired advanced degrees or are engaged in advanced study in engineering, business, law, medicine, or other appropriate fields.
• Our graduates will have established themselves as practicing engineers in electrical, computer or related engineering fields.
• Our graduates will be filling the technical needs of society by solving engineering problems using Electrical or Computer engineering principles, tools, and practices.

Student Outcomes

Program outcomes are consistent with the mission statements of the department, the college, and the university. Program outcomes are given below.

a. An ability to apply knowledge of mathematics, science, and engineering.
b. An ability to design and conduct experiments, as well as to analyze and interpret data.
c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d. An ability to function on multi-disciplinary teams.
e. An ability to identify, formulate, and solve engineering problems.
f. An understanding of professional and ethical responsibility.
g. An ability to communicate effectively.
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context.
i. A recognition of the need for, and an ability to engage in life-long learning.
j. A knowledge of contemporary issues.
k. An ability to use techniques, skills, and modern engineering tools necessary for engineering practice.
l. Knowledge and application of probability, statistics, and advanced math.
m. Knowledge of mathematics and the basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic systems which may include hardware and software.
n. Knowledge of discrete mathematics.

Degree Requirements

Basic Science & Math (36 credits)
CHEM 163 General Chemistry I 3
CHEM 165 General Chemistry I Lab 1
PHYS 161 Engineering Physics I 3
PHYS 162 Engineering Physics I Lab 1
PHYS 163 Engineering Physics II 3
PHYS 164 Engineering Physics II Lab 1
MATH 135 Discrete Mathematics 3
MATH 142 Calculus I 4
MATH 143 Calculus II 4
MATH 244 Calculus III 4
MATH 311 Linear Algebra 3
MATH 355 Differential Equations 3
MATH 403 Probability and Statistics 3

Communications (6 credits)
ENGL 190 Advance Strategies Rhetoric & Research 3
ENGL 400 Business & Professional Writing 3

Computer Science (14 credits)
CSCI 150 Intro Object Oriented Program 4
CSCI 180 Data Structures 4
CSCI 290 OO Software Design 3
CSCI 324 Operating Systems 3

Liberal Arts (15 credits)
PHIL 340 Ethics and Engineering 3
THEO 100 Theological Foundations 3
Cultural Diversity 3
Humanities 3
Social & Behavioral Science 3
Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core on page 5 for more information.

Humanities courses include: Fine Arts (excludes applied, studio, and performance courses), Literature (ENGL 200-260, 300-395, 410-479), History, and Foreign Languages (excludes English or native language).

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**Computer Engineering Core (44 credits)**

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 101</td>
<td>Intro to ECE</td>
<td>1</td>
</tr>
<tr>
<td>ECE 102</td>
<td>Intro to ECE II</td>
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</tr>
<tr>
<td>ECE 202</td>
<td>Engineering Circuits I</td>
<td>3</td>
</tr>
<tr>
<td>ECE 203</td>
<td>Engineering Circuits II</td>
<td>3</td>
</tr>
<tr>
<td>ECE 204</td>
<td>Electrical Science Lab</td>
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<tr>
<td>ECE 205</td>
<td>Digital Design</td>
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<tr>
<td>ECE 206</td>
<td>Digital Design Lab</td>
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<td>ECE 305</td>
<td>Advanced Digital Design</td>
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<tr>
<td>ECE 315</td>
<td>Computer Systems Design</td>
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</tr>
<tr>
<td>ECE 316</td>
<td>Computer Systems Design Lab</td>
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</tr>
<tr>
<td>ECE 317</td>
<td>Computer Architecture</td>
<td>3</td>
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<tr>
<td>ECE 325</td>
<td>Microprocessors</td>
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<td>ECE 326</td>
<td>Microprocessors Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 330</td>
<td>Semiconductor Devices</td>
<td>3</td>
</tr>
<tr>
<td>ECE 350</td>
<td>Signals &amp; Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECE 390</td>
<td>Junior Design</td>
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<td>ECE 445</td>
<td>Computer Networks</td>
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<td>ECE 490</td>
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</tr>
<tr>
<td>ECE 491</td>
<td>ECE Design II</td>
<td>3</td>
</tr>
</tbody>
</table>

**ECE (CSCI) Electives for CpE Majors**

Students are required to take at least six (6) credit hours from the following list. Please check with ECE Dept. for a complete list of approved electives.

ECE310 Energy Conversion
ECE331 Electronic Circuits
ECE340 Electromagnetic Fields
ECE425 Hardware Software Co-design
ECE426 Robotics
ECE435 Digital IC
ECE451 Digital Signal Processing

**ECE498 Special Topics**
CSCI314 Algorithms
CSCI344 Programming Languages
CSCI357 Computer Graphics I
CSCI371 Databases
CSCI390 Software Engineering
CSCI425 Advanced Operating Systems
CSCI434 Network Programming II
CSCI462 Artificial Intelligence
MATH 465 Cryptography

**Humanities (9 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 275</td>
<td>Co-op</td>
<td>0-3</td>
</tr>
<tr>
<td>ECE 375</td>
<td>Co-op</td>
<td>0-3</td>
</tr>
<tr>
<td>ECE 475</td>
<td>Co-op</td>
<td>0-3</td>
</tr>
<tr>
<td>ECE 276</td>
<td>Internship</td>
<td>0-3</td>
</tr>
<tr>
<td>ECE 376</td>
<td>Internship</td>
<td>0-3</td>
</tr>
<tr>
<td>ECE 476</td>
<td>Internship</td>
<td>0-3</td>
</tr>
</tbody>
</table>

**Minimum BS Credits 127**

**B.S. in Computer Engineering with Pre-Law Minor**

**Degree Requirements**

**Basic Science & Math (36 credits)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 163</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 165</td>
<td>General Chemistry I Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 161</td>
<td>Engineering Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 162</td>
<td>Engineering Physics I Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 163</td>
<td>Engineering Physics II</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 164</td>
<td>Engineering Physics II Lab</td>
<td>1</td>
</tr>
<tr>
<td>MATH 135</td>
<td>Discrete Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 142</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 143</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 244</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 311</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 355</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 403</td>
<td>Probability and Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Communications (9 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 190</td>
<td>Adv Strategies Rhetoric &amp; Research</td>
<td>3</td>
</tr>
</tbody>
</table>

**Liberal Arts (9 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHIL 340</td>
<td>Ethics and Engineering</td>
<td>3</td>
</tr>
<tr>
<td>THEO 100</td>
<td>Theological Foundations</td>
<td>3</td>
</tr>
</tbody>
</table>
Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core on page 5 for more information. (PLS 400 will satisfy cultural diversity).

**Computer Engineering Core (44 credits)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 101</td>
<td>Intro to ECE</td>
<td>1</td>
</tr>
<tr>
<td>ECE 102</td>
<td>Intro to ECE II</td>
<td>1</td>
</tr>
<tr>
<td>ECE 202</td>
<td>Engineering Circuits I</td>
<td>3</td>
</tr>
<tr>
<td>ECE 203</td>
<td>Engineering Circuits II</td>
<td>3</td>
</tr>
<tr>
<td>ECE 204</td>
<td>Electrical Science Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 205</td>
<td>Digital Design</td>
<td>3</td>
</tr>
<tr>
<td>ECE 206</td>
<td>Digital Design Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 305</td>
<td>Advanced Digital Design</td>
<td>3</td>
</tr>
<tr>
<td>ECE 315</td>
<td>Computer Systems Design</td>
<td>3</td>
</tr>
<tr>
<td>ECE 316</td>
<td>Computer Systems Design Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 317</td>
<td>Computer Architecture</td>
<td>3</td>
</tr>
<tr>
<td>ECE 325</td>
<td>Microprocessors</td>
<td>3</td>
</tr>
<tr>
<td>ECE 326</td>
<td>Microprocessors Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 330</td>
<td>Semiconductor Devices</td>
<td>3</td>
</tr>
<tr>
<td>ECE 350</td>
<td>Signals &amp; Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECE 351</td>
<td>Signals &amp; Systems Lab</td>
<td>1</td>
</tr>
<tr>
<td>ECE 390</td>
<td>Junior Design</td>
<td>1</td>
</tr>
<tr>
<td>ECE 445</td>
<td>Computer Networks</td>
<td>3</td>
</tr>
<tr>
<td>ECE 490</td>
<td>ECE Design I</td>
<td>3</td>
</tr>
<tr>
<td>ECE 491</td>
<td>ECE Design II</td>
<td>3</td>
</tr>
</tbody>
</table>

**Computer Science (14 credits)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 150</td>
<td>Intro Object Oriented Program</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 180</td>
<td>Data Structures</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 290</td>
<td>OO Software Design</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 324</td>
<td>Operating Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

**ECE (CSCI) Electives for CpE Majors**

Students are required to take at least six (6) credit hours from the following list. Please check with ECE Dept. for a complete list of approved electives.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE310</td>
<td>Energy Conversion</td>
</tr>
<tr>
<td>ECE331</td>
<td>Electronic Circuits</td>
</tr>
<tr>
<td>ECE340</td>
<td>Electromagnetic Fields</td>
</tr>
<tr>
<td>ECE425</td>
<td>Hardware Software Co-design</td>
</tr>
<tr>
<td>ECE426</td>
<td>Robotics</td>
</tr>
<tr>
<td>ECE435</td>
<td>Digital IC</td>
</tr>
<tr>
<td>ECE451</td>
<td>Digital Signal Processing</td>
</tr>
<tr>
<td>ECE498</td>
<td>Special Topics</td>
</tr>
<tr>
<td>CSCI314</td>
<td>Algorithms</td>
</tr>
<tr>
<td>CSCI344</td>
<td>Programming Languages</td>
</tr>
<tr>
<td>CSCI357</td>
<td>Computer Graphics I</td>
</tr>
<tr>
<td>CSCI371</td>
<td>Databases</td>
</tr>
<tr>
<td>CSCI390</td>
<td>Software Engineering</td>
</tr>
<tr>
<td>CSCI425</td>
<td>Advanced Operating Systems</td>
</tr>
<tr>
<td>CSCI434</td>
<td>Network Programming II</td>
</tr>
<tr>
<td>CSCI462</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>MATH 465</td>
<td>Cryptography</td>
</tr>
</tbody>
</table>

**One core elective under Certificate Program**

**One Technical Elective**

1 approved course (3 hours) selected from courses in science, mathematics, or engineering, at the 300-level or higher, or computer science at any level. This course must not be used to satisfy other curriculum requirements.

**Pre-law Core (15 credits)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>PLS 100</td>
<td>Intro to Law</td>
</tr>
<tr>
<td>PLS 105</td>
<td>Intro to Legal Careers</td>
</tr>
<tr>
<td>PLS 200 or 210</td>
<td></td>
</tr>
<tr>
<td>PLS 390</td>
<td>Intro to Aptl. Advocacy</td>
</tr>
<tr>
<td>PLS 375</td>
<td>Issues in Law</td>
</tr>
<tr>
<td>PLS 400</td>
<td>Comparative Legal Systems</td>
</tr>
</tbody>
</table>

**Minimum BS Credits 130**
Physics

William D. Thacker, Ph.D., Chair
http://www.slu.edu/x14154.xml

Faculty:
Leslie P. Benofy, Ph.D.
Gregory L. Comer, Ph.D.
Vijai V. Dixit, Ph.D.
John C. James, Ph. D.
Irma Kuljanishvili, Ph.D.
Martin Nikolo, Ph. D.
Jean Potvin, Ph.D.
Ian H. Redmount, Ph.D.
Thalanayar S. Santhanam, Ph.D.
William D. Thacker, Ph.D.
David Wisbey, Ph.D.

The Department of Physics offers two undergraduate degrees in Physics: the Bachelor of Science (B. S.) degree for students enrolled in Parks College and the Bachelor of Arts (B. A.) degree for students in the College of Arts and Sciences. The department also offers a Bachelor of Science (B. S.) degree in Engineering Physics for students enrolled in Parks College. (See College of Arts and Sciences Section for the B. A. degree program.) In addition, the department offers Minors in Physics, useful primarily to students majoring in mathematics, computer science, engineering fields, and other sciences. Major-minor links between physics and other disciplines provide opportunities for students to acquire valuable analytical and problem-solving skills and to distinguish themselves from others pursuing similar career paths.

Physics (B. S.)

The Bachelor of Science degree stresses undergraduate research and applications of computers in physics, taking advantage of the unique facilities of Parks College within the University. A focused set of electives, the Allied Electives, allows a student to adapt the program to his or her own post-baccalaureate plans. For example, a student may use these electives to earn a minor in some other field, a double major in physics and mathematics or, in nine or ten semesters, to earn a double major in physics and engineering, or computer science. A student might use these electives to prepare for graduate school in physics or a related field, or for medical school.

The required courses listed below are accompanied by the Parks College core. This degree is conferred by Parks College. This curriculum also satisfies all requirements for a Minor in Engineering Mathematics.

Prerequisites (28 cr):
PHYS 111 Intro to Physics (as a Career) 1
CHEM 163/165 General Chemistry I/Lab 4
PHYS 161/162 Engineering Physics I/Lab 4
PHYS 163/164 Engineering Physics II/Lab 4
MATH 142 Calculus I 4
MATH 143 Calculus II 4
MATH 244 Calculus III 4
CSCI 145 Scientific Programming 3

Required Physics & Mathematics Courses (39 cr)
PHYS 261/262 Modern Physics/Lab 4
PHYS 311 Classical Mechanics 3
PHYS 361 Modern Physics II 3
PHYS 421 Electricity and Magnetism I 3
PHYS 461 Quantum Mechanics 3
PHYS 331/332 Optics/Lab 4
PHYS 341 Thermo & Statistical Mechanics 3
PHYS 351 Analog and Digital Electronics 4
MATH 355 Differential Equations I 3
MATH 370 Adv Mathematics for Engineers 3
MATH 403 Probability & Stats for Engn 3
MATH 320 Numerical Methods 3

Additional Requirements (6 cr)
Two additional upper division physics courses (minimum 6 hours) selected from the list below.
PHYS 312 Advanced Classical Mechanics 3
PHYS 421 Electricity and Magnetism I 3
PHYS 462 Applic. of Quantum Mechanics 3

Research Experience (3 cr)
PHYS 386 Physics Research I 0
PHYS 487 Physics Research II 0
PHYS 488 Physics Research III 3

Allied Electives (21 cr)
Seven Courses Selected with Mentor 21

College Core (22 cr)
ENGL 190 or 192 Advanced Writing 3
CMM 220 Small Group Presentation 1
THEO 100 Theological Foundations 3
PHIL 205 Ethics 3
Social/Behavioral Science Elective 3
Humanities Elective 3
General Elect (Soc/Behav or Humanities) 3
Cultural Diversity Elective 3

Cultural Diversity, Humanities, and Social/Behavioral Science elective courses must be selected from an approved list. See the Parks College introduction in this catalog for more information.
Open Elective (3 cr)
One Course 3

Physics Minor
A Parks College student can earn a minor in physics by completing at least 22 hours of physics consisting of:
PHYS 161/162 Engineering Physics I/Lab 4
PHYS 163/164 Engineering Physics II/Lab 4
PHYS 261/262 Modern Physics/Lab 4
Three physics courses (one with Lab) numbered PHYS 300 – PHYS 493 10

A College of Arts & Sciences student can earn a minor in physics by completing at least 18 hours of physics consisting of:
PHYS 161/162 Engineering Physics I/Lab 4
PHYS 163/164 Engineering Physics II/Lab 4
PHYS 261/262 Modern Physics/Lab 4
Two physics courses numbered PHYS 300–PHYS 493 6

Engineering Physics (B. S.)

The Department of Physics, in collaboration with the Engineering Departments of Parks College offers a Bachelor of Science Degree in Engineering Physics that prepares students for a broad range of careers requiring scientific and technical knowledge. This program is ideally suited for those students who have an interest in and aptitude for both physics and engineering. The curriculum satisfies the requirements for a minor in Engineering Mathematics and has essentially the same physics content as our traditional B. S. degree. Students may select a concentration in Aerospace, Biomedical, Computer, Electrical, or Mechanical Engineering, or choose the Interdisciplinary Option. Each student completes a senior design project, typically as a member of a multidisciplinary team.

The required courses listed below are accompanied by the Parks College core. This degree is conferred by Parks College. This curriculum also satisfies all requirements for a Minor in Engineering Mathematics.

Concentration in Aerospace Engineering

Professional Orientation (1cr required)
Selected from the following:
PHYS 111 Introduction to Physics (as a Career) 1
ESCI 101 Freshman Engineering I 1
BME 100 Biomedical Engineering Orientation 1
ECE 101 Introduction to ECE 1
(It is recommended that students in this Concentration take PHYS111 and ESCI101)

Basic Science and Mathematics (43 cr)
CHEM 163/165 General Chemistry I/Lab 4
MATH 142 Calculus I 4
MATH 143 Calculus II 4
MATH 244 Calculus III 4
MATH 355 Differential Equations I 3
MATH 370 Adv Mathematics for Engineers 3
MATH 403 Probability & Stats for Engn 3
MATH 320 Numerical Methods 3
PHYS 161/162 Engineering Physics I/Lab 4
PHYS 163/164 Engineering Physics II/Lab 4
PHYS 261/262 Modern Physics/Lab 4
PHYS 461 Quantum Mechanics 3

Engineering Physics & Engineering Topics (58 cr)
ESCI 102 Intro to Computer Aided Design 1
CSCI 145 Scientific Programming 3
ESCI 210 Statics 3
ESCI 211 Dynamics 3
ESCI 220 Thermodynamics 3
ESCI 322/323 Fluid Mechanics/Lab 4
ESCI 330 Linear Vibrations 3
PHYS 331/332 Optics/Lab 4
PHYS 351 Analog and Digital Electronics 4
PHYS 421 Electricity & Magnetism I 3

Two Engineering Physics Electives Selected From:
PHYS 312 Advanced Classical Mechanics 3
PHYS 422 Electricity and Magnetism II 3
PHYS 462 Applic. of Quantum Mechanics 3
PHYS 493 Special Topics (Selected w mentor) 3

One of the Two Following Tracks:
Track 1 Aeronautics
AENG 200 Intro to Aero and Astronautics 3
AENG 320 Performance 3
AENG 420 Stability and Control 3
Two Upper Division Courses 6

Track 2 Astronautics
AENG 200 Intro to Aero and Astronautics 3
AENG 322 Astrodynamics 3
AENG 441 Orbital Mechanics 3
Two Upper Division Courses 6

Senior Design Project
AENG 450 Engineering Design I 3
AENG 451 Engineering Design II 3
**College Core (22 cr)**
- ENGL 190 or 192 Advanced Writing 3
- CMM 220 Small Group Presentation 1
- THEO 100 Theological Foundations 3
- PHIL 205 Ethics 3
- PHIL 340 Engineering Ethics 3
- Social/Behavioral Science Elective 3
- Humanities Elective 3
- Cultural Diversity Elective 3

Cultural Diversity, Humanities, and Social/Behavioral Science elective courses must be selected from an approved list. See the Parks College introduction in this catalog for more information.

**Open Elective (3 cr)**
- One Course 3

**Concentration in Biomedical Engineering**

**Professional Orientation (1 cr required)**
- Selected from the following:
  - PHYS 111 Introduction to Physics (as a Career) 1
  - ESCI 101 Freshman Engineering I 1
  - BME 100 Biomedical Engineering Orientation 1
  - ECE 101 Introduction to ECE 1

**Basic Science and Mathematics (58 cr)**
- CHEM 163/165 General Chemistry I/Lab 4
- CHEM 164/166 General Chemistry II/Lab 4
- BIOL 104 Principles of Biology I/Lab 4
- BIOL 106 Principles of Biology II/Lab 4
- BIOL 260 Human Physiology 3
- MATH 142 Calculus I 4
- MATH 143 Calculus II 4
- MATH 244 Calculus III 4
- MATH 355 Differential Equations I 3
- MATH 370 Adv Mathematics for Engineers 3
- MATH 403 Probability & Stats for Engr 3
- MATH 320 Numerical Methods 3
- PHYS 161/162 Engineering Physics I/Lab 4
- PHYS 163/164 Engineering Physics II/Lab 4
- PHYS 261/262 Modern Physics/Lab 4
- PHYS 461 Quantum Mechanics 3

**Engineering Physics & Engineering Topics (48 cr)**
- BME 101 Biomedical Engineering Introduction 1
- BME 200 Biomedical Computing 3
- BME 320 Mechanics 3
- BME 420 Biomechanics 3
- PHYS 341 Thermo & Statistical Mechanics 3
- ECE 200/201 Elec & Computer Engineering w Lab 4
- PHYS 331/332 Optics/Lab 4
- PHYS 421 Electricity and Magnetism I 3

**Two Engineering Physics Electives Selected From:**
- PHYS 312 Advanced Classical Mechanics 3
- PHYS 422 Electricity and Magnetism II 3
- PHYS 462 Appl. of Quantum Mechanics 3
- PHYS 493 Special Topics (Selected w mentor) 3

**Complete Two of the Following Two-Course Sequences:**
- **Transport**
  - BME 330 Transport Fundamentals 3
  - BME 430 Biotransport 3
- **Materials Science**
  - BME 340 Materials Science 3
  - BME 440 Biomaterials 3
- **Measurements**
  - BME 305 Measurements 3
  - And one of the following two courses:
    - BME 405 Biomedical Instrumentation 3
    - BME 415 Sensory Systems 3
- **Signals and Systems**
  - BME 310 Signals and Systems 3
  - BME 410 Biomedical Signals 3

**Senior Design Project**
- BME 495 Senior Projects I 3
- BME 496 Senior Projects II 3

**College Core (22 cr)**
- ENGL 190 or 192 Advanced Writing 3
- CMM 220 Small Group Presentation 1
- THEO 100 Theological Foundations 3
- PHIL 205 Ethics 3
- PHIL 340 Engineering Ethics 3
- Social/Behavioral Science Elective 3
- Humanities Elective 3
- Cultural Diversity Elective 3

Cultural Diversity, Humanities, and Social/Behavioral Science elective courses must be selected from an approved list. See the Parks College introduction in this catalog for more information.

**Concentration in Computer Engineering**

**Professional Orientation (1 cr required)**
- Selected from the following:
  - PHYS 111 Introduction to Physics (as a Career) 1
  - ESCI 101 Freshman Engineering I 1
  - BME 100 Biomedical Engineering Orientation 1
  - ECE 101 Introduction to ECE 1

**Basic Science and Mathematics (46 cr)**
- CHEM 163/165 General Chemistry I/Lab 4
- MATH 142 Calculus I 4
- MATH 143 Calculus II 4
MATH 244 Calculus III 4
MATH 355 Differential Equations I 3
MATH 370 Adv Mathematics for Engineers 3
MATH 403 Probability & Stats for Engr 3
MATH 320 Numerical Methods 3
PHYS 161/162 Engineering Physics I/Lab 4
PHYS 163/164 Engineering Physics II/Lab 4
PHYS 261/262 Modern Physics/Lab 4
PHYS 311 Classical Mechanics 3
PHYS 461 Quantum Mechanics 3

Engineering Physics & Engineering Topics (53 cr)
CSCI 145 Scientific Programming 3
ECE 205/206 Digital Design / Lab 4
ECE 202 Engineering Circuits I 3
ECE 203 Engineering Circuits II 3
ECE 204 Electrical Science Lab 1
ECE 340 Electromagnetic Fields 3
ECE 330 Semiconductor Devices 3
ECE 352/356 Microprocessors / Lab 4
ECE 351/356 Computer Sys Design / Lab 4
Two Engineering Electives selected in consultation with advisor 6
PHYS 331/332 Optics/Lab 4
PHYS 341 Thermo & Statistical Mechanics 3

Senior Design Project
ECE 490 Electrical Engineering Design I 3
ECE 491 Electrical Engineering Design II 3

College Core (22 cr)
ENGL 190 or 192 Advanced Writing 3
CMM 220 Small Group Presentation 1
THEO 100 Theological Foundations 3
PHIL 205 Ethics 3
PHIL 340 Engineering Ethics 3
Social/Behavioral Science Elective 3
Humanities Elective 3
Cultural Diversity Elective 3

Cultural Diversity, Humanities, and Social/Behavioral Science elective courses must be selected from an approved list. See the Parks College introduction in this catalog for more information.

Open Electives (6 cr)
Two Courses 6

Concentration in Electrical Engineering

Professional Orientation (1cr required)
Selected from the following:
PHYS 111 Introduction to Physics (as a Career) 1
ESCI 101 Freshman Engineering I 1
BME 100 Biomedical Engineering Orientation 1
ECE 101 Introduction to ECE 1

Basic Science and Mathematics (46 cr)
CHEM163/165 General Chemistry I/Lab 4
MATH 142 Calculus I 4
MATH 143 Calculus II 4
MATH 244 Calculus III 4
MATH 355 Differential Equations I 3
MATH 370 Adv Mathematics for Engineers 3
MATH 403 Probability & Stats for Engr 3
MATH 320 Numerical Methods 3
PHYS 161/162 Engineering Physics I/Lab 4
PHYS 163/164 Engineering Physics II/Lab 4
PHYS 261/262 Modern Physics/Lab 4
PHYS 311 Classical Mechanics 3
PHYS 461 Quantum Mechanics 3

Engineering Physics & Engineering Topics (50-51 cr)
CSCI 145 Scientific Programming 3
ECE 202 Engineering Circuits I 3
ECE 203 Engineering Circuits II 3
ECE 204 Electrical Science Lab 1
ECE 340 Electromagnetic Fields 3
ECE 330 Semiconductor Devices 3
PHYS 331/332 Optics/Lab 4
PHYS 341 Thermo & Statistical Mechanics 3

Two Engineering Physics Electives Selected From:
PHYS 312 Advanced Classical Mechanics 3
PHYS 422 Electricity and Magnetism II 3
PHYS 462 Applic. of Quantum Mechanics 3
PHYS 493 Special Topics (Selected w mentor) 3

Two Engineering Physics Electives Selected From:
PHYS 312 Advanced Classical Mechanics 3
PHYS 422 Electricity and Magnetism II 3
PHYS 462 Applic. of Quantum Mechanics 3
PHYS 493 Special Topics (Selected w mentor) 3

One of the Following Three Tracks:
Track 1 Electromagnetic Fields and Waves
ECE 310 Electric Energy Conversion 3
ECE 460 Communication Systems 3
ECE 440 Electromagnetic Waves 3
Two Engineering Electives selected in consultation with advisor 6

Track 2 Analog Electronics
ECE 350 Signals and Systems 3
ECE 331/332 Electronic Circuit Design/Lab 4
ECE 420 Automatic Control Systems 3
Two Engineering Electives selected in consultation with mentor 6

Track 3 Communication
ECE 205/206 Digital Design / Lab 4
ECE 350 Signals and Systems 3
ECE 460 Communication Systems 3
Two Engineering Electives selected in consultation with mentor 6

**Senior Design Project**
ECE 490 Electrical Engineering Design I 3
ECE 491 Electrical Engineering Design II 3

**College Core (22 cr)**
ENGL 190 or 192 Advanced Writing 3
CMM 220 Small Group Presentation 1
THEO 100 Theological Foundations 3
PHIL 205 Ethics 3
PHIL 340 Engineering Ethics 3
Social/Behavioral Science Elective 3
Humanities Elective 3
Cultural Diversity Elective 3

Cultural Diversity, Humanities, and Social/Behavioral Science elective courses must be selected from an approved list. See the Parks College introduction in this catalog for more information.

**Open Electives (6 cr)**
Two Courses 6

**Concentration in Mechanical Engineering**

**Professional Orientation (1cr required)**
Selected from the following:
PHYS 111 Introduction to Physics 1
ESCI 101 Freshman Engineering I 1
BME 100 Biomedical Engineering Orientation 1
ECE 101 Introduction to ECE 1
(It is recommended that students in this Concentration take PHYS 111 and ESCI 101)

**Basic Science and Mathematics (43 cr)**
CHEM163/165 General Chemistry I/Lab 4
MATH 142 Calculus I 4
MATH 143 Calculus II 4
MATH 244 Calculus III 4
MATH 355 Differential Equations I 3
MATH 370 Adv Mathematics for Engineers 3
MATH 403 Probability & Stats for Engn 3
MATH 320 Numerical Methods 3
PHYS 161/162 Engineering Physics I/Lab 4
PHYS 163/164 Engineering Physics II/Lab 4
PHYS 261/262 Modern Physics/Lab 4
PHYS 461 Quantum Mechanics 3

**Engineering Physics & Engineering Topics (59 cr)**
ESCI 102 Intro to Computer Aided Design 1
CSCI 145 Scientific Programming 3
ESCI 210 Statics 3
ESCI 211 Dynamics 3
ESCI 220 Thermodynamics 3
ESCI 310/311 Mechanics of Solids / Lab 4
ESCI 322/323 Fluid Mechanics/Lab 4
ESCI 330 Linear Vibrations 3
MENG 200 Foundations of Engineering Design 3
MENG 345 Machine Design 3
MENG 365 Computer Aided Engineering 3
Upper Division Engineering Course 3
PHYS 331/332 Optics/Lab 4
PHYS 351 Analog and Digital Electronics 4
PHYS 421 Electricity and Magnetism I 3

**Two Engineering Physics Electives Selected From:**
PHYS 312 Advanced Classical Mechanics 3
PHYS 422 Electricity and Magnetism II 3
PHYS 462 Applic. of Quantum Mechanics 3
PHYS 493 Special Topics (Selected w mentor) 3

**Senior Design Project**
MENG 450 Engineering Design I 3
MENG 451 Engineering Design II 3

**College Core (22 cr)**
ENGL 190 or 192 Advanced Writing 3
CMM 220 Small Group Presentation 1
THEO 100 Theological Foundations 3
PHIL 205 Ethics 3
PHIL 340 Engineering Ethics 3
Social/Behavioral Science Elective 3
Humanities Elective 3
Cultural Diversity Elective 3

Cultural Diversity, Humanities, and Social/Behavioral Science elective courses must be selected from an approved list. See the Parks College introduction in this catalog for more information.

**Open Elective (3 cr)**
One course 3

**Interdisciplinary Option**

**Professional Orientation (1cr required)**
Selected from the following:
PHYS 111 Introduction to Physics (as a Career) 1
ESCI 101 Freshman Engineering I 1
BME 100 Biomedical Engineering Orientation 1
ECE 101 Introduction to ECE 1

**Basic Science and Mathematics (55 cr)**
CHEM 163/165 General Chemistry I/Lab 4
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHEM 164/166</td>
<td>General Chemistry II/Lab</td>
<td>4</td>
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<tr>
<td>BIOL 104</td>
<td>Principles of Biology I/Lab</td>
<td>4</td>
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<tr>
<td>BIOL 106</td>
<td>Principles of Biology II/Lab</td>
<td>4</td>
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<tr>
<td>MATH 142</td>
<td>Calculus I</td>
<td>4</td>
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<tr>
<td>MATH 143</td>
<td>Calculus II</td>
<td>4</td>
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<tr>
<td>MATH 244</td>
<td>Calculus III</td>
<td>4</td>
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<tr>
<td>MATH 355</td>
<td>Differential Equations I</td>
<td>3</td>
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<tr>
<td>MATH 403</td>
<td>Adv Mathematics for Engineers</td>
<td>3</td>
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<tr>
<td>MATH 320</td>
<td>Probability &amp; Stats for Engn</td>
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<td>PHYS 161/162</td>
<td>Engineering Physics I/Lab</td>
<td>4</td>
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<tr>
<td>PHYS 163/164</td>
<td>Engineering Physics II/Lab</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 261/262</td>
<td>Modern Physics/Lab</td>
<td>4</td>
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</table>

**Engineering Physics & Engineering Topics (50 cr)**

**Engineering Breadth**

- **Engineering Mechanics** – One of the following options
  - BME 320, BME 420 Mechanics and Biomech
  - ESCI 210, 211 Statics and Dynamics

- **Computation** – One of the following options
  - BME 200 Biomedical Computing
  - CSCI 145 Scientific Programming

- **Thermodynamics** – One of the following options
  - PHYS 341 Thermo and Statistical Mechanics
  - ESCI 220 Thermodynamics

- **Electricity and Magnetism**
  - PHYS 421 Electricity and Magnetism I
  - And one of the following options:
    - ECE 200/201 Elec & Computer Engineering w Lab
    - PHYS 351 Analog and Digital Electronics

- **Optics**
  - PHYS 331/332 Optics / Lab

- **And two of the following three Engineering Breadth Areas:**
  - **Materials Science** – One of the following options
    - BME 340 Materials Science
    - ESCI 310 Mechanics of Solids
  - **Transport/Fluids** – One of the following options
    - BME 330 Transport Fundamentals
    - ESCI 322 Fluid Dynamics
  - **Signals/Systems** – One of the following options
    - BME 310 Signals and Systems
    - ECE 350 Signals and Systems

**Engineering Depth**

- Focus Area:
  - Three Upper Division Engineering courses

**Senior Design Project**

- Two Course Sequence

**College Core (22 cr)**

- ENGL 190 or 192 Advanced Writing
- CMM 220 Small Group Presentation
- THEO 100 Theological Foundations
- PHIL 205 Ethics
- PHIL 340 Engineering Ethics
- Social/Behavioral Science Elective
- Humanities Elective
- Cultural Diversity Elective

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