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, Biomedical Engineering and Civil 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 curriculum is accredited by the Aviation Accreditation Board International (AABI) 3410 Skyway Drive, Auburn, AL USA 36830. The College also offers an Aviation Management curriculum that prepares students with specialized knowledge of the aviation industry and a strong foundation in business administration. Additionally, student may pursue 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:
Aeronautics
  Concentrations available in Aviation Management and Flight Science
Aerospace Engineering
Biomedical Engineering
Civil Engineering
Computer Engineering
Electrical Engineering
  Concentration available in Bioelectronics
Engineering Physics
Interdisciplinary Engineering
Mechanical Engineering
Physics

Minors Available:
Air Traffic Control
Aerospace Engineering

Parks College, Math, Computer Science, & Physics students only
Biomedical Engineering
Flight Education
Flight Science majors only
Flight Science
Mechanical Engineering
Parks College, Math, Computer Science, & Physics students only
Physics

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>Bachelor of Science</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>3.00</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>3.00</td>
<td>2.70</td>
</tr>
<tr>
<td>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
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 intending to major in engineering who is admitted or starts with a math course lower than Pre-Calculus will be considered a Parks College Deciding student. These 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 credits 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 credits 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 credits 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) credits may be taken under the following options:
1. Any credits above the number required for graduation.
2. Any credits 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 credits within the area of concentration which are not required by the controlling department and for which the student has received the approval of the academic advisor. Pass/No Pass credits 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 Chief Instructor 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 Chief Instructor 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 credits 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 as an early warning notification to the student and his/her academic advisor. This report is, in effect, a warning. At the discretion of the instructor, a grade of “F” (failure in course) 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

Non-Degree
Anyone enrolled in Parks College who is not pursuing a program of study designed to obtain a degree from the college or university but who enrolls in one or more classes will be considered a non-degree student. Non-degree 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 credits, full-time if enrolled for between twelve and eighteen credits, and full-time on overload if enrolled for more than eighteen credits.

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 credits. The academic advisor may grant exceptions to these rules.
3. After receiving mid-term grades, the student must consult with his/her academic 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 credits.
3. After receiving their mid-term grades, they must consult with their academic 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 fifth 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 credits)
Philosophy and/or Ethics (3 credits)
Humanistic Values (6 credits)
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, American Studies, Foreign Language.

Knowledge (minimum of 16 credits)
Science with laboratory experience (4 credits)
Science courses shall be chosen from:
Astronomy, Biology, Chemistry, Engineering Science, Geology, Meteorology, Physics
Mathematics (3 credits)
Additional experience in Science and/or Mathematics (6 credits)
Science courses shall be chosen from:
Astronomy, Biology, Chemistry, Engineering Science, Geology, Meteorology, Physics

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

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 credits 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 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

Faculty:
Theodosios Alexander, Sc.D
Lawrence G. Boyer, M.S.
Sanjay Jayaram, Ph.D.
Jenna Gorlewicz, Ph.D.
Srikanth Gururajan, Ph.D.
Raymond LeBeau, Ph.D.
Jianfeng (Jeff) Ma, Ph.D.
Mark W. McQuilling, Ph.D.
Krishnaswamy Ravindra, Ph.D., P.E.
Michael Swartwout, Ph.D.
Emeritus:
Richard M. Andres, Ph.D., P.E., Professor Emeritus
Patricia A. Benoy, Ph.D., Professor Emeritus
Marty A. Ferman, Ph.D., P.E., Professor Emeritus
John A. George, Ph.D. Professor Emeritus

Aerospace & Mechanical Engineering
Sridhar Condoor, Ph.D., Department Chair
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 aeronautics 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 Engineering
CSCI 1060 Scientific Programming 3
ECE 2001 Electrical & Computer Engineering 3
ECE 2002 Electrical & Computer Engineering Lab 1

Engineering Science Courses
ESCI 2100 Statics 3
ESCI 2150 Dynamics 3
ESCI 2300 Thermodynamics 3
ESCI 3100 Mechanics of Solids 3
ESCI 3101 Mechanics of Solids Lab 1
ESCI 3110 Linear Vibrations 3
ESCI 3200 Fluid Dynamics 3
ESCI 3201 Fluid Dynamics Lab 1
ESCI 3410 Linear Systems 3
MENG2011 Engineering Shop Practice 1

Aerospace Engineering Courses
AENG 1001 Intro to Aerospace/Mechanical Eng 1
AENG 1002 Computer Aided Engineering Des 1
AENG 2000 Intro to Aero & Astro 3
AENG 3000 Performance 3
AENG 3100 Computer Aided Engineering 3
AENG 3150 Astrodynamics 3
AENG 3210 Gas Dynamics 3
AENG 3220 Aerodynamics 3
AENG 4004 Design I & Lab 3
AENG 4014 Design II & Lab 3
AENG 4110 Flight Vehicle Structures 3
AENG 4111 Aerospace Lab 1
AENG 4210 Propulsion 3
AENG 4400 Stability & Control 3
MENG4300 Heat Transfer 3

Technical Electives
Choose 6 credits from the list below.
AENG 4150 Orbital Mechanics 3
AENG 4230 Intro. to Comp. Fluid Dynamics 3
AENG 4240 Hypersonics 3
AENG 4410 Flight Simulation 3
AENG 4700 Aerelasticity 3

The following technical electives will be offered as AENG 4930 (a different section # will be assigned):
Applied Aerodynamics
Space Dynamics & Control
Space Mission Failures
Space Mission Analysis & Design
Space Mission Integration & Test
Engineering Entrepreneurship

Technical electives provide an opportunity to expand the horizon of each student’s program major or in areas related to program major. Students are encouraged to take courses at 4000 level in the area of program major or a 3000 level or above in allied disciplines. Allied disciplines include courses in engineering other than student’s major, Mathematics – MATH, Computer Science – CSCI, Management – MGT, Pre-Law – PLS, Physics – PHYS, Chemistry – CHEM and Biology – BIOL.
The student may also do a project or research independent study with a faculty member and it is considered as equivalent to technical elective. The courses or independent study in these areas should be beyond the required courses within the curriculum.

Basic Science & Math
<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHEM 1510 Engineering Chemistry I Lecture</td>
<td>3</td>
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<tr>
<td>CHEM 1520 Engineering Chemistry I Lab</td>
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<tr>
<td>PHYS 1610 Engineering Physics I Lecture</td>
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<td>PHYS 1620 Engineering Physics I Lab</td>
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<tr>
<td>PHYS 1630 Engineering Physics II Lecture</td>
<td>3</td>
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<tr>
<td>PHYS 1640 Engineering Physics II Lab</td>
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<tr>
<td>MATH 1510 Calculus I</td>
<td>4</td>
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<tr>
<td>MATH 1520 Calculus II</td>
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<tr>
<td>MATH 2530 Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 3550 Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3270 Advanced Math for Engineers</td>
<td>3</td>
</tr>
</tbody>
</table>

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

- BIOL 1040 Principles of Biology I
- BIOL 1060 Principles of Biology II
- BIOL 1090 Biodiversity & Conservation
- BIOL 1100 Introduction to Biology
- BIOL 1150 Genetics & Human Diversity
- BIOL 2160 Genetics & Social Science
- BIOL 2600 Human Physiology
- BIOL 4170 Introduction to GIS
- BIOL 4190 GIS in Biology
- CHEM 1120 General Chemistry II
- EAS 1010 Earth Systems I-The Solid Earth
- EAS 1030 Earth's Dynamics Environment II
- EAS 1050 Introduction to Oceanography
- EAS 1070 Understanding the Weather
- EAS 1080 Intro to Environmental Science
- EAS 1090 Climate and Humankind in History
- EAS 1140 Earth History
- EAS 1170 Physical Geography
- EAS 1300 Seismology of Nuclear Explosion
- EAS 1310 Water-Our Precious Resource
- EAS 1350 Real Meteorology
- EAS 1380 Missouri Climate
- EAS 1420 Foundations of Atmospheric Science
- EAS 1600 Sustainable Energy
- EAS 1800 Introduction to Earthquakes
- EAS 2200 Mineralogy
- EAS 3250 Global Change
- EAS 4050 Petrology
- EAS 4230 Micrometeorology
- EAS 4300 Structural Geology
- EAS 4600 Introduction to the Physics of Solid Earth
- EAS 4620 Intro to Earthquake Seismology
- EAS 4700 Theory of Vibrating Systems
- EAS 4720 Seismological Instrumentation
- MATH 2660 Principles of Mathematics
- MATH 3110 Linear Algebra for Engineers
- MATH 3120 Introduction to Linear Algebra
- MATH 3240 Numerical Analysis
- MATH 3600 Combinatorics
- MATH 3760 Financial Mathematics
- MATH 4810 Elementary Theory of Probability
- MATH 4880 Probability and Statistics for Engineers
- MATH 4050 History of Mathematics
- MATH 4110 Introduction to Abstract Algebra
- MATH 4210 Intro to Analysis
- MATH 4410 Foundations of Geometry
- MATH 4430 Non-Euclidean Geometry
- MATH 4310 Introduction to Complex Variables
- MATH 4550 Nonlinear Dynamics and Chaos
- MATH 4570 Partial Differential Equations
- MATH 4630 Graph Theory
- MATH 4650 Cryptography
- PHYS 2610 Modern Physics
- PHYS 3110 Classical Mechanics
- PHYS 3310 Optics
- PHYS 3410 Thermodynamics and Statistical Mech
- PHYS 3510 Analog & Digital Electronics
- PHYS 3610 Modern Physics II
- PHYS 4010 Topics in Modern Physics
- PHYS 4210 Electricity & Magnetism I
- PHYS 4410 General Relativity
- PHYS 4610 Quantum Mechanics

**Communications**

- ENGL 1920 Advanced Writing for Professionals | 3 |

**Liberal Arts**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tr>
<td>THEO 1000 Theological Foundations</td>
<td>3</td>
</tr>
<tr>
<td>PHIL 3400 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 above for more information.

**Humanistic Values**

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

**Fine Arts** (excludes applied, studio, and performance courses), Literature (ENGL2000-2600, 3000-3950, 4100-4790), History, American Studies and Foreign Languages (excludes English or native language).


**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 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**

Mechanical Engineering program prepares students to apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations); to model, analyze, design, and realize physical systems, components or processes; and to work professionally in either thermal or mechanical systems while requiring courses in each area.

The Mechanical Engineering curriculum emphasizes Design and Manufacturing, which are the two most important functions of an engineer. Design is well integrated into all levels of the curriculum. An attempt is made to solicit industry-sponsored projects for the capstone senior design course. In addition to basic science, mathematics, and engineering science courses, the curriculum includes courses in both the thermal system and mechanical system. The humanistic value courses, including Engineering Ethics, provide a well-rounded engineering education. Since modern mechanical systems are controlled by electronic systems, a course on Principles of Mechatronics has been included to provide the necessary interdisciplinary 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 Engineering**

- CSCI 1060 Scientific Programming 3
- ECE 2001 Electrical & Computer Engineering 3
- ECE 2002 Electrical & Computer Engineering Lab 1

**Engineering Science Courses**

- ESCI 2100 Statics 3
- ESCI 2150 Dynamics 3
- ESCI 2300 Thermodynamics 3
- ESCI 3100 Mechanics of Solids 3
- ESCI 3101 Mechanics of Solids Lab 1
- ESCI 3200 Fluid Dynamics 3
- ESCI 3201 Fluid Dynamics Lab 1
- ESCI 3110 Linear Vibrations 3
- ESCI 3410 Linear Systems 3
- MENG2011 Engineering Shop Practice 1

**Mechanical Engineering Courses**

- MENG1001 Intro to Aerospace/Mechanical Eng 1
- MENG1002 Computer Aided Engineering Des 1
- MENG2000 Foundation to Engineering Design 3
- MENG 2300 Applied Thermodynamics 3
- MENG 2600 Manufacturing Process/Lab 3
- MENG 3001 Mechanical Engineering Lab 1
- MENG3010 Machine Design 3
- AENG 3100 Computer Aided Engineering 3
- MENG 3430 Measurements 3
- MENG3510 Material Science 3
- MENG4004 Design I & Lab 3
- MENG4014 Design II & Lab 3
- MENG4300 Heat Transfer 3
- MENG4450 Principles of Mechatronics 3

**Technical Electives**

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

- MENG 4020 Optimal Design
- MENG 4140 Experimental Mechanics
MENG 4150 Computational Mechanics
MENG 4350 Thermal Design
MENG 4530 Composite Materials for Structure & Design
MENG 4800 Innovation, Creativity, & Sustainability
MENG 4810 Technology Entrepreneurship

The following technical electives will be offered as MENG 4930 (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

Technical electives provide an opportunity to expand the horizon of each student’s program major or in areas related to program major. Students are encouraged to take courses at 4000 level in the area of program major or a 3000 level or above in allied disciplines. Allied disciplines include courses in engineering other than student’s major, Mathematics – MATH, Computer Science – CS, Management – MGT, Pre-Law – PLS, Physics – PHYS, Chemistry – CHEM and Biology – BIOL.

The student may also do a project or research independent study with a faculty member and it is considered as equivalent to technical elective. The courses or independent study in these areas should be beyond the required courses within the curriculum.

**Basic Science & Math**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1070</td>
<td>Engineering Chemistry I Lecture</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 1075</td>
<td>Engineering Chemistry I Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1610</td>
<td>Engineering Physics I Lecture</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 1620</td>
<td>Engineering Physics I Lab</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1630</td>
<td>Engineering Physics II Lecture</td>
<td>3</td>
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<tr>
<td>PHYS 1640</td>
<td>Engineering Physics II Lab</td>
<td>1</td>
</tr>
<tr>
<td>MATH 1510</td>
<td>Calculus I</td>
<td>4</td>
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<tr>
<td>MATH 1520</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 2530</td>
<td>Calculus III</td>
<td>4</td>
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<tr>
<td>MATH 3550</td>
<td>Diff. Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3270</td>
<td>Advanced Math for Engineers</td>
<td>3</td>
</tr>
</tbody>
</table>

**Math/Science Elective**

Choose one 3-credit course from the following list.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 1040</td>
<td>Principles of Biology I</td>
</tr>
<tr>
<td>BIOL 1060</td>
<td>Principles of Biology II</td>
</tr>
<tr>
<td>BIOL 1090</td>
<td>Biodiversity &amp; Conservation</td>
</tr>
<tr>
<td>BIOL 1100</td>
<td>Introduction to Biology</td>
</tr>
<tr>
<td>BIOL 1150</td>
<td>Genetics &amp; Human Diversity</td>
</tr>
<tr>
<td>BIOL 2160</td>
<td>Genetics &amp; Social Science</td>
</tr>
<tr>
<td>BIOL 2600</td>
<td>Human Physiology</td>
</tr>
<tr>
<td>BIOL 4170</td>
<td>Introduction to GIS</td>
</tr>
<tr>
<td>BIOL 4190</td>
<td>GIS in Biology</td>
</tr>
<tr>
<td>CHEM 1120</td>
<td>General Chemistry II</td>
</tr>
<tr>
<td>EAS 1010</td>
<td>Earth Systems I-The Solid Earth</td>
</tr>
<tr>
<td>EAS 1030</td>
<td>Earth's Dynamics Environment II</td>
</tr>
<tr>
<td>EAS 1050</td>
<td>Introduction to Oceanography</td>
</tr>
<tr>
<td>EAS 1070</td>
<td>Understanding the Weather</td>
</tr>
<tr>
<td>EAS 1080</td>
<td>Intro to Environmental Science</td>
</tr>
<tr>
<td>EAS 1090</td>
<td>Climate and Humankind in History</td>
</tr>
<tr>
<td>EAS 1140</td>
<td>Earth History</td>
</tr>
<tr>
<td>EAS 1170</td>
<td>Physical Geography</td>
</tr>
<tr>
<td>EAS 1300</td>
<td>Seismology of Nuclear Explosion</td>
</tr>
<tr>
<td>EAS 1310</td>
<td>Water-Our Precious Resource</td>
</tr>
<tr>
<td>EAS 1350</td>
<td>Real Meteorology</td>
</tr>
<tr>
<td>EAS 1380</td>
<td>Missouri Climate</td>
</tr>
<tr>
<td>EAS 1420</td>
<td>Foundations of Atmospheric Science</td>
</tr>
<tr>
<td>EAS 1600</td>
<td>Sustainable Energy</td>
</tr>
<tr>
<td>EAS 1800</td>
<td>Introduction to Earthquakes</td>
</tr>
<tr>
<td>EAS 2200</td>
<td>Mineralogy</td>
</tr>
<tr>
<td>EAS 3250</td>
<td>Global Change</td>
</tr>
<tr>
<td>EAS 4050</td>
<td>Petrology</td>
</tr>
<tr>
<td>EAS 4230</td>
<td>Micrometeorology</td>
</tr>
<tr>
<td>EAS 4300</td>
<td>Structural Geology</td>
</tr>
<tr>
<td>EAS 4600</td>
<td>Introduction to the Physics of Solid Earth</td>
</tr>
<tr>
<td>EAS 4620</td>
<td>Intro to Earthquake Seismology</td>
</tr>
<tr>
<td>EAS 4700</td>
<td>Theory of Vibrating Systems</td>
</tr>
<tr>
<td>EAS 4720</td>
<td>Seismological Instrumentation</td>
</tr>
<tr>
<td>MATH 2660</td>
<td>Principles of Mathematics</td>
</tr>
<tr>
<td>MATH 3110</td>
<td>Linear Algebra for Engineers</td>
</tr>
<tr>
<td>MATH 3120</td>
<td>Introduction to Linear Algebra</td>
</tr>
<tr>
<td>MATH 3240</td>
<td>Numerical Analysis</td>
</tr>
<tr>
<td>MATH 3600</td>
<td>Combinatorics</td>
</tr>
<tr>
<td>MATH 3760</td>
<td>Financial Mathematics</td>
</tr>
<tr>
<td>MATH 4810</td>
<td>Elementary Theory of Probability</td>
</tr>
<tr>
<td>MATH 4880</td>
<td>Probability and Statistics for Engineers</td>
</tr>
<tr>
<td>MATH 4050</td>
<td>History of Mathematics</td>
</tr>
<tr>
<td>MATH 4110</td>
<td>Introduction to Abstract Algebra</td>
</tr>
<tr>
<td>MATH 4210</td>
<td>Intro to Analysis</td>
</tr>
<tr>
<td>MATH 4410</td>
<td>Foundations of Geometry</td>
</tr>
<tr>
<td>MATH 4430</td>
<td>Non-Euclidean Geometry</td>
</tr>
<tr>
<td>MATH 4310</td>
<td>Introduction to Complex Variables</td>
</tr>
<tr>
<td>MATH 4550</td>
<td>Nonlinear Dynamics and Chaos</td>
</tr>
<tr>
<td>MATH 4570</td>
<td>Partial Differential Equations</td>
</tr>
<tr>
<td>MATH 4630</td>
<td>Graph Theory</td>
</tr>
<tr>
<td>MATH 4650</td>
<td>Cryptography</td>
</tr>
<tr>
<td>PHYS 2610</td>
<td>Modern Physics</td>
</tr>
<tr>
<td>PHYS 3110</td>
<td>Classical Mechanics</td>
</tr>
<tr>
<td>PHYS 3310</td>
<td>Optics</td>
</tr>
<tr>
<td>PHYS 3410</td>
<td>Thermodynamics and Statistical Mech</td>
</tr>
<tr>
<td>PHYS 3510</td>
<td>Analog &amp; Digital Electronics</td>
</tr>
<tr>
<td>PHYS 3610</td>
<td>Modern Physics II</td>
</tr>
<tr>
<td>PHYS 4010</td>
<td>Topics in Modern Physics</td>
</tr>
<tr>
<td>PHYS 4210</td>
<td>Electricity &amp; Magnetism I</td>
</tr>
<tr>
<td>PHYS 4410</td>
<td>General Relativity</td>
</tr>
<tr>
<td>PHYS 4610</td>
<td>Quantum Mechanics</td>
</tr>
</tbody>
</table>

**Communications**
ENGL1920 Advanced Writing for Professionals 3

Liberal Arts
THEO 1000 Theological Foundations 3
PHIL 3400 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 above for more information.

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

Humanities courses include: Courses shall be chosen from Philosophy, Theology, Social and Behavioral Sciences, or Humanities. (refer to guidelines below)

Fine Arts (excludes applied, studio, and performance courses), Literature (ENGL2000-2600, 3000-3950, 4100-4790), History, American Studies and Foreign Languages (excludes English or native language).


Bachelor-Master’s Degree and Double Major Options

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 credits course work, of which up to 9 credits may be research credit. Up to 9 credits may be course work at the 4000 level; the remaining course credits must be at the 5000 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>AENG primary major, Additional courses</th>
<th>MENG primary major, Additional courses required:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MENG 2600 Manufacturing Processes</td>
<td>AENG 2000 Intro to Aero &amp; Astro</td>
</tr>
<tr>
<td>MENG 2300 Applied Thermodynamics</td>
<td>AENG 3210 Gas Dynamics*</td>
</tr>
<tr>
<td>MENG 2001 ME Lab</td>
<td>AENG 3220 Aerodynamics*</td>
</tr>
<tr>
<td>MENG 3430 Measurements</td>
<td>AENG 3000 Performance</td>
</tr>
<tr>
<td>MENG 3010 Machine Design</td>
<td>AENG 3150 Astrodynamics</td>
</tr>
<tr>
<td>MENG 3510 Material Science</td>
<td>AENG 4110 Flight Vehicle Structures</td>
</tr>
<tr>
<td>MENG 4450 Principles of Mechatronics</td>
<td>AENG 4210 Propulsion</td>
</tr>
<tr>
<td>MENG 4004 ME Design I/Lab</td>
<td>AENG 4111 Aerospace Lab</td>
</tr>
<tr>
<td>MENG 4014 ME Design II/Lab</td>
<td>AENG 4400 Stability &amp; Control</td>
</tr>
<tr>
<td></td>
<td>AENG 4004 AE Design I/Lab</td>
</tr>
</tbody>
</table>

*Student must take either Gas Dynamics or Aerodynamics to fulfill double 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 2000) and at least five AENG and ESCI courses at 2000 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 2000) and at least five MENG and ESCI courses at 2000 level or above. The grades in all MENG/ESCI courses must be C or better.
Aviation Science

Stephen Magoc, M.B.A., Department Chair

Faculty:
Stephen Belt, Ph.D.
William Irwin, M. P. A.
Terrance Kelly, Ph.D.
Manoj Patankar, Ph.D.
Saul Robinson, M.S., Chief Instructor

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.

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. The Code of Federal Regulations, Part 141, regulates flight instruction within the program. 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 countries 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 countries 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 crewmembers.

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 a minor in aviation, the department offers the following:

Minor in Air Traffic Control
Minor in Flight Education
Minor in Flight Science

Degree Requirements
Flight Science Concentration (121 credits)

Professional Orientation (3 credits)
ASCI 1010 Professional Orientation 2
UNIV 1010 Enhancing 1st Yr. Success 1
Within the Aviation Science program, the following classes provide training toward a Federal Aviation Administration certificate or rating under 14 CFR 141:

**Flight 1.**
This course provides 31.0 hours in an aircraft and 5.0 hours in an aircraft training device.

**Flight 2.**
This course provides 47.0 hours in an aircraft and 6.0 hours in an aircraft training device.

**Flight 3.**
This course provides 41.0 hours in an aircraft and 14.5 hours in an aircraft training device.

**Flight 4.**
This course provides 42.0 hours in an aircraft and 14.5 hours in an aircraft training device.

**Flight 5.**
This course provides 40.0 hours in an aircraft and 10.5 hours in an aircraft training device.

### Approved Emphasis Area (18 credits)
*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.

**On-Ground Degree Requirements**

**Aviation Management Concentration (121 credits)**

<table>
<thead>
<tr>
<th>Professional Orientation (3 credits)</th>
<th>ASCI 1010 Professional Orientation</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UNIV 1010 Enhancing 1st Yr. Success</td>
<td>1</td>
</tr>
</tbody>
</table>

**Jesuit Tradition (12 credits)**

| PHIL 1050 Introduction to Philosophy | 3 |
| PHIL 2050 Ethics                     | 3 |
| PSY 1010 General Psychology         | 3 |
| THEO 1000 Theological Foundations    | 3 |

**Knowledge (16 credits)**

| ITM 2000 Intro to Information Tech Management | 3 |

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

<table>
<thead>
<tr>
<th>MATH1200 College Algebra</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH1320 Survey of Calculus</td>
<td>3</td>
</tr>
<tr>
<td>Or</td>
<td></td>
</tr>
<tr>
<td>MATH1400 Pre-Calculus</td>
<td>3</td>
</tr>
<tr>
<td>MATH1510 Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 1350 Aviation Physics I &amp; Lab</td>
<td>4</td>
</tr>
<tr>
<td>FSCI 1300 Aviation Weather</td>
<td>3</td>
</tr>
</tbody>
</table>

**Communication Skills (12 credits)**

| CMM 1200 Public Speaking | 3 |

| ENGL 1500 The Process of Composition | 3 |
| ENGL 1900 Advanced Strategies Rhetoric/Research | 3 |
| ENGL 2020 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 Elective | 3 |

**Aviation Science Core (18 credits)**

<table>
<thead>
<tr>
<th>ASCI 1850 Safety Management Systems</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCI 3100 Air Carrier Operations</td>
<td>3</td>
</tr>
<tr>
<td>ASCI 4050 Human Factors</td>
<td>3</td>
</tr>
<tr>
<td>ASCI 4350 Team Resource Management</td>
<td>3</td>
</tr>
<tr>
<td>ASCI 4250 Professional Ethics and Standards</td>
<td>3</td>
</tr>
<tr>
<td>FSCI 4450 Aviation Law</td>
<td>3</td>
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</table>

**Aviation Management Concentration (30 credits)**

<table>
<thead>
<tr>
<th>ECON 1900 Principles of Economics</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 4000 Business &amp; Professional Writing</td>
<td>3</td>
</tr>
<tr>
<td>FSCI 4650 Economics of Air Transportation</td>
<td>3</td>
</tr>
<tr>
<td>MGT 3000 Management Theory and Practice</td>
<td>3</td>
</tr>
<tr>
<td>MGT 3300 Management of Human Resources</td>
<td>3</td>
</tr>
<tr>
<td>OPM 2070 Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>OPM 3050 Introduction to Management Science</td>
<td>3</td>
</tr>
<tr>
<td>ASCI 4800 International Aviation</td>
<td>3</td>
</tr>
<tr>
<td>ASCI 4900 Senior Seminar (Capstone)</td>
<td>3</td>
</tr>
<tr>
<td>ASCI 4915 Internship with Industry</td>
<td>3</td>
</tr>
</tbody>
</table>

**Approved Emphasis Area (27 credits)**

*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**

| 121 |

**Distance Degree Requirements**

**Aviation Management Concentration (120 credits)**

<table>
<thead>
<tr>
<th>Professional Orientation (3 credits)</th>
<th>ASCI 1010 Professional Orientation</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PST 1000 Enhancing 1st Yr. Success</td>
<td>1</td>
</tr>
</tbody>
</table>

**Jesuit Tradition (12 credits)**

| PHIL 1050 Introduction to Philosophy | 3 |
| PHIL 2050 Ethics                     | 3 |
| PSY 1010 General Psychology         | 3 |
| THEO 1000 Theological Foundations    | 3 |

**Knowledge (16 credits)**

| CIS 1300 Information System & Technology | 3 |

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

| MATH1200 College Algebra | 3 |
MATH1320 Survey of Calculus 3
Or
MATH1400 Pre-Calculus 3
MATH1510 Calculus I 4

PHYS 1350 Aviation Physics I & Lab 4
FSCI 1300 Aviation Weather 3

Communication Skills (12 credits)
CMMK1210 Public Speaking 3
ENGL 1500 The Process of Composition 3
ENGL 1900 Advanced Strategies Rhetoric/Research 3
ENGL 2020 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 Elective 3

Aviation Science Core (18 credits)
ASCI 1850 Safety Management Systems 3
ASCI 3100 Air Carrier Operations 3
ASCI 4050 Human Factors 3
ASCI 4250 Professional Ethics and Standards 3
FSCI 4450 Aviation Law 3
OSTD 3305 Team Dynamics 3

Aviation Management Concentration (30 credits)
CIS 2850 Principles of Data Analysis 3
ENGL 4000 Business & Professional Writing 3
FSCI 4650 Economics of Air Transportation 3
OSTD 3200 Interpersonal Relations in Organizations 3
OSTD 3005 Organizational Foundations 3
PST 1900 Survey of Economics 3
PST 3200 Human Resources in Organizations 3
ASCI 4800 International Aviation 3
ASCI 4900 Senior Seminar (Capstone) 3
ASCI 4915 Internship with Industry 3

Approved Emphasis Area (27 credits)
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 121

Minor in Air Traffic Control
The Minor in Air Traffic Control is intended to prepare students 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 1300 Aviation Weather 3
FSCI 1250 Basic Flight Foundations 3
ASCI 1020 Intro to Air Traffic Control System 2
ASCI 2020 Fundamentals of Air Traffic Control 3
ASCI 3030 Basic ATC Tower & Radar 3
ASCI 3040 Advanced ATC Tower & Radar 3
Total Credit Hours 17

Minor in Flight Education
Students with the appropriate FAA pilot certification 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)

Flight Education Minor
PP 3100 Flight Instructor Prep I 2
PP 3200 Principles of Flight Instruction I 3
PP 3500 Flight Instructor Prep II 2
PP 3600 Principles of Flight Instruction II 3
PP 4100 CFI Practicum I 3
PP 4500 CFI Practicum II 3
Total Credit Hours 16

Minor in Flight Science
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)

FSCI 1150 Flight 1 2
FSCI 1250 Basic Flight Foundations 3
FSCI 1550 Flight 2 2
FSCI 2150 Flight 3 2
FSCI 2250 Instrument Flight Foundations 3
FSCI 2550 Flight 4 2
FSCI 2650 Navigation Flight Foundations 3
FSCI 3550 Flight 5 2
Total Credit Hours 19

Biomedical Engineering
Michel B. Sabick, Ph.D., Department Chair

Faculty:
Gary Bledsoe, Ph.D.
Natasha Case, Ph.D.
Yan Gai, Ph.D.
Andrew Hall, Ph.D.
Scott Sell, Ph.D.
Silviya P. Zusiak, 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, biomeasurements, and biortransport. 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 strong 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;
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 1000 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
CHEM1110 General Chemistry I 3
CHEM1115 General Chemistry I Lab 1
CHEM1120 General Chemistry II 3
CHEM1125 General Chemistry II Lab 1
BIOL 1040 Biology I & Lab 4
BIOL 1060 Biology II & Lab 4
BIOL 2600 Human Physiology 3
PHYS 1610 Engineering Physics I 3
PHYS 1620 Engineering Physics I Lab 1
PHYS 1630 Engineering Physics II 3
PHYS 1640 Engineering Physics II Lab 1
PHYS 3410 Thermodynamics 3
MATH1510 Calculus I 4
MATH1520 Calculus II 4
MATH2530 Calculus III 4
MATH3550 Differential Equations 3
MATH4880 Probability & Statistics 3

Basic Engineering
BME 3200 Mechanics 3
ECE 2001 Electrical & Computer Eng 3
ECE 2002 Electrical & Computer Eng Lab 1
MENG2011 Engineering Shop Practice 1

Communications
ENGL 1900 Adv Strategies of Rhet & Research 3

One credit of the four credit Parks College Core requirement for written and oral communication will be satisfied by BME 1000 Orientation, BME 1010 Intro, or CMM 2200 Small Group Presentations. 1

Liberal Arts
THEO 1000 Theological Foundations 3
PHIL 2050 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 above for more information.

Humanities courses include: Fine Arts (excludes applied, studio, and performance courses), Literature (ENGL 2020-2750, 3190-3740, 4130-4890), History, American Studies, and Foreign Languages (excludes English or native language).

Social & Behavioral Sciences courses include: Anthropology, Communication (CMM 1000, 2000, 2800), Communication Disorders (CSDI 1000, 4700), Economics, Education (EDF 4240, EDI 3620, EDSP4310), Political Science, Psychology, Social Work (SWRK 1000, 2100, 3100, 3200), Sociology, Criminal Justice, 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
BME 1000 BME Orientation 1
BME 1010 BME Introduction 1
BME 2000 BME Computing 3
BME 3100 Signals 3
BME 3300 Transport Fundamentals 3
BME 3400 Materials Science 3
BME 3840 Junior Lab 1
BME 4050 Biomedical Instrumentation 3
BME 4950/4960 Senior Project I & II 6

Required Related Courses:
Students must take 18 credits from the Advanced Biomedical Engineering area and an additional 9 credits among BME-Related General Electives.

A. Advanced Biomedical Engineering
BME 4100 Biomedical Signals 3
BME 4200 Biomechanics 3
BME 4300 Biotransport 3
BME 4310 Advanced Topics in Biotransport 3
BME 4400 Biomaterials 3
BME 4410 Tissue Engineering 3
BME 4500 Numerical Methods in BME 3
BME 4600 Quantitative Physiology I 3
BME 4650 Quantitative Physiology II 3
BME 4980 Independent Research 3

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 (MATH 1400) or The Process of Composition (ENGL 1500).

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 2600 or
The minimum IDE curriculum includes: faculty members with the appropriate expertise in exploring options for Focus Areas and with finding other students. The IDE program has mentors who will assist students may be unique to a single student, or it may involve multiple require the expertise of several faculty members. A Focus Area the interest of an individual faculty member, but more likely will include courses that provide the necessary depth of knowledge in Focus Area that w

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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:

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PPY 2540 Human Physiology) and at least five BME courses. At least three of the BME courses must be selected at the 4000-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 fill out a "Minor in BME" plan with the BME Faculty member to discuss the minor courses and their prerequisites. The "Minor in BME" form serves as a planning tool and that 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:

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MATH 1510 Calculus I 4
MATH 1520 Calculus II 4
MATH 2530 Calculus III 4
MATH 3550 Differential Equations 3
MATH 4880 Probability & Statistics 3

**Communications & Liberal Arts**

| ENGL 1900 Adv Strategies of Rhet & Research 3 |
| THEO 1000 Theological Foundations 3 |
| PHIL 2050 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 above for more information.

Humanities courses include: Fine Arts (excludes applied, studio, and performance courses), Literature (ENGL2020-2750, 3190-3740, 4130-4890), History, American Studies, and Foreign Languages (excludes English or native language).

Social & Behavioral Sciences courses include: Anthropology, Communication (CMM 1000, 2000, 2800), Communication Disorders (CSDI 1000, 4700), Economics, Education (EDF 4240, EDI 3620, EDSP4310), Political Science, Psychology, Social Work (SWRK 1000, 2100, 3100, 3200), Sociology, Criminal Justice, 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 1000 BME Orientation 1 |
| BME 1010 BME Introduction 1 |
| BME 2000 BME Computing 3 |
| ECE 2001 Electrical & Computer Eng 3 |
| ECE 2002 Electrical & Computer Eng Lab 1 |
| ESCI 2300 Thermodynamics 3 |
| BME 3100 Signals 3 |
| BME 3200 Mechanics 3 |
| BME 3300 Transport Fundamentals 3 |
| BME 3400 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 4950/4960 Senior Thesis I & II 6
Courses directly related to preparation and completion of the senior thesis.

Minimum BS Credits (IDE) 120

Civil Engineering
Ronaldo Luna, Ph.D., P.E., Department Chair

Faculty:
Christopher Carroll, Ph.D.
Amanda Cox, Ph.D., P.E.
Riyadh Hindi, Ph.D., P.E.
Jalil Kianfar, Ph.D.
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 1110 General Chemistry I Lecture 3
CHEM 1115 General Chemistry I Lab 1
PHYS 1610 Engineering Physics I Lecture 3
PHYS 1620 Engineering Physics I Lab 1
MATH 1510 Calculus I 4
MATH 1520 Calculus II 4
MATH 2530 Calculus III 4
MATH 3550 Diff. Equations 3
MATH 4880 Probability and Statistics 3

Math/Science Electives 7
Choose 7 credits in Math or Science. The Math and Science elective cannot be a prerequisite course for required courses in the curriculum. Either BIOL 1040 or an EAS course (or both) must be taken to satisfy the ABET basic science requirement. Acceptable EAS courses include EAS 2300, EAS 2110/2440, or EAS 2530. Courses for non-science majors and engineering courses will not be accepted. Contact the Faculty Mentor for approval of the Math/Science Electives choices.

Communications
ENGL 1920 Advanced Writing for Professionals 3
CMM 2200 Small Group Presentation 1

Earth &Atmospheric Science Courses
GIS 2170 GIS in Civil Engineering 3

Liberal Arts
THEO 1000 Theological Foundations 3
PHIL 3400 Engineering Ethics 3
Humanistic Values Electives 6
Cultural Diversity Elective 3

Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core above 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, History, American Studies and Foreign Languages (excludes English or native language).

Social & Behavioral Sciences courses (3-credit) include: Anthropology, Communication, Communication Disorders, Economics, Education, Political Science, Psychology, Social Work, Sociology, Criminal Justice, and Public Policy Studies (excludes field service courses).
Engineering Science Courses
ESCI 2100 Statics 3
ESCI 2150 Dynamics 3
ESCI 3100 Mechanics of Solids 3
ESCI 3101 Mechanics of Solids Lab 1
ESCI 3200 Fluid Dynamics 3
ESCI 3201 Fluid Dynamics Lab 1

Civil Engineering Courses
All of the following courses will be offered only once a year.
CVNG 1010 Freshman Engineering I 1
CVNG 1020 Freshman Engineering II 1
CVNG 1500 Civil Engineering Computing 3
CVNG 2030 Sustainability & Environmental Engr. 3
CVNG 2040 Sustainability & Envr. Engr. Lab 1
CVNG 3010 Structural Analysis 3
CVNG 3020 Structural Analysis Lab 1
CVNG 3030 Civil Engineering Materials 2
CVNG 3050 Introduction to Surveying 1
CVNG 3070 Engineering Project Management 2
CVNG 3090 Geotechnical Engineering 3
CVNG 3100 Geotechnical Engineering Lab 3
CVNG 3110 Transportation Engineering 3
CVNG 3120 Transportation Engineering Lab 1
CVNG 3130 Hydraulic Engineering 3
CVNG 3140 Hydraulic Engineering Lab 1
CVNG 3150 Introduction to Structural Design 3
CVNG 3160 Introduction to Structural Design Lab 1
CVNG 4010 Senior Engineering 1
CVNG 4500 Capstone Design I 3
CVNG 4510 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 credits must be upper division courses.

Minimum 125

Electrical and Computer Engineering

Huliyar S. Mallikarjuna, Ph.D., Department 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. (khalilia@slu.edu)
Kyle Mitchell, Ph.D. (mitchekk@slu.edu)
Habib Rahman, Ph.D. (rahmanmh@slu.edu)
Jason Fritts, 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. These programs are accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. 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)
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 that may include hardware and software.

n) Knowledge of discrete mathematics.

**Degree Requirements**

**Basic Science & Math Requirements (36 credits)**
- CHEM1110 General Chemistry I 3
- CHEM1115 General Chemistry I Lab 1
- PHYS 1610 Engineering Physics I 3
- PHYS 1620 Engineering Physics I Lab 1
- PHYS 1630 Engineering Physics II 3
- PHYS 1640 Engineering Physics II Lab 1
- MATH1660 Discrete Mathematics 3
- MATH1510 Calculus I 4
- MATH1520 Calculus II 4
- MATH2530 Calculus III 4
- MATH3110 Linear Algebra 3
- MATH3550 Differential Equations 3
- MATH4880 Probability and Statistics 3

**Communications Requirements (3 credits)**
- ENGL 1920 Adv Writing for Professionals 3

**Computer Requirement**
- CSCI 1060 Intro to Scientific Programming 3

**Liberal Arts Requirements (15 credits)**
- PHIL 3400 Ethics and Engineering 3
- THEO 1000 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 above for more information.

**Electrical Engineering Core Requirements (50 credits)**
- ECE 1001 Intro to ECE I 1
- ECE 1002 Intro to ECE II 1
- ECE 2101 Electrical Circuits I 3
- ECE 2102 Electrical Circuits II 3
- ECE 2103 Electrical Circuits Lab 1
- ECE 2205 Digital Design 3
- ECE 2206 Digital Design Lab 1
- ECE 3110 Electric Energy Conversion 3
- ECE 3225 Microprocessors 3
- ECE 3226 Microprocessors Lab 1
- ECE 3130 Semiconductor Devices 3
- ECE 3131 Electronic Circuit Design 3
- ECE 3132 Electronic Circuit Design Lab 1
- ECE 3140 Electromagnetic Fields 3
- ECE 3150 Linear Systems 3
- ECE 3151 Linear Systems Lab 1
- ECE 3090 Junior Design 1
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**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 1040</td>
<td>Biology I &amp; Lab</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 1060</td>
<td>Biology II &amp; Lab</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 2600</td>
<td>Human Physiology</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 1110</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 1115</td>
<td>General Chemistry I Lab</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 1120</td>
<td>General Chemistry II</td>
<td>3</td>
</tr>
</tbody>
</table>

**Bioelectronics Concentration (B.S. in Electrical Engineering)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 4120</td>
<td>Automatic Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECE 4140</td>
<td>Electromagnetic Waves</td>
<td>3</td>
</tr>
<tr>
<td>ECE 4160</td>
<td>Communication Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECE 4800</td>
<td>ECE Design I</td>
<td>3</td>
</tr>
<tr>
<td>ECE 4810</td>
<td>ECE Design II</td>
<td>3</td>
</tr>
</tbody>
</table>

ECE Electives for EE majors:

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 3217</td>
<td>Computer Architecture &amp; Organization</td>
<td></td>
</tr>
<tr>
<td>ECE 4170</td>
<td>Energy Technologies I</td>
<td></td>
</tr>
<tr>
<td>ECE 4110</td>
<td>Power Systems Analysis I</td>
<td></td>
</tr>
<tr>
<td>ECE 4153</td>
<td>Image Processing</td>
<td></td>
</tr>
<tr>
<td>ECE 4226</td>
<td>Mobile Robotics</td>
<td></td>
</tr>
<tr>
<td>ECE 4132</td>
<td>Analog IC Design</td>
<td></td>
</tr>
<tr>
<td>ECE 4235</td>
<td>Digital IC Design</td>
<td></td>
</tr>
<tr>
<td>ECE 4141</td>
<td>Radar Systems</td>
<td></td>
</tr>
<tr>
<td>ECE 4245</td>
<td>Computer Networks Design</td>
<td></td>
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<tr>
<td>ECE 4150</td>
<td>Filter Design</td>
<td></td>
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<tr>
<td>ECE 4151</td>
<td>Digital Signal Processing</td>
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<tr>
<td>ECE 4161</td>
<td>Satellite Communications</td>
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<tr>
<td>ECE 4162</td>
<td>Cellular Communications</td>
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<tr>
<td>ECE 4170</td>
<td>Energy Technology I</td>
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<td>ECE 5110</td>
<td>Power Systems Analysis I</td>
<td></td>
</tr>
<tr>
<td>ECE 4930</td>
<td>Special Topics</td>
<td></td>
</tr>
<tr>
<td>MATH 4650</td>
<td>Cryptography</td>
<td></td>
</tr>
</tbody>
</table>

**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 credits) selected from courses in science, mathematics, or engineering, at the 2000-level or higher, or Computer Science at 3000 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.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 2910</td>
<td>Co-op</td>
<td>0-3</td>
</tr>
<tr>
<td>ECE 3910</td>
<td>Co-op</td>
<td>0-3</td>
</tr>
<tr>
<td>ECE 4910</td>
<td>Co-op</td>
<td>0-3</td>
</tr>
<tr>
<td>ECE 2915</td>
<td>Internship</td>
<td>0-3</td>
</tr>
<tr>
<td>ECE 3915</td>
<td>Internship</td>
<td>0-3</td>
</tr>
<tr>
<td>ECE 4915</td>
<td>Internship</td>
<td>0-3</td>
</tr>
</tbody>
</table>

**Minimum BS Credits**

125

2015-2016 Saint Louis University Undergraduate Academic Catalog
CHEM 1125 General Chemistry II Lab 1
PHYS 1610 Engineering Physics I 3
PHYS 1620 Engineering Physics I Lab 1
PHYS 1630 Engineering Physics II 3
PHYS 1640 Engineering Physics II Lab 1
MATH 1660 Discrete Math 3
MATH 1510 Calculus I 4
MATH 1520 Calculus II 4
MATH 2530 Calculus III 4
MATH 3110 Linear Algebra 3
MATH 3550 Differential Equations 3
MATH 4880 Probability and Statistics 3

**Communications (3 credits)**

ENGL 1920 Adv Writing for Professionals 3

**Liberal Arts (15 credits)**

PHIL 3400 Ethics and Engineering 3
THEO 1000 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 above for more information.

**Electrical Engineering Core Requirements (41 credits)**

ECE 1001 Intro to ECE I 1
ECE 1002 Intro to ECE II 1
ECE 2101 Electrical Circuits I 3
ECE 2102 Electrical Circuits II 3
ECE 2103 Electrical Circuits Lab 1
ECE 2205 Digital Design 3
ECE 2206 Digital Design Lab 1
ECE 3225 Microprocessors 3
ECE 3226 Microprocessors Lab 1
ECE 3130 Semiconductor Devices 3
ECE 3131 Electronic Circuit Design 3
ECE 3132 Electronic Circuit Design Lab 1
ECE 3140 Electromagnetic Fields 3
ECE 3150 Linear Systems 3
ECE 3151 Linear Systems Lab 1
ECE 3090 Junior Design 1
ECE 4120 Automatic Control Systems 3
ECE 4800 ECE Design I 3
ECE 4810 ECE Design II 3

**Biomedical Engineering Core (12 credits)**

BME 2000 BME Computing 3
BME 4050 Biomedical Instrumentation 3
BME 4100 Biomedical Signals 3
BME 4600 BME Sensory Systems 3

**Biomedical, Electrical, Computer Engineering Elective**

Select one 3-credit course from a list of approved ECE or BME courses at 3000-level or higher.

**Internship and Co-op**

Although not required, students are encouraged to participate in an internship or cooperative experience before graduation.

ECE 2910 Co-op 0-3
ECE 3910 Co-op 0-3
ECE 4910 Co-op 0-3
ECE 2915 Internship 0-3
ECE 3915 Internship 0-3
ECE 4915 Internship 0-3

**Minimum BS Credits 125**

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

**Degree Requirements**

**Basic Science & Math (59 credits)**

BIOL 1040 Biology I & Lab 4
BIOL 1060 Biology II & Lab 4
BIOL 3020 Molecular Cell Biology I 3
CHEM 1110 General Chemistry I 3
CHEM 1115 General Chemistry I Lab 1
CHEM 1120 General Chemistry II 3
CHEM 1125 General Chemistry II Lab 1
CHEM 2410 Organic Chemistry 3
CHEM 2415 Organic Chemistry Lab 1
CHEM 2420 Organic Chemistry II 3
CHEM 2425 Organic Chemistry II Lab 1
PHYS 1610 Engineering Physics I 3
PHYS 1620 Engineering Physics I Lab 1
PHYS 1630 Engineering Physics II 3
PHYS 1640 Engineering Physics II Lab 1
MATH 1660 Discrete Math 3
MATH 1510 Calculus I 4
MATH 1520 Calculus II 4
MATH 2530 Calculus III 4
MATH 3110 Linear Algebra 3
MATH 3550 Differential Equations 3
MATH 4880 Probability and Statistics 3

**Communications (3 credits)**

ENGL 1920 Adv Writing for Professionals 3

**Liberal Arts (15 credits)**

PHIL 3400 Ethics and Engineering 3
THEO 1000 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 above for more information.
Electrical Engineering Core (41 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 1001</td>
<td>Intro to ECE I</td>
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<tr>
<td>ECE 1002</td>
<td>Intro to ECE II</td>
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<tr>
<td>ECE 2101</td>
<td>Electrical Circuits I</td>
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<td>ECE 2102</td>
<td>Electrical Circuits II</td>
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<td>ECE 2103</td>
<td>Electrical Circuits Lab</td>
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<td>ECE 2205</td>
<td>Digital Design</td>
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<td>ECE 2206</td>
<td>Digital Design Lab</td>
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<tr>
<td>ECE 3225</td>
<td>Microprocessors</td>
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<td>ECE 3226</td>
<td>Microprocessors Lab</td>
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<tr>
<td>ECE 3130</td>
<td>Semiconductor Devices</td>
<td>3</td>
</tr>
<tr>
<td>ECE 3131</td>
<td>Electronic Circuit Design</td>
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<tr>
<td>ECE 3132</td>
<td>Electronic Circuit Design Lab</td>
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<tr>
<td>ECE 3140</td>
<td>Electromagnetic Fields</td>
<td>3</td>
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<tr>
<td>ECE 3150</td>
<td>Linear Systems</td>
<td>3</td>
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<tr>
<td>ECE 3151</td>
<td>Linear Systems Lab</td>
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<tr>
<td>ECE 4120</td>
<td>Automatic Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECE 4800</td>
<td>ECE Design I</td>
<td>3</td>
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<tr>
<td>ECE 4810</td>
<td>ECE Design II</td>
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</table>

Biomedical Engineering Core

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>BME 2000</td>
<td>BME Computing</td>
<td>3</td>
</tr>
<tr>
<td>BME 4050</td>
<td>Biomedical Instrumentation</td>
<td>3</td>
</tr>
</tbody>
</table>

Biomedical, Electrical, Computer Engineering Option
Select one 3-credit course from a list of approved ECE or BME courses at 3000-level or higher.

Minimum BS Credits 125

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 multidisciplinary 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 that 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 lifelong 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 that may include hardware and software.
n) Knowledge of discrete mathematics.

Degree Requirements

Basic Science & Math (36 credits)
CHEM 1110 General Chemistry I 3
CHEM 1115 General Chemistry I Lab 1
PHYS 1610 Engineering Physics I 3
PHYS 1620 Engineering Physics I Lab 1
PHYS 1630 Engineering Physics II 3
PHYS 1640 Engineering Physics II Lab 1
MATH 1660 Discrete Mathematics 3
MATH 1510 Calculus I 4
MATH 1520 Calculus II 4
MATH 2530 Calculus III 4
MATH 3110 Linear Algebra 3
MATH 3550 Differential Equations 3
MATH 4880 Probability and Statistics 3

Communications (3 credits)
ENGL 1920 Adv Writing for Professionals 3

Computer Science (14 credits)
CSCI 1300 Intro Object Oriented Program 4
CSCI 2100 Data Structures 4
CSCI 2300 Object Oriented Software Design 3
CSCI 3500 Operating Systems 3

Liberal Arts (15 credits)
PHIL 3400 Ethics and Engineering 3
THEO 1000 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 above for more information.

Computer Engineering Core (44 credits)
ECE 1001 Intro to ECE I 1
ECE 1002 Intro to ECE II 1
ECE 2101 Electrical Circuits I 3
ECE 2102 Electrical Circuits II 3
ECE 2103 Electrical Circuits Lab 1
ECE 2205 Digital Design 3
ECE 2206 Digital Design Lab 1
ECE 3205 Advanced Digital Design 3
ECE 3215 Computer Systems Design 3
ECE 3216 Computer Systems Design Lab 1
ECE 3217 Computer Architecture 3
ECE 3225 Microprocessors 3
ECE 3226 Microprocessors Lab 1
ECE 3130 Semiconductor Devices 3
ECE 3150 Linear Systems 3
ECE 3151 Linear Systems Lab 1
ECE 3090 Junior Design 1
ECE 4245 Computer Networks 3
ECE 4800 ECE Design I 3
ECE 4810 ECE Design II 3

ECE (CSCI) Electives for CpE Majors
Students are required to take at least six (6) credits from the following list. Please check with ECE Dept. for a complete list of approved electives.
ECE 3110 Energy Conversion
ECE 3131 Electronic Circuits
ECE 3140 Electromagnetic Fields
ECE 4225 Hardware Software Co-design
ECE 4226 Mobile Robotics
ECE 4235 Digital IC Design
ECE 4151 Digital Signal Processing
ECE 4930 Special Topics
CSCI 3100 Algorithms
CSCI 3200 Programming Languages
CSCI 3820 Computer Graphics I
CSCI 3710 Databases
CSCI 3200 Software Engineering
CSCI 4550 Advanced Operating Systems
CSCI 3760 Artificial Intelligence
MATH 4650 Cryptography

Two Technical Elective
2 approved course (6 credits) selected from courses in science, mathematics, or engineering, at the 2000-level or higher, or Computer Science at 3000-level 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 2910 Co-op 0-3
ECE 3910 Co-op 0-3
ECE 4910 Co-op 0-3
ECE 2915 Internship 0-3
ECE 3915 Internship 0-3
ECE 4915 Internship 0-3

Minimum BS Credits 125

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

Degree Requirements

Basic Science & Math (36 credits)
CHEM1110 General Chemistry I 3
CHEM1115 General Chemistry I Lab 1
PHYS 1610 Engineering Physics I 3
PHYS 1620 Engineering Physics I Lab 1
PHYS 1630 Engineering Physics II 3
PHYS 1640 Engineering Physics II Lab 1
MATH1660 Discrete Mathematics 3
MATH1510 Calculus I 4
MATH1520 Calculus II 4
MATH2530 Calculus III 4
MATH3110 Linear Algebra 3
MATH3550 Differential Equations 3
MATH4880 Probability and Statistics 3

Communications
ENGL 1920 Adv Writing for Professionals 3

Liberal Arts (9 credits)
PHIL 3400 Ethics and Engineering 3
THEO 1000 Theological Foundations 3
Cultural Diversity 3

Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core above for more information. (PLS 4960 will satisfy cultural diversity).

Computer Engineering Core (44 credits)
ECE 1001 Intro to ECE I 1
ECE 1002 Intro to ECE II 1
ECE 2101 Electrical Circuits I 3
ECE 2102 Electrical Circuits II 3
ECE 2103 Electrical Circuits Lab 1
ECE 2205 Digital Design 3
ECE 2206 Digital Design Lab 1
ECE 3205 Advanced Digital Design 3
ECE 3215 Computer Systems Design 3
ECE 3216 Computer Systems Design Lab 1
ECE 3217 Computer Architecture 3
ECE 3225 Microprocessors 3
ECE 3226 Microprocessors Lab 1
ECE 3130 Semiconductor Devices 3
ECE 3150 Linear Systems 3
ECE 3151 Linear Systems Lab 1

ECE 3090 Junior Design 1
ECE 4245 Computer Networks 3
ECE 4800 ECE Design I 3
ECE 4810 ECE Design II 3

Computer Science (14 credits)
CSCI 1300 Intro Object Oriented Program 4
CSCI 2100 Data Structures 4
CSCI 2300 Object Oriented Software Design 3
CSCI 3500 Operating Systems 3

ECE (CSCI) Electives for CpE Majors
Students are required to take at least six (6) credits from the following list. Please check with ECEDept. for a complete list of approved electives.
ECE 3110 Energy Conversion
ECE 3131 Electronic Circuits
ECE 3140 Electromagnetic Fields
ECE 4225 Hardware Software Co-design
ECE 4226 Mobile Robotics
ECE 4235 Digital IC Design
ECE 4151 Digital Signal Processing
ECE 4930 Special Topics
CSCI 3100 Algorithms
CSCI 3200 Programming Languages
CSCI 3820 Computer Graphics I
CSCI 3710 Databases
CSCI 3200 Software Engineering
CSCI 4550 Advanced Operating Systems
CSCI 3760 Artificial Intelligence
MATH4650 Cryptography

One core elective under Certificate Program

One Technical Elective
1 approved course (3 credits) selected from courses in science, mathematics, or engineering, at the 3000-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)
PLS 1000 Intro to Law 2
PLS 1050 Intro to Legal Careers 1
PLS 2000 Intro Legal Research & Writing 3
PLS 3900 Intro to Aplt. Advocacy 3
PLS 3935 Issues in Law 3
PLS 4960 Comparative Legal Systems 3

Minimum BS Credits 130

Physics
Prerequisites (28 credits):
PHYS 1110 Introduction to Physics (as a career) 1
CHEM1110/1115 General Chemistry I/Lab 4
PHYS 1610/1620 Engineering Physics I/Lab 4
PHYS 1630/1640 Engineering Physics II/Lab 4
MATH1510 Calculus I 4
MATH1520 Calculus II 4
MATH2530 Calculus III 4
CSCI 1060 Intro. to CS: Scientific Programming 3

Required Physics & Mathematics Courses (39 credits)
PHYS 2610 Modern Physics 3
PHYS 2620 Modern Physics Lab 1
PHYS 3110 Classical Mechanics 3
PHYS 3610 Modern Physics II 3
PHYS 4210 Electricity & Magnetism I 3
PHYS 4610 Quantum Mechanics 3
PHYS 3310/3320 Optics/Lab 4
PHYS 3410 Thermodynamics & Statistical Mechanics 3
PHYS 3510 Analog & Digital Electronics/Lab 4
MATH3550 Differential Equations I 3
MATH3270 Advanced Mathematics for Engineers 3
MATH4880 Probability & Statistics for Engineers 3
MATH3240 Numerical Analysis 3

Additional Requirements (6 credits)
Two additional upper division physics courses (minimum 6 credits) selected from the list below.
PHYS 3120 Advanced Classical Mechanics 3
PHYS 4220 Electricity & Magnetism II 3
PHYS 4620 Application of Quantum Mechanics 3

Research Experience (3 credits)
PHYS 3860 Physics Research I 0
PHYS 4870 Physics Research II 0
PHYS 4880 Physics Research III 3

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

College Core (22 credits)
ENGL 1900 Adv. Rhet. & Research or 1920 Adv. Writing 3
CMM 2200 Small Group Presentation 1
THEO 1000 Theological Foundations 3
PHIL 2050 Ethics 3
Social/Behavioral Science Elective 3
Humaneities 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 credits)
One Course 3

Physics Minor
A Parks College student can earn a minor in physics by completing at least 22 credits of physics consisting of:
PHYS 1610/1620 Engineering Physics I/Lab 4
PHYS 1630/1640 Engineering Physics II/Lab 4
PHYS 2610/2620 Modern Physics/Lab 4
Three physics courses (one with lab) numbered
PHYS 3000 – PHYS 4930 10

A College of Arts & Sciences student can earn a minor in physics by completing at least 18 credits of physics consisting of:
PHYS 1610/1620 Engineering Physics I/Lab 4
PHYS 1630/1640 Engineering Physics II/Lab 4
PHYS 2610/2620 Modern Physics/Lab 4
Two physics courses numbered PHYS 3000–PHYS 4930 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 accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. 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 introduction in this catalog for more information.

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 (1 credit required)
Selected from the following:
PHYS 1110 Introduction to Physics (as a career) 1
AENG 1001 Introduction to AE & ME 1
BME 1000 Biomedical Engineering Orientation 1
ECE 1001 Introduction to ECE 1
(It is recommended that students in this concentration take PHYS 1110 & AENG 1001)

Basic Science & Mathematics (43 credits)
CHEM1110/1115 General Chemistry I/Lab 4
MATH1510 Calculus I 4
MATH1520 Calculus II 4
MATH2530 Calculus III 4
MATH3550 Differential Equations I 3
MATH3270 Advanced Mathematics for Engineers 3
MATH4880 Probability & Statistics for Engineers 3
MATH3240 Numerical Analysis 3

Engineering Physics & Engineering Topics (58 credits)
AENG 1002 Computer-Aided Engineering Design 1
CSCI 1060 Scientific Programming 3
ESCI 2100 Statics 3
ESCI 2150 Dynamics 3
ESCI 2300 Thermodynamics 3
ESCI 3200/3201 Fluid Dynamics/Lab 4
ESCI 3110 Linear Vibrations 3
PHYS 3310/3320 Optics/Lab 4
PHYS 3510 Analog & Digital Electronics/Lab 4
PHYS 4210 Electricity & Magnetism I 3

Two Engineering Physics Electives Selected From:
PHYS 3120 Advanced Classical Mechanics 3
PHYS 4220 Electricity & Magnetism II 3
PHYS 4620 Application of Quantum Mechanics 3
PHYS 4930 Special Topics (Selected with mentor) 3

One of the Two Following Tracks:
Track 1 Aeronautics
AENG 2000 Intro. to Aeronautics & Astronautics 3
AENG 3000 Performance 3
AENG 4400 Stability & Control 3
Two Upper Division Courses (AENG/ESCI 3xxx, 4xxx) 6

Track 2 Astronautics
AENG 2000 Intro. to Aeronautics and Astronautics 3
AENG 3150 Astrodynamics 3
AENG 4150 Orbital Mechanics 3
Two Upper Division Courses (AENG/ESCI 3xxx, 4xxx) 6

Senior Design Project
AENG 4004 Flight Vehicle Analysis & Design I 3
AENG 4014 Flight Vehicle Analysis & Design II 3

College Core (22 credits)
ENGL 1900 Adv. Rhet. & Research or 1920 Adv. Writing 3
CMM 2200 Small Group Presentation 1
THEO 1000 Theological Foundations 3
PHIL 2050 Ethics 3
PHIL 3400 Ethics & Engineering 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 credits)

One Course

3

Concentration in Biomedical Engineering

Professional Orientation (1 credit required)

Selected from the following:

PHYS 1110 Introduction to Physics (as a career)
AENG/MENG 1001 Introduction to AE & ME
BME 1000 Biomedical Engineering Orientation
ECE 1001 Introduction to ECE

1

Basic Science & Mathematics (58 credits)

CHEM 1110/1115 General Chemistry I/Lab
CHEM 1120/1125 General Chemistry II/Lab
BIOL 1040 Principles of Biology I/Lab
BIOL 1060 Principles of Biology II/Lab
BIOL 2600 Human Physiology
MATH 1510 Calculus I
MATH 1520 Calculus II
MATH 2530 Calculus III
MATH 3550 Differential Equations I
MATH 3270 Advanced Mathematics for Engineers
MATH 4880 Probability & Statistics for Engineers
MATH 3240 Numerical Analysis
PHYS 1610/1620 Engineering Physics I/Lab
PHYS 1630/1640 Engineering Physics II/Lab
PHYS 2610/2620 Modern Physics/Lab
PHYS 4610 Quantum Mechanics

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Engineering Physics & Engineering Topics (48 credits)

BME 1010 Biomedical Engineering Introduction
BME 2000 Biomedical Engineering Computing
BME 3200 Mechanics
BME 4200 Biomechanics
PHYS 3410 Thermodynamics & Statistical Mechanics
ECE 2001/2002 Intro. to Electrical Engineering/Lab
PHYS 3310/3320 Optics/Lab
PHYS 4210 Electricity & Magnetism I

1

Two Engineering Physics Electives Selected From:

PHYS 3120 Advanced Classical Mechanics
PHYS 4220 Electricity & Magnetism II
PHYS 4620 Application of Quantum Mechanics

3

Complete Two of the Following Two-Course Sequences:

Transport
BME 3300 Transport Fundamentals
BME 4300 Biotransport

3

Materials Science
BME 3400 Materials Science
BME 4400 Biomaterials

3

Measurements
BME 3050 Measurements

3

And one of the following two courses:
BME 4050 Biomedical Instrumentation
BME 4600 Sensory Systems

3

Signals & Systems
BME 3100 Signals
BME 4100 Biomedical Signals

3

Senior Design Project
BME 4950 Senior Project I
BME 4960 Senior Project II

3

College Core (22 credits)

ENGL 1900 Adv. Rhet. & Research or 1920 Adv. Writing
CMM 2200 Small Group Presentation
THEO 1000 Theological Foundations
PHIL 2050 Ethics
PHIL 3400 Ethics & Engineering
Social/Behavioral Science Elective
Humanities Elective
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 credit required)

Selected from the following:

PHYS 1110 Introduction to Physics (as a career)
AENG/MENG 1001 Introduction to AE & ME
BME 1000 Biomedical Engineering Orientation
ECE 1001 Introduction to ECE

1

Basic Science & Mathematics (46 credits)

CHEM1110/1115 General Chemistry I/Lab
MATH1510 Calculus I
MATH1520 Calculus II
MATH2530 Calculus III
MATH3550 Differential Equations I
MATH3270 Advanced Mathematics for Engineers
MATH4880 Probability & Statistics for Engineers
MATH3240 Numerical Analysis
PHYS 1610/1620 Engineering Physics I/Lab
PHYS 1630/1640 Engineering Physics II/Lab
PHYS 2610/2620 Modern Physics/Lab
PHYS 4610 Quantum Mechanics

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Engineering Physics & Engineering Topics (53 credits)

CSCI 1060 Intro. to CS: Scientific Programming
ECE 2101 Engineering Circuits I

3
ECE 2102 Engineering Circuits II 3
ECE 2103 Electrical Science Lab 1
ECE 2205/2206 Digital Design/Lab 4
ECE 3130 Semiconductor Devices 3
ECE 3140 Electromagnetic Fields 3
ECE 3215/3216 Computer Systems Design/Lab 4
ECE 3225/3226 Microprocessors/Lab 4
Two Engineering Electives selected with mentor 6
PHYS 3310/3320 Optics/Lab 4
PHYS 3410 Thermodynamics & Statistical Mechanics 3

Two Engineering Physics Electives Selected From:
PHYS 3120 Advanced Classical Mechanics 3
PHYS 4220 Electricity & Magnetism II 3
PHYS 4620 Application of Quantum Mechanics 3
PHYS 4930 Special Topics (Selected with mentor) 3

Senior Design Project
ECE 4800 Electrical Engineering Design I 3
ECE 4810 Electrical Engineering Design II 3

College Core (22 credits)
ENGL 1900 Adv. Rhet. & Research or 1920 Adv. Writing 3
CMM 2200 Small Group Presentation 1
THEO 1000 Theological Foundations 3
PHIL 2050 Ethics 3
PHIL 3400 Ethics & Engineering 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 credits)
Two Courses 6

Concentration in Electrical Engineering

Professional Orientation (1 credit required)
Selected from the following:
PHYS 1110 Introduction to Physics (as a career) 1
AENG/MENG 1001 Introduction to AE & ME 1
BME 1000 Biomedical Engineering Orientation 1
ECE 1001 Introduction to ECE 1

Basic Science & Mathematics (46 credits)
CHEM1110/1115 General Chemistry I/Lab 4
MATH1510 Calculus I 4
MATH1520 Calculus II 4
MATH2530 Calculus III 4
MATH3550 Differential Equations I 3
MATH3270 Advanced Mathematics for Engineers 3
MATH4880 Probability & Statistics for Engineers 3
MATH3240 Numerical Analysis 3
PHYS 1610/1620 Engineering Physics I/Lab 4
PHYS 1630/1640 Engineering Physics II/Lab 4
PHYS 2610/2620 Modern Physics/Lab 4
PHYS 3110 Classical Mechanics 3
PHYS 4610 Quantum Mechanics 3

Engineering Physics & Engineering Topics (50-51 credits)
CSCI 1060 Intro. to CS: Scientific Programming 3
ECE 2101 Engineering Circuits I 3
ECE 2102 Engineering Circuits II 3
ECE 2103 Electrical Science Lab 1
ECE 3130 Semiconductor Devices 3
ECE 3140 Electromagnetic Fields 3
PHYS 3310/3320 Optics/Lab 4
PHYS 3410 Thermodynamics & Statistical Mechanics 3

Two Engineering Physics Electives Selected From:
PHYS 3120 Advanced Classical Mechanics 3
PHYS 4220 Electricity & Magnetism II 3
PHYS 4620 Application of Quantum Mechanics 3
PHYS 4930 Special Topics (Selected with mentor) 3

One of the Following Three Tracks:
Track 1 Electromagnetic Fields and Waves
ECE 3110 Electric Energy Conversion 3
ECE 4160 Communication Systems 3
ECE 4140 Electromagnetic Waves 3
Two Engineering Electives selected with advisor 6

Track 2 Analog Electronics
ECE 3150 Linear Systems 3
ECE 3131/3132 Electronic Circuit Design/Lab 4
ECE 4120 Automatic Control Systems 3
Two Engineering Electives selected with mentor 6

Track 3 Communications
ECE 2205/2206 Digital Design/Lab 4
ECE 3150 Linear Systems 3
ECE 4160 Communication Systems 3
Two Engineering Electives selected with mentor 6

Senior Design Project
ECE 4800 Electrical Engineering Design I 3
ECE 4810 Electrical Engineering Design II 3

College Core (22 credits)
ENGL 1900 Adv. Rhet. & Research or 1920 Adv. Writing 3
CMM 2200 Small Group Presentation 1
THEO 1000 Theological Foundations 3
PHIL 2050 Ethics 3
PHIL 3400 Ethics & Engineering 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 credits)
Two Courses 6

Concentration in Mechanical Engineering

Professional Orientation (1 credit required)
Selected from the following:
PHYS 1110 Introduction to Physics (as a career) 1
MENG 1001 Introduction to AE & ME 1
BME 1000 Biomedical Engineering Orientation 1
ECE 1001 Introduction to ECE 1
(1 credit required)
(1 credit required)

Basic Science & Mathematics (43 credits)
CHEM1110/1115 General Chemistry I/Lab 4
MATH1510 Calculus I 4
MATH1520 Calculus II 4
MATH2530 Calculus III 4
MATH3550 Differential Equations I 3
MATH3270 Advanced Mathematics for Engineers 3
MATH4880 Probability & Statistics for Engineers 3
MATH3240 Numerical Analysis 3
PHYS 1610/1620 Engineering Physics I/Lab 4
PHYS 1630/1640 Engineering Physics II/Lab 4
PHYS 2610/2620 Modern Physics/Lab 4
PHYS 4610 Quantum Mechanics 3

Engineering Physics & Engineering Topics (59 credits)
AENG 3100 Computer Aided Engineering 3
CSCI 1060 Intro. to CS: Scientific Programming 3
MENG1002 Computer-Aided Engineering Design 1
ESCI 2100 Statics 3
ESCI 2150 Dynamics 3
ESCI 2300 Thermodynamics 3
ESCI 3100/3101 Mechanics of Solids/Lab 4
ESCI 3200/3201 Fluid Dynamics/Lab 4
ESCI 3110 Linear Vibrations 3
MENG2000 Foundations of Engineering Design 3
MENG3010 Machine Design 3
Upper Div. Engineering Course (MENG/ESCI 3xx, 4xx) 3
PHYS 3310/3320 Optics/Lab 4
PHYS 3510 Analog &Digital Electronics/Lab 4
PHYS 4210 Electricity & Magnetism I 3

Two Engineering Physics Electives Selected From:
PHYS 3120 Advanced Classical Mechanics 3
PHYS 4220 Electricity & Magnetism II 3
PHYS 4620 Application of Quantum Mechanics 3
PHYS 4930 Special Topics (Selected with mentor) 3

Senior Design Project
MENG4004 Design I 3
MENG4014 Design II 3

College Core (22 credits)
ENGL 1900 Adv. Rhet. & Research or 1920 Adv. Writing 3
CMM 2200 Small Group Presentation 1
THEO 1000 Theological Foundations 3
PHIL 2050 Ethics 3
PHIL 3400 Ethics & Engineering 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 credits)
One course 3

Interdisciplinary Option

Professional Orientation (1 credit required)
Selected from the following:
PHYS 1110 Introduction to Physics (as a career) 1
AENG/MENG 1001 Introduction to AE & ME 1
BME 1000 Biomedical Engineering Orientation 1
ECE 1001 Introduction to ECE 1

Basic Science & Mathematics (55 credits)
CHEM1110/1115 General Chemistry I/Lab 4
CHEM1120/1125 General Chemistry II/Lab 4
BIOL 1040 Principles of Biology I/Lab 4
BIOL 1060 Principles of Biology II/Lab 4
MATH1510 Calculus I 4
MATH1520 Calculus II 4
MATH2530 Calculus III 4
MATH3550 Differential Equations I 3
MATH3270 Advanced Mathematics for Engineers 3
MATH4880 Probability & Statistics for Engineers 3
MATH3240 Numerical Analysis 3
PHYS 1610/1620 Engineering Physics I/Lab 4
PHYS 1630/1640 Engineering Physics II/Lab 4
PHYS 2610/2620 Modern Physics/Lab 4
PHYS 4610 Quantum Mechanics 3

Engineering Physics & Engineering Topics (50 credits)

Engineering Breadth
Engineering Mechanics – One of the following options
BME 3200 Mechanics 3
BME 4200 Biomechanics 3
or
ESCI 2100 Statics 3
ESCI 2150 Dynamics 3
Computation – One of the following options
BME 2000 Biomedical Engineering Computing 3
CSCI 1060 Intro. to CS: Scientific Programming 3

Thermodynamics – One of the following options
PHYS 3410 Thermodynamics & Statistical Mechanics 3
ESCI 2300 Thermodynamics 3

Electricity & Magnetism
PHYS 4210 Electricity & Magnetism I 3
And one of the following options:
ECE 2001/2002 Intro. to ECE/Lab 4
PHYS 3510 Analog & Digital Electronics/Lab 4

Optics
PHYS 3310/3320 Optics/Lab 4

And two of the following three Engineering Breadth Areas:
Materials Science – One of the following options
BME 3400 Materials Science 3
ESCI 3100 Mechanics of Solids 3
Transport/Fluids – One of the following options
BME 3300 Transport Fundamentals 3
ESCI 3200 Fluid Dynamics 3
Signals/Systems – One of the following options
BME 3100 Signals 3
ECE 3150 Linear Systems 3

Engineering Depth
Focus Area:
Three Upper Division Engineering Courses 9

Two Engineering Physics Electives Selected From:
PHYS 3120 Advanced Classical Mechanics 3
PHYS 4220 Electricity & Magnetism II 3
PHYS 4620 Application of Quantum Mechanics 3
PHYS 4930 Special Topics (Selected with mentor) 3

Senior Design Project
Two Course Sequence 6

College Core (22 credits)
ENGL 1900 Adv. Rhet. & Research or 1920 Adv. Writing 3
CMM 2200 Small Group Presentation 1
THEO 1000 Theological Foundations 3
PHIL 2050 Ethics 3
PHIL 3400 Ethics & Engineering 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.