Parks College of Engineering, Aviation and Technology

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

Accreditation

The Aerospace Engineering, Mechanical Engineering, Electrical Engineering, Computer Engineering, Engineering Physics, and Biomedical Engineering curricula are accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 – telephone: (410) 347-7700. The Flight Science curricula is accredited by the Aviation Accreditation Board International (AABI) 3410 Skyway Drive, Auburn, AL USA 36830. The newly established Civil Engineering (2009) degree program has sought ABET accreditation in 2013. The College also offers an Interdisciplinary Engineering degree that allows students to create a customized study plan in preparation for a wide variety of career paths.

Undergraduate Degrees Offered

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

Majors Available:

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
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:

Bachelor of Science	Freshman GPA	Transfer GPA
Aerospace Engineering	3.00	2.70
Biomedical Engineering	3.00	2.70
Civil Engineering	3.00	2.70
Computer Engineering	3.00	2.70
Electrical Engineering	3.00	2.70
Engineering Physics	3.00	2.70
Interdisciplinary Engineering	3.00	2.70
Mechanical Engineering	3.00	2.70
Physics	3.00	2.70
Still Deciding – Engineering	3.00	n/a

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

Bachelor of Science in	Freshman	Transfer

Aviation	GPA	GPA
Flight Science	2.70	2.70
Aviation Management	2.70	2.70

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

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

Admission to Flight Science Program

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

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

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

Math for Entering Students

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

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

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

Special Registration Procedures

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

Pass/No Pass Option

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

These eighteen (18) hours may be taken under the following options:

1. Any hours above the number required for graduation.
2. Any hours within the number required for graduation which are no longer specified due to the results of testing out of courses and/or advanced placement.
3. Any hours within the area of concentration which are not required by the controlling department and for which the student has received the approval of the advisor.

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

Audit

A student may audit a course offered at Parks College with the following reservations:

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

Registration at Another Educational Institution

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

Flight Instruction at Other Institutions

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

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

Students with prior flight experience/certification will be evaluated for proficiency at the corresponding flight certification level. Based on the results of such evaluation, the Chief Flight 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 Flight 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 hours required in the approved programs. Students should contact the academic departments for details of these regulations.

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

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

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

Minimum GPA for Flight Training

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

Academic Categories

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 hours, full-time if enrolled for between twelve and eighteen credit hours, and full-time on overload if enrolled for more than eighteen credit hours.

Students on Supervisory Status

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

Supervisory conditions include:

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

Students on Contract Status

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

Contract conditions include:

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

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

Dismissed Students

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

Appeal Options for Dismissed Students

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

Parks College Core Curriculum

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

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

Notice to students:

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

Professional Orientation (minimum of 1 credit)

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

Jesuit Tradition (minimum of 12 credits)
Theology (3 Cr.)
Philosophy and/or Ethics (3 Cr.)
Humanistic Values (6 Cr.)
Humanistic value courses shall be chosen from: Philosophy; Theology; Social and Behavioral Sciences including Anthropology, Communications, Economics, Education, Political Science, Psychology, Public Health, Public Policy Studies, Sociology, Social Work; and Humanities including Fine Arts, Literature, History, Foreign Language.

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

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

Cultural Diversity (minimum of 3 credits)
Cultural diversity courses shall be chosen from the list of courses provided by the College of Arts and Sciences. Students may also satisfy the cultural diversity requirement for an academic semester of study at an institution where the culture is significantly different from the students' native culture; however, the credit hours will need to be replaced with an additional Humanistic Values course. Students should always consult with their Department Chair prior to the semester of study at another institution.

Capstone Experience (minimum of 3 credits)
A senior-level course or sequence of courses providing opportunities for students to use their acquired and accumulated knowledge on a problem or in a setting that is representative of that found in the profession.

Aerospace & Mechanical Engineering

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

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
Ray N. Nitzsche, Ph.D., P.E., Associate Professor Emeritus

Aerospace Engineering (B.S.)[1]

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

Student Outcomes for Aerospace Engineering

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

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

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

Program Criteria

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

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

With a solid core of mechanics, thermodynamics, fluid dynamics, electrical engineering, and linear control systems, the student is able to progress to the discipline specific areas of structures, flight mechanics, stability and control, astrodynamics, aerodynamics, and propulsion.

There is an emphasis on both aeronautics and astronautics. The humanistic value courses, including Engineering Ethics, provide a well-rounded engineering education.

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

Degree Requirements

Basic Engineering

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

Engineering Science Courses

ESCI 201 Engineering Shop Practice	1
ESCI 210 Statics	3
ESCI 211 Dynamics	3
ESCI 220 Thermodynamics	3
ESCI 310 Mechanics of Solids	3
ESCI 311 Mechanics of Solids Lab	1
ESCI 322 Fluid Dynamics	3
ESCI 323 Fluid Dynamics Lab	1
ESCI 330 Linear Vibrations	3
ESCI 430 Linear Systems	3

Aerospace Engineering Courses

Courses in bold will be offered only once a year.

AENG101 Intro to Aerospace/Mechanical Eng	**1**
AENG102 Computer Aided Engineering Des	**1**
AENG 200 Intro to Aero & Astro	**3**
AENG 310 Gas Dynamics	**3**
AENG 311 Aerodynamics	**3**
AENG 320 Performance	**3**
AENG 322 Astrodynamics	**3**
AENG 365 Computer Aided Engineering	3
AENG 401 Flight Vehicle Structures	**3**
AENG 410 Propulsion	**3**
AENG 411 Aerospace Lab	**1**
AENG 420 Stability & Control	**3**
AENG 450 Design I & Lab	**3**
AENG 451 Design II & Lab	**3**
AENG 455 Heat Transfer	3

Technical Electives

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

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

The following technical electives will be offered as AENG 493 (a different section # will be assigned)
Applied Aerodynamics
Space Mission Design
Space Dynamics & Control
Space Mission Failures
Space Mission Analysis & Design
Space Mission Integration & Test
Engineering Entrepreneurship

AENG 498 Engineering Economics

ESCI 433-01 Composite Materials

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

MATH 311 Linear Algebra for Engineers – *spring only*
MATH 315 Linear Algebra
MATH 451 Introduction to Complex Variables
MATH 454 Applied Partial Differential Equations
MATH 473 Fourier Series & Related Boundary Value Probs

MATH 493 Numerical Analysis

Basic Science & Math

CHEM 151 Engineering Chemistry I Lecture	3
CHEM 152 Engineering Chemistry I Lab	1
PHYS 161 Engineering Physics I Lecture	3
PHYS 162 Engineering Physics I Lab	1
PHYS 163 Engineering Physics II Lecture	3
PHYS 164 Engineering Physics II Lab	1
MATH 142 Calculus I	4
MATH 143 Calculus II	4
MATH 244 Calculus III	4
MATH 355 Differential Equations	3
MATH 370 Advanced Math for Engineers	3

Math/Science Elective **3**

Choose one 3 credit hour course from the following list.

BIOL 104 Principles of Biology I
BIOL 106 Principles of Biology II
BIOL 109 Biodiversity & Conservation
BIOL 110 Introduction to Biology
BIOL 115 Genetics & Human Diversity
BIOL 215 Genetics & Human Diversity
BIOL 216 Genetics & Social Science
BIOL 236 Concepts of Biology
BIOL 260 Human Physiology
BIOL 417 Introduction to GIS

BIOL 419 GIS in Biology

CHEM 164 General Chemistry II
CHEM 220 Chemistry & Crime

EAS 101 Earth Systems I-The Solid Earth
EAS 103 Earth's Dynamics Environment II
EAS 105 Introduction to Oceanography
EAS 107 Understanding the Weather
EAS 108 Intro to Environmental Science
EAS 109 Climate and Humankind in History
EAS 114 Earth History
EAS 117 Physical Geography
EAS 130 Seismology of Nuclear Explosion
EAS 131 Water-Our Precious Resource
EAS 135 Real Meteorology
EAS 138 Missouri Climate
EAS 142 Foundations of Atmospheric Science
EAS 160 Sustainable Energy
EAS 193 Introduction to Earthquakes
EAS 220 Mineralogy
EAS 325 Global Change
EAS 405 Petrology
EAS 423 Micrometeorology
EAS 430 Structural Geology
EAS 460 Introduction to the Physics of Solid Earth
EAS 462 Intro to Earthquake Seismology
EAS 470 Theory of Vibrating Systems
EAS 472 Seismological Instrumentation

MATH 266 Principles of Mathematics
MATH 311 Linear Algebra for Engineers
MATH 315 Introduction to Linear Algebra
MATH 320 Numerical Analysis
MATH 360 Combinatorics
MATH 363 Financial Mathematics
MATH 401 Elementary Theory of Probability
MATH 403 Probability and Statistics for Engineers
MATH 405 History of Mathematics
MATH 411 Introduction to Abstract Algebra
MATH 421 Intro to Analysis
MATH 441 Foundations of Geometry
MATH 447 Non-Euclidean Geometry
MATH 451 Introduction to Complex Variables
MATH 455 Nonlinear Dynamics and Chaos
MATH 457 Partial Differential Equations
MATH 463 Graph Theory
MATH 465 Cryptography

PHYS261 Modern Physics
PHYS311 Classical Mechanics
PHYS331 Optics
PHYS341 Thermodynamics and Statistical Mech
PHYS351 Analog & Digital Electronics
PHYS361 Modern Physics II
PHYS401 Topics in Modern Physics
PHYS421 Electricity & Magnetism I
PHYS441 General Relativity
PHYS461 Quantum Mechanics

Communications

ENGL1920 Advanced Writing for Professionals	3

Liberal Arts

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

Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core on 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 (ENGL 2000-2600, 3000-3950, 4100-4790), History, and Foreign Languages (excludes English or native language).

Social & Behavioral Sciences courses (3 credits) 100 or 200 level: Anthropology, Communication, Communication

Disorders, Criminology and Criminal Justice, Economics, Education, Political Science, Psychology, Social Work, Sociology, and Public Policy Studies (excludes field service courses).

Mechanical Engineering (B.S.)[2]

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

Engineering Science Courses

ESCI 201 Engineering Shop Practice	1
ESCI 210 Statics	3
ESCI 211 Dynamics	3
ESCI 220 Thermodynamics	3
ESCI 310 Mechanics of Solids	3
ESCI 311 Mechanics of Solids Lab	1
ESCI 322 Fluid Dynamics	3
ESCI 323 Fluid Dynamics Lab	1
ESCI 330 Linear Vibrations	3
ESCI 430 Linear Systems	3

Mechanical Engineering Courses

Courses in bold will be offered only once a year

MENG101 Intro to Aerospace/Mechanical Eng	**1**
MENG102 Computer Aided Engineering Des	**1**
MENG 200 Foundation to Engineering Design	**3**
MENG 225 Manufacturing Process/Lab	**3**
MENG 235 Applied Thermodynamics	**3**
MENG 333 Mechanical Engineering Lab	**1**

MENG 339 Measurements **3**
MENG 345 Machine Design **3**
MENG 351 Material Science 3
MENG 365 Computer Aided Engineering **3**
MENG 445 Principles of Mechatronics **3**
MENG 450 Design I & Lab **3**
MENG 451 Design II & Lab **3**
MENG 455 Heat Transfer 3

Technical Electives
Choose 6 credit hours from the list below. Each course is 3 credit hours. Check Self Service Banner to see if the course is currently being offered.
AENG 453-01 Intro to Comp. Fluid Dynamics
ESCI 433 Composite Materials

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

MENG 470 Creativity, Innovation & Sustainability
MENG 498 Special Topics

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

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

Basic Science & Math
CHEM 151 Engineering Chemistry I Lecture 3
CHEM 152 Engineering Chemistry I Lab 1

PHYS 161 Engineering Physics I Lecture 3
PHYS 162 Engineering Physics I Lab 1
PHYS 163 Engineering Physics II Lecture 3
PHYS 164 Engineering Physics II Lab 1
MATH 142 Calculus I 4
MATH 143 Calculus II 4
MATH 244 Calculus III 4
MATH 355 Diff. Equations 3
MATH 370 Advanced Math for Engineers 3

Math/Science Elective **3**

Choose one 3 credit hour course from the following list.

BIOL 104 Principles of Biology I
BIOL 106 Principles of Biology II
BIOL 109 Biodiversity & Conservation
BIOL 110 Introduction to Biology
BIOL 115 Genetics & Human Diversity
BIOL 215 Genetics & Human Diversity
BIOL 216 Genetics & Social Science
BIOL 236 Concepts of Biology
BIOL 260 Human Physiology
BIOL 417 Introduction to GIS
BIOL 419 GIS in Biology

CHEM 164 General Chemistry II
CHEM 220 Chemistry & Crime

EAS 101 Earth Systems I-The Solid Earth
EAS 103 Earth's Dynamics Environment II
EAS 105 Introduction to Oceanography
EAS 107 Understanding the Weather
EAS 108 Intro to Environmental Science
EAS 109 Climate and Humankind in History
EAS 114 Earth History
EAS 117 Physical Geography
EAS 130 Seismology of Nuclear Explosion
EAS 131 Water-Our Precious Resource
EAS 135 Real Meteorology
EAS 138 Missouri Climate
EAS 142 Foundations of Atmospheric Science
EAS 160 Sustainable Energy
EAS 193 Introduction to Earthquakes
EAS 220 Mineralogy
EAS 325 Global Change
EAS 405 Petrology
EAS 423 Micrometeorology
EAS 430 Structural Geology
EAS 460 Introduction to the Physics of Solid Earth
EAS 462 Intro to Earthquake Seismology
EAS 470 Theory of Vibrating Systems
EAS 472 Seismological Instrumentation

MATH266 Principles of Mathematics
MATH311 Linear Algebra for Engineers
MATH315 Introduction to Linear Algebra
MATH320 Numerical Analysis
MATH360 Combinatorics
MATH363 Financial Mathematics
MATH401 Elementary Theory of Probability
MATH403 Probability and Statistics for Engineers
MATH405 History of Mathematics
MATH411 Introduction to Abstract Algebra
MATH421 Intro to Analysis
MATH441 Foundations of Geometry
MATH447 Non-Euclidean Geometry
MATH451 Introduction to Complex Variables
MATH455 Nonlinear Dynamics and Chaos
MATH457 Partial Differential Equations
MATH463 Graph Theory
MATH465 Cryptography

PHYS261 Modern Physics

PHYS311 Classical Mechanics
PHYS331 Optics
PHYS341 Thermodynamics and Statistical Mech
PHYS351 Analog & Digital Electronics
PHYS361 Modern Physics II
PHYS401Topics in Modern Physics
PHYS421 Electricity & Magnetism I
PHYS441 General Relativity
PHYS461 Quantum Mechanics

Communications
ENGL1920 Advanced Writing for Professionals 3

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

Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core 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 (ENGL 2000-2600, 3000-3950, 4100-4790), History,
and Foreign Languages (excludes English or native language)

Social & Behavioral Sciences courses (3credits) 100 or 200 level: Anthropology, Communication, Communication Disorders, Criminology and Criminal Justice, Economics, Education, Political Science, Psychology, Social Work, Sociology, and Public Policy Studies (excludes field service courses).

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 credit hours course work, of which up to 9 hours may be research credit. Up to 9 credits may be course work at the 400 level; the remaining course credits must be at the 500 level or above. For course only option, 30 credits of course work is required. Specific programs of study for each student are developed under the guidance of a faculty mentor.

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

AENG primary major, MENG secondary major. Additional courses required:		MENG primary major, AENG secondary major. Additional courses required:	
MENG 225	Manufacturing Processes	AENG 200	Intro to Aero & Astro
MENG 235	Applied Thermodynamics	AENG 310	Gas Dynamics*
MENG 333	ME Lab	AENG 311	Aerodynamcis*
MENG 339	Measurements	AENG 310	Performance
MENG 345	Machine Design	AENG 322	Astrodynamics
MENG 351	Material Science	AENG 401	Flight Vehicle Structures
MENG 445	Principles of Mechatronics	AENG 410	Propulsion
MENG 450	ME Design I/Lab	AENG 411	Aerospace Lab
MENG 451	ME Design II/Lab	AENG 420	Stability & Control
		AENG 450	AE Design I/Lab

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

Minor in Aerospace Engineering

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

Minor in Mechanical Engineering

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

Aviation Science

Stephen M. Belt, Ph.D., **Chair**

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

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

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

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

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

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

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

Minor/Approved Emphasis Area

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

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

Minor in Air Traffic Control
Minor in Flight Education

Minor in Flight Science

Degree Requirements
Flight Science Concentration (121 credit hours)

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

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

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

Students should complete one of the two math sequences.
MATH 120 College Algebra 3
MATH 132 Survey of Calculus 3
Or
MATH 141 Pre-Calculus 3
MATH 142 Calculus I 4
PHYS 135 Aviation Physics I/Lab 4

Communication Skills (12 credit hours)
CMM 120 Public Speaking 3
ENGL 1500 The Process of Composition 3
ENGL 1900 Adv Str Rhetoric and Research 3
ENGL 2020 English 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 3

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

Flight Science (19 credit hours)

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

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

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

Certificate, minor or affiliated electives 18

Total Credit Hours 121

Aviation Management (B.S. in Aeronautics)

The Aviation Management program prepares the graduate for entry-level positions within the aviation and space industries, and/or government agencies. Career opportunities for graduates include: management and supervisory positions with commercial airlines, the aircraft/aerospace industry, airports and governmental agencies, as well as positions as contract negotiators, budget analyst, project administrators, personnel directors and positions in sales, marketing and advertising.

The goal of the Aviation Management program is to not only prepare our graduates to manage aviation operations, but also to prepare them as socially responsible leaders who have a strong foundation in technical skills and are equipped with sufficient breath 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 (120 credit hours)

Professional Orientation (3 credit hours)

ASCI 101 Professional Orientation	2
EDH 100 Enhancing 1st Yr. Success	1

Jesuit Tradition (12 credit hours)

PHIL 105 Introduction to Philosophy	3
PHIL 205 Ethics	3
PSY 101 General Psychology	3
THEO 100 Theological Foundations	3

Knowledge (16 credit hours)

ITM 200 Intro to Information Tech Management	3

Students should complete one of the two math sequences.

MATH 120 College Algebra	3
MATH 132 Survey of Calculus	3
Or	
MATH 141 Pre-Calculus	3
MATH 142 Calculus I	4

PHYS 135 Aviation Physics I & Lab	4
FSCI 130 Aviation Weather	3

Communication Skills (12 credit hours)

CMM 120 Public Speaking	3
ENGL 1500 The Process of Composition	3
ENGL 1900 Advanced Strategies Rhetoric/Research	3
ENGL 2020 English 2020 or higher	3

Cultural Diversity (3 credit hours)

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

Cultural Diversity Elective	3

Liberal Arts

Cultural Diversity Elective	3

Aviation Science Core (18 credit hours)

ASCI 195 Safety Management Systems	3
ASCI 310 Air Carrier Operations	3
ASCI 405 Human Factors	3
ASCI 435 Team Resource Management	3
ASCI 425 Professional Ethics and Standards	3
FSCI 445 Aviation Law	3

Aviation Management Concentration (30 credit hours)

AMGT 480 International Aviation	3
AMGT 490 Senior Seminar (Capstone)	3
ECON 190 Principles of Economics	3
ENGL 4000 Business & Professional Writing	3
FSCI 465 Economics of Air Transportation	3
MGMT 300 Management Theory and Practice	3
MGMT 310 Management of Human Resources	3
OPM 207 Introduction to Statistics	3
OPM 305 Introduction to Management Science	3

ASCI 475 Internship with Industry	3

Approved Emphasis Area (27 credit hours)

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

Certificate, minor or affiliated electives	27
Total Credit Hours	**120**

Distance Degree Requirements

Aviation Management Concentration (120 credit hours)

Professional Orientation (3 credit hours)

ASCI 101 Professional Orientation	2
PST 100 Enhancing 1st Yr. Success	1

Jesuit Tradition (12 credit hours)

PHIL 105 Introduction to Philosophy	3
PHIL 205 Ethics	3
PSYK 101 General Psychology	3
THEO 100 Theological Foundations	3

Knowledge (16 credit hours)

CSTD 130 Information System & Technology	3

Students should complete one of the two math sequences.

MATH 120 College Algebra	3
MATH 132 Survey of Calculus	3
Or	
MATH 141 Pre-Calculus	3

MATH 142 Calculus I	4
PHYS 135 Aviation Physics I & Lab	4
FSCI 130 Aviation Weather	3

Communication Skills (12 credit hours)

CMMK 121 Public Speaking	3
ENGL 1500 The Process of Composition	3
ENGL 1900 Advanced Strategies Rhetoric/Research	3
ENGL 2020 English 2020 or higher	3

Cultural Diversity (3 credit hours)

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

Cultural Diversity Elective	3

Liberal Arts

Cultural Diversity Elective	3

Aviation Science Core (18 credit hours)

ASCI 195 Safety Management Systems	3
ASCI 310 Air Carrier Operations	3
ASCI 405 Human Factors	3
ASCI 425 Professional Ethics and Standards	3
FSCI 445 Aviation Law	3
OSTD 330 Team Dynamics	3

Aviation Management Concentration (30 credit hours)

AMGT 480 International Aviation	3
AMGT 490 Senior Seminar (Capstone)	3
CSTD 295 Principles of Data Analysis	3
ENGL 4000 Business & Professional Writing	3
FSCI 465 Economics of Air Transportation	3
OSTD 320 Interpersonal Relations in Organizations	3
OSTD 300 Organizational Foundations	3
PST 190 Survey of Economics	3
PST 320 Human Resources in Organizations	3
ASCI 475 Internship with Industry	3

Approved Emphasis Area (27 credit hours)

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

Certificate, minor or affiliated electives	27
Total Credit Hours	**120**

Minor in Air Traffic Control

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 130 Aviation Weather	3
FSCI 125 Basic Flight Foundations	3
ASCI 102 Intro to Air Traffic Control System	2
ASCI 202 Fundamentals of Air Traffic Control	3
ASCI 303 Basic ATC Tower & Radar	3
ASCI 304 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 310 Flight Instructor Prep I	2
PP 320 Principles of Flight Instruction I	3
PP 350 Flight Instructor Prep II	2
PP 360 Principles of Flight Instruction II	3
PP 410 CFI Practicum I	3
PP 450 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 115 Flight 1	2
FSCI 125 Basic Flight Foundations	3
FSCI 155 Flight 2	2
FSCI 215 Flight 3	2
FSCI 225 Instrument Flight Foundations	3
FSCI 255 Flight 4	2
FSCI 265 Navigation Flight Foundations	3
FSCI 355 Flight 5	2
Total Credit Hours	**19**

Biomedical Engineering

Michelle B. Sabick, Ph.D.

Faculty:
Gary Bledsoe, Ph.D.
Natasha Case, Ph.D.
Yan Gai, Ph.D.
Andrew Hall, Ph.D.
Scott Sell, Ph.D.
Cecil W. Thomas, Ph.D.
Silviya P. Zustiak, 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 biotransport. Within these courses, topics may address problems in areas like cardiology, orthopedics, neurobiology, biology, or psychology. Students develop research and design skills in courses and laboratories throughout the curriculum, but the senior project provides a culminating experience by focusing on a specific yearlong problem that may be done individually or in teams.

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

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

Program Educational Objectives

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

1: Graduates will have established themselves as practicing engineers in biomedical engineering and health related positions in industry, government and academia.

2: Graduates will have acquired advanced degrees or be engaged in advanced study in biomedical engineering or other fields related to their long term career goals.

3: Graduates will attain a major milestone in their career development within the first five to seven years.

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

a) an ability to apply knowledge of mathematics, science, and engineering;
b) an ability to design and conduct experiments, as well as to analyze and interpret data;
c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
d) an ability to function on multi-disciplinary teams;
e) an ability to identify, formulate, and solve engineering problems;
f) an understanding of professional and ethical responsibility;
g) an ability to communicate effectively;
h) the broad education necessary to understand the impact of engineering solutions in a global and societal context;
i) a recognition of the need for, and an ability to engage in life-long learning;
j) a knowledge of contemporary issues;
k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;
l) an understanding of biology and physiology, and the capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology;
m) an ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems.

Biomedical Engineering (B.S.)

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

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

The minimum curriculum includes:

Basic Science & Math

CHEM 163 General Chemistry I	3
CHEM 165 General Chemistry I Lab	1
CHEM 164 General Chemistry II	3
CHEM 166 General Chemistry II Lab	1
BIOL 104 Biology I & Lab	4
BIOL 106 Biology II & Lab	4
BIOL 260 Human Physiology	3
PHYS 161 Engineering Physics I	3
PHYS 162 Engineering Physics I Lab	1
PHYS 163 Engineering Physics II	3
PHYS 164 Engineering Physics II Lab	1
PHYS 341 Thermodynamics	3
MATH 142 Calculus I	4
MATH 143 Calculus II	4
MATH 244 Calculus III	4
MATH 355 Differential Equations	3
MATH 403 Probability & Statistics	3

Basic Engineering

BME 320 Mechanics	3
ECE 200 Electrical & Computer Eng	3
ECE 201 Electrical & Computer Eng Lab	1
ESCI 201 Engineering Shop Practice	1

Communications

ENGL 1900 Adv Strategies of Rhet & Research	3

One credit hour of the four credit hour Parks College Core requirement for written and oral communication will be satisfied by BME 100 Orientation, BME 101 Intro, or CMM293 Small Group Presentations. 1

Liberal Arts

THEO 100 Theological Foundations	3
PHIL 205 Ethics	3
Humanities	3
Cultural Diversity	3
Social & Behavioral Sciences	3
Non-Technical Elective	3

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

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

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

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

Biomedical Engineering Core

BME 100 BME Orientation	1
BME 101 BME Introduction	1
BME 200 BME Computing	3
BME 310 Signals	3
BME 330 Transport Fundamentals	3
BME 340 Materials Science	3
BME 395 Junior Lab	1
BME 405 Biomedical Instrumentation	3
BME 495/496 Senior Project I & II	6

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

A. Advanced Biomedical Engineering

BME 410 Biomedical Signals	3
BME 415 Sensory Systems	3
BME 420 Biomechanics	3
BME 430 Biotransport	3
BME 431 Advanced Topics in Biotransport	3
BME 440 Biomaterials	3
BME 450 Numerical Methods in BME	3
BME 460 Quantitative Physiology	3
BME 441 Tissue Engineering	3
BME 442 Tissue/Material Interfaces	3
BME 498 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 (MATH141) or The Process of Composition (ENGA1500).

Minimum BS Credits (BME) 128

Minor in Biomedical Engineering

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

To initiate a Minor in BME, a student should file a "Minor in BME" plan with the BME Department after meeting with a BME Faculty member to discuss the minor courses and their prerequisites. The "Minor in BME" form serves as a planning tool and 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 by unique to a single student, or it may involve multiple students. The IDE program has mentors who will assist students in exploring options for Focus Areas and with finding other faculty members with the appropriate expertise

The minimum IDE curriculum includes:

Basic Science & Math

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

Communications & Liberal Arts

ENGL 1900 Adv Strategies of Rhet & Research	3
THEO 100 Theological Foundations	3
PHIL 205 Ethics	3
Humanities	3
Cultural Diversity	3
Social & Behavioral Sciences	3
Non-Technical Elective	3

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

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

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

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

Engineering Core

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

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

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

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

Minimum BS Credits (IDE) 120

Civil Engineering

Ronaldo Luna, Ph.D., P.E., Chair

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

Civil Engineering (B.S.)

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

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

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

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

Degree Requirements

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

Math/Science Electives 7
Choose 7 credit hours in Math or Science. The Math and Science elective cannot be a prerequisite course for required courses in the curriculum. Either BIOL 104 or an EAS course (or both) must be taken to satisfy the ABET basic science requirement. Acceptable EAS courses include EAS 230, EAS 211/244, or EAS 253. 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
ENGL192 Advanced Writing for Professionals 3
CMM 293 Small Group Presentation 1

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

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

Cultural Diversity elective courses must be selected from an approved Arts & Sciences list. See the description of the Parks College core 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 (ENGL 200-260, 300-395, 410-479), History, and Foreign Languages (excludes English or native language).

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

Basic Engineering

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

Engineering Science Courses

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

Civil Engineering Courses

All of the following courses will be offered only once a year.

CVNG 101 Freshman Engineering I	1
CVNG 102 Freshman Engineering II	1
CVNG 150 Civil Engineering Computing	3
CVNG 203 Sustainability & Environmental Engr.	3
CVNG 204 Sustainability & Envir. Engr. Lab	1
CVNG 301 Structural Analysis	3
CVNG 302 Structural Analysis Lab	1
CVNG 303 Civil Engineering Materials	2
CVNG 305 Introduction to Surveying	1
CVNG 307 Engineering Project Management	2
CVNG 309 Geotechnical Engineering	3
CVNG 310 Geotechnical Engineering Lab	3
CVNG 311 Transportation Engineering	3
CVNG 312 Transportation Engineering Lab	1
CVNG 313 Hydraulic Engineering	3
CVNG 314 Hydraulic Engineering Lab	1
CVNG 315 Introduction to Structural Design	3
CVNG 401 Senior Engineering	1
CVNG 450 Capstone Design I	3
CVNG 451 Capstone Design II	3

Professional Development Electives **12**

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

Minimum 125

Electrical and Computer Engineering

Huliyar S. Mallikarjuna, Ph.D., Chair (mallikhs@slu.edu)

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

The Department of Electrical and Computer Engineering offers two undergraduate programs leading to the degree of Bachelor of Science in Electrical Engineering or Computer Engineering. 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)

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

Communications Requirements (3 credits)

ENGL 1920 Adv Writing for Professionals	3

Computer Requirement

CSCI 145 Intro to Scientific Programming	3

Liberal Arts Requirements (15 credits)

PHIL 340 Ethics and Engineering	3
THEO 100 Theological Foundations	3
Cultural Diversity	3
Humanities	3
Social & Behavioral Science	3

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

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

Social & Behavioral Sciences courses include: Anthropology, Communication (CMM 100, 401, 402, 403, 406, 407, 409, 461), Communication Disorders (CSDI 100, 254, 470), Economics, Education (EDF 304, 305, 423, 470, EDI 204, 420, 462, 431),

Political Science, Psychology, Social Work (SWRK 100, 225, 302, 327), Sociology, Criminal Justice, and Public Policy Studies (excludes field service courses).

Electrical Engineering Core Requirements (50 credits)

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

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

ECE317 Computer Architecture
ECE400 Sustainable Energy
ECE401 Systems Engineering
ECE410 Power Systems
ECE421 Image Processing
ECE426 Robotics Design
ECE430 Analog IC
ECE435 Digital IC
ECE441Radar Systems
ECE445 Computer Networks
ECE450 Filter Design
ECE451 Digital Signal Processing
ECE461Spacecraft Communications
ECE462 Cellular Communications
ECE470 Energy Technologies I
ECE510 Power Systems Analysis II
ECE498 Special Topics
MATH465 Cryptography

One Open Elective

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

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

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

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

Minimum BS Credits 125

Bioelectronics Concentration (B.S. in Electrical Engineering)

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

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

When students graduate from the program with the Electrical Engineering Degree with Bioelectronics concentration in hand, they will find a wealth of career opportunities open to them as effective engineers in bioengineering industries. Graduates can find employment with hospitals' Clinical Engineering Divisions, medical equipment and medical device manufacturers,

healthcare R&D centers, healthcare services companies, medical laboratories, university laboratories, and equipment vendors. Degree-holders could also choose to work in the electrical engineering and biomedical engineering industries. Graduates will be able to provide much needed training and support in the use of highly sophisticated medical equipment to researchers, clinicians, medical doctors, and other healthcare professionals.

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

Degree Requirements

Basic Science & Math (51 credits)

BIOL 104 Biology I & Lab	4
BIOL 106 Biology II & Lab	4
BIOL 260 Human Physiology	3
CHEM 163 General Chemistry I	3
CHEM 165 General Chemistry I Lab	1
CHEM 164 General Chemistry II	3
CHEM 166 General Chemistry II Lab	1
PHYS 161 Engineering Physics I	3
PHYS 162 Engineering Physics I Lab	1
PHYS 163 Engineering Physics II	3
PHYS 164 Engineering Physics II Lab	1
MATH 135 Discrete Math	3
MATH 142 Calculus I	4
MATH 143 Calculus II	4
MATH 244 Calculus III	4
MATH 311 Linear Algebra	3
MATH 355 Differential Equations	3
MATH 403 Probability and Statistics	3

Communications (3 credits)

ENGL 1920 Adv Writing for Professionals	3

Liberal Arts (15 credits)

PHIL 340 Ethics and Engineering	3
THEO 100 Theological Foundations	3
Cultural Diversity	3
Humanities	3
Social & Behavioral Science	3

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

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

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

Electrical Engineering Core Requirements (41 credits)

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

Biomedical Engineering Core (12 credits)

BME 200 BME Computing	3
BME 405 Biomedical Instrumentation	3
BME 410 Biomedical Signals	3
BME 415 BME Sensory Systems	3

Biomedical, Electrical, Computer Engineering Elective

Select one 3 credit hour course from a list of approved ECE or BME courses at 300 level or higher.

Internship and Co-op

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

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

Minimum BS Credits 125

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

Degree Requirements

Basic Science & Math (59 credits)

BIOL 104 Biology I & Lab	4
BIOL 106 Biology II & Lab	4
BIOL 302 Molecular Cell Biology I	3
CHEM 163 General Chemistry I	3
CHEM 165 General Chemistry I Lab	1
CHEM 164 General Chemistry II	3
CHEM 166 General Chemistry II Lab	1
CHEM 342 Organic Chemistry	3
CHEM 344 Organic Chemistry Lab	1
CHEM 343 Organic Chemistry II	3
CHEM 345 Organic Chemistry II Lab	1
PHYS 161 Engineering Physics I	3
PHYS 162 Engineering Physics I Lab	1
PHYS 163 Engineering Physics II	3
PHYS 164 Engineering Physics II Lab	1
MATH 135 Discrete Math	3
MATH 142 Calculus I	4
MATH 143 Calculus II	4
MATH 244 Calculus III	4
MATH 311 Linear Algebra	3
MATH 355 Differential Equations	3
MATH 403 Probability and Statistics	3

Communications (3 credits)

ENGL 1920 Adv Writing for Professionals	3

Liberal Arts (15 credits)

PHIL 340 Ethics and Engineering	3
THEO 100 Theological Foundations	3
Cultural Diversity	3
Humanities	3
Social & Behavioral Science	3

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

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

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

Electrical Engineering Core (41 credits)

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

Biomedical Engineering Core

BME 200 BME Computing	3
BME 405 Biomedical Instrumentation	3

Biomedical, Electrical, Computer Engineering Option

Select one 3 credit hour course from a list of approved ECE or BME courses at 300 level or higher.

Minimum BS Credits 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 multi-disciplinary teams, and also develop effective communication skills. In addition to a strong focus on computer skills and computer software, the program provides a design experience which is developed and integrated throughout the program by introducing fundamental elements of design process in course work. The program also includes a two-semester design sequence to provide a meaningful, major engineering design experience that also focuses on professional practice. Several modern laboratories in the program provide "hands-on" experience. There is also a strong emphasis on the studies of

humanities and social sciences that serve not only to fulfill an objective appropriate to the engineering profession but also to meet Saint Louis University's educational objectives. The overall program provides an integrated educational experience and training to maintain professional competency through life-long learning.

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

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

Program Mission

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

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

Program Educational Objectives

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

Student Outcomes

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

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

Degree Requirements

Basic Science & Math (36 credits)

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

Communications (3 credits)

ENGL 1920 Adv Writing for Professionals	3

Computer Science (14 credits)

CSCI 150 Intro Object Oriented Program	4
CSCI 180 Data Structures	4
CSCI 290 OO Software Design	3
CSCI 324 Operating Systems	3

Liberal Arts (15 credits)

PHIL 340 Ethics and Engineering	3
THEO 100 Theological Foundations	3
Cultural Diversity	3
Humanities	3
Social & Behavioral Science	3

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

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

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

Computer Engineering Core (44 credits)

ECE 101 Intro to ECE	1
ECE 102 Intro to ECE II	1
ECE 202 Engineering Circuits I	3
ECE 203 Engineering Circuits II	3
ECE 204 Electrical Science Lab	1
ECE 205 Digital Design	3
ECE 206 Digital Design Lab	1
ECE 305 Advanced Digital Design	3
ECE 315 Computer Systems Design	3
ECE 316 Computer Systems Design Lab	1
ECE 317 Computer Architecture	3
ECE 325 Microprocessors	3
ECE 326 Microprocessors Lab	1
ECE 330 Semiconductor Devices	3
ECE 350 Signals & Systems	3
ECE 351 Signals & Systems Lab	1
ECE 390 Junior Design	1
ECE 445 Computer Networks	3
ECE 490 ECE Design I	3
ECE 491 ECE Design II	3

ECE (CSCI) Electives for CpE Majors

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

ECE 310 Energy Conversion
ECE 331 Electronic Circuits
ECE 340 Electromagnetic Fields
ECE 425 Hardware Software Co-design
ECE 426 Robotics
ECE 435 Digital IC
ECE 451 Digital Signal Processing
ECE 498 Special Topics
CSCI 314 Algorithms
CSCI 344 Programming Languages
CSCI 357 Computer Graphics I
CSCI 371 Databases
CSCI 390 Software Engineering
CSCI 425 Advanced Operating Systems
CSCI 434 Network Programming II
CSCI 462 Artificial Intelligence
MATH 465 Cryptography

Two Technical Elective

2 approved course (6 hours) selected from courses in science, mathematics, or engineering, at the 200-level or higher, or Computer Science at 300 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 275 Co-op	0-3
ECE 375 Co-op	0-3
ECE 475 Co-op	0-3
ECE 276 Internship	0-3
ECE 376 Internship	0-3
ECE 476 Internship	0-3

Minimum BS Credits 125

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

Degree Requirements

Basic Science & Math (36 credits)

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

Communications

ENGL 1920 Adv Writing for Professionals	3

Liberal Arts (9 credit hours)

PHIL 340 Ethics and Engineering	3
THEO 100 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 400 will satisfy cultural diversity).

Computer Engineering Core (44 credits)

ECE 101 Intro to ECE	1
ECE 102 Intro to ECE II	1
ECE 202 Engineering Circuits I	3
ECE 203 Engineering Circuits II	3

ECE 204 Electrical Science Lab	1
ECE 205 Digital Design	3
ECE 206 Digital Design Lab	1
ECE 305 Advanced Digital Design	3
ECE 315 Computer Systems Design	3
ECE 316 Computer Systems Design Lab	1
ECE 317 Computer Architecture	3
ECE 325 Microprocessors	3
ECE 326 Microprocessors Lab	1
ECE 330 Semiconductor Devices	3
ECE 350 Signals & Systems	3
ECE 351 Signals & Systems Lab	1
ECE 390 Junior Design	1
ECE 445 Computer Networks	3
ECE 490 ECE Design I	3
ECE 491 ECE Design II	3

Computer Science (14 credits)

CSCI 150 Intro Object Oriented Program	4
CSCI 180 Data Structures	4
CSCI 290 OO Software Design	3
CSCI 324 Operating Systems	3

ECE (CSCI) Electives for CpE Majors

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

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

One core elective under Certificate Program

One Technical Elective

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

Pre-law Core (15 credits)

PLS 100 Intro to Law	2
PLS 105 Intro to Legal Careers	1
PLS 200 or 210	3
PLS 390 Intro to Aplt. Advocacy	3
PLS 375 Issues in Law	3
PLS 400 Comparative Legal Systems	3

Minimum BS Credits 130

Physics

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

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

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

Physics (B. S.)

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

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

Prerequisites (28 credits):

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

Required Physics & Mathematics Courses (39 credits)

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

Additional Requirements (6 credits)

Two additional upper division physics courses (minimum 6 hours) selected from the list below.

PHYS 312 Advanced Classical Mechanics	3
PHYS 422 Electricity and Magnetism II	3
PHYS 462 Application of Quantum Mechanics	3

Research Experience (3 credits)

PHYS 386 Physics Research I	0
PHYS 487 Physics Research II	0
PHYS 488 Physics Research III	3

Allied Electives (21 credits)

Seven Courses Selected with Mentor	21

College Core (22 credits)

ENGL 1900 or 1920 Advanced Writing	3
CMM 220 Small Group Presentation	1
THEO 100 Theological Foundations	3
PHIL 205 Ethics	3
Social/Behavioral Science Elective	3
Humanities Elective	3
General Elect (Soc/Behav or Humanities)	3
Cultural Diversity Elective	3

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

Open Elective (3 credits)

One Course	3

Physics Minor

A **Parks College** student can earn a minor in physics by completing at least 22 hours of physics consisting of:

PHYS 161/162 Engineering Physics I/Lab	4
PHYS 163/164 Engineering Physics II/Lab	4
PHYS 261/262 Modern Physics/Lab	4
Three physics courses (one with Lab) numbered PHYS 300 – PHYS 493	10

A **College of Arts & Sciences** student can earn a minor in physics by completing at least 18 hours of physics consisting of:

PHYS 161/162 Engineering Physics I/Lab	4
PHYS 163/164 Engineering Physics II/Lab	4
PHYS 261/262 Modern Physics/Lab	4
Two physics courses numbered PHYS 300–PHYS 493	6

Engineering Physics (B. S.)

The Department of Physics, in collaboration with the Engineering Departments of Parks College offers a Bachelor of Science Degree in Engineering Physics that prepares students for a broad range of careers requiring scientific and technical knowledge. This program is 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 core. This degree is conferred by Parks College. This curriculum also satisfies all requirements for a Minor in Engineering Mathematics.

Concentration in Aerospace Engineering

Professional Orientation (1cr required)

Selected from the following:

PHYS 111 Introduction to Physics (as a Career)	1
ESCI 101 Freshman Engineering I	1
BME 100 Biomedical Engineering Orientation	1
ECE 101 Introduction to ECE	1

(It is recommended that students in this Concentration take PHYS111 and ESCI101)

Basic Science and Mathematics (43 credits)

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

Engineering Physics & Engineering Topics (58 credits)

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

Two Engineering Physics Electives Selected From:

PHYS 312 Advanced Classical Mechanics	3
PHYS 422 Electricity and Magnetism II	3
PHYS 462 Application of Quantum Mechanics	3
PHYS 493 Special Topics (Selected with mentor)	3

One of the Two Following Tracks:

Track1 Aeronautics

AENG 200 Intro to Aero and Astronautics	3
AENG 320 Performance	3
AENG 420 Stability and Control	3
Two Upper Division Courses	6

Track 2 Astronautics

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

Senior Design Project

AENG 450 Engineering Design I	3
AENG 451 Engineering Design II	3

College Core (22 credits)

ENGL 1900 or 1920 Advanced Writing	3
CMM 220 Small Group Presentation	1
THEO 100 Theological Foundations	3
PHIL 205 Ethics	3
PHIL 340 Engineering Ethics	3
Social/Behavioral Science Elective	3
Humanities Elective	3
Cultural Diversity Elective	3

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

Open Elective (3 credits)

One Course	3

Concentration in Biomedical Engineering

Professional Orientation (1cr required)

Selected from the following:

PHYS 111 Introduction to Physics (as a Career)	1
ESCI 101 Freshman Engineering I	1
BME 100 Biomedical Engineering Orientation	1
ECE 101 Introduction to ECE	1

Basic Science and Mathematics (58 credits)

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

Engineering Physics & Engineering Topics (48 credits)

BME 101 Biomedical Engineering Introduction	1
BME 200 Biomedical Computing	3
BME 320 Mechanics	3
BME 420 Biomechanics	3
PHYS 341 Thermo & Statistical Mechanics	3
ECE 200/201 Electric & Computer Engineering with Lab	4
PHYS 331/332 Optics/Lab	4
PHYS 421 Electricity and Magnetism I	3

Two Engineering Physics Electives Selected From:

PHYS 312 Advanced Classical Mechanics	3
PHYS 422 Electricity and Magnetism II	3
PHYS 462 Application of Quantum Mechanics	3
PHYS 493 Special Topics (Selected with mentor)	3

Complete Two of the Following Two-Course Sequences:

Transport

BME 330 Transport Fundamentals	3
BME 430 Biotransport	3

Materials Science

BME 340 Materials Science	3
BME 440 Biomaterials	3

Measurements

BME 305 Measurements	3

And one of the following two courses:

BME 405 Biomedical Instrumentation	3
BME 415 Sensory Systems	3

Signals and Systems

BME 310 Signals and Systems	3
BME 410 Biomedical Signals	3

Senior Design Project

BME 495 Senior Projects I	3
BME 496 Senior Projects II	3

College Core (22 credits)

ENGL 1900 or 1920 Advanced Writing	3
CMM 220 Small Group Presentation	1
THEO 100 Theological Foundations	3
PHIL 205 Ethics	3
PHIL 340 Engineering Ethics	3
Social/Behavioral Science Elective	3
Humanities Elective	3
Cultural Diversity Elective	3

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

Concentration in Computer Engineering

Professional Orientation (1cr required)

Selected from the following:

PHYS 111 Introduction to Physics (as a Career)	1
ESCI 101 Freshman Engineering I	1
BME 100 Biomedical Engineering Orientation	1
ECE 101 Introduction to ECE	1

Basic Science and Mathematics (46 credits)

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

Engineering Physics & Engineering Topics (53 credits)

CSCI 145 Scientific Programming	3
ECE 205/206 Digital Design / Lab	4
ECE 202 Engineering Circuits I	3
ECE 203 Engineering Circuits II	3
ECE 204 Electrical Science Lab	1
ECE 340 Electromagnetic Fields	3
ECE 330 Semiconductor Devices	3
ECE 325/326 Microprocessors / Lab	4
ECE 315/316 Computer Sys Design / Lab	4
Two Engineering Electives selected with mentor	6
PHYS 331/332 Optics/Lab	4
PHYS 341 Thermo & Statistical Mechanics	3

Two Engineering Physics Electives Selected From:

PHYS 312 Advanced Classical Mechanics	3
PHYS 422 Electricity and Magnetism II	3
PHYS 462 Application of Quantum Mechanics	3
PHYS 493 Special Topics (Selected with mentor)	3

Senior Design Project

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

College Core (22 credits)

ENGL 1900 or 1920 Advanced Writing	3
CMM 220 Small Group Presentation	1
THEO 100 Theological Foundations	3
PHIL 205 Ethics	3
PHIL 340 Engineering Ethics	3
Social/Behavioral Science Elective	3
Humanities Elective	3
Cultural Diversity Elective	3

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

Open Electives (6 credits)

Two Courses	6

Concentration in Electrical Engineering

Professional Orientation (1cr required)

Selected from the following:

PHYS 111 Introduction to Physics (as a Career)	1
ESCI 101 Freshman Engineering I	1
BME 100 Biomedical Engineering Orientation	1
ECE 101 Introduction to ECE	1

Basic Science and Mathematics (46 credits)

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

Engineering Physics & Engineering Topics (50-51 credits)

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

Two Engineering Physics Electives Selected From:

PHYS 312 Advanced Classical Mechanics	3
PHYS 422 Electricity and Magnetism II	3
PHYS 462 Application of Quantum Mechanics	3
PHYS 493 Special Topics (Selected with mentor)	3

One of the Following Three Tracks:

Track 1 Electromagnetic Fields and Waves

ECE 310 Electric Energy Conversion	3
ECE 460 Communication Systems	3
ECE 440 Electromagnetic Waves	3
Two Engineering Electives selected with advisor	6

Track 2 Analog Electronics

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

Track 3 Communication

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

Senior Design Project

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

College Core (22 credits)

ENGL 1900 or 1920 Advanced Writing	3
CMM 220 Small Group Presentation	1
THEO 100 Theological Foundations	3
PHIL 205 Ethics	3
PHIL 340 Engineering Ethics	3
Social/Behavioral Science Elective	3
Humanities Elective	3
Cultural Diversity Elective	3

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

Open Electives (6 credits)

Two Courses	6

Concentration in Mechanical Engineering

Professional Orientation (1cr required)

Selected from the following:

PHYS 111 Introduction to Physics	1
ESCI 101 Freshman Engineering I	1
BME 100 Biomedical Engineering Orientation	1
ECE 101 Introduction to ECE	1

(It is recommended that students in this Concentration take PHYS 111 and ESCI 101)

Basic Science and Mathematics (43 credits)

CHEM163/165 General Chemistry I/Lab	4
MATH 142 Calculus I	4
MATH 143 Calculus II	4
MATH 244 Calculus III	4
MATH 355 Differential Equations I	3
MATH 370 Advanced Mathematics for Engineers	3
MATH 403 Probability & Stats for Engineers	3
MATH 320 Numerical Methods	3
PHYS 161/162 Engineering Physics I/Lab	4
PHYS 163/164 Engineering Physics II/Lab	4
PHYS 261/262 Modern Physics/Lab	4
PHYS 461 Quantum Mechanics	3

Engineering Physics & Engineering Topics (59 credits)

ESCI 102 Intro to Computer Aided Design	1
CSCI 145 Scientific Programming	3
ESCI 210 Statics	3
ESCI 211 Dynamics	3
ESCI 220 Thermodynamics	3
ESCI 310/311 Mechanics of Solids / Lab	4
ESCI 322/323 Fluid Mechanics/Lab	4
ESCI 330 Linear Vibrations	3
MENG 200 Foundations of Engineering Design	3
MENG 345 Machine Design	3
MENG 365 Computer Aided Engineering	3
Upper Division Engineering Course	3
PHYS 331/332 Optics/Lab	4

PHYS 351 Analog and Digital Electronics	4
PHYS 421 Electricity and Magnetism I	3
Two Engineering Physics Electives Selected From:	
PHYS 312 Advanced Classical Mechanics	3
PHYS 422 Electricity and Magnetism II	3
PHYS 462 Application of Quantum Mechanics	3
PHYS 493 Special Topics (Selected with mentor)	3

Senior Design Project

MENG 450 Engineering Design I	3
MENG 451 Engineering Design II	3

College Core (22 credits)

ENGL 1900 or 1920 Advanced Writing	3
CMM 220 Small Group Presentation	1
THEO 100 Theological Foundations	3
PHIL 205 Ethics	3
PHIL 340 Engineering Ethics	3
Social/Behavioral Science Elective	3
Humanities Elective	3
Cultural Diversity Elective	3

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

Open Elective (3 credits)

One course	3

Interdisciplinary Option

Professional Orientation (1cr required)

Selected from the following:

PHYS 111 Introduction to Physics (as a Career)	1
ESCI 101 Freshman Engineering I	1
BME 100 Biomedical Engineering Orientation	1
ECE 101 Introduction to ECE	1

Basic Science and Mathematics (55 credits)

CHEM 163/165 General Chemistry I/Lab	4
CHEM 164/166 General Chemistry II/Lab	4
BIOL 104 Principles of Biology I/Lab	4
BIOL 106 Principles of Biology II/Lab	4
MATH 142 Calculus I	4
MATH 143 Calculus II	4
MATH 244 Calculus III	4
MATH 355 Differential Equations I	3
MATH 370 Advanced Mathematics for Engineers	3
MATH 403 Probability & Stats for Engineers	3
MATH 320 Numerical Methods	3
PHYS 161/162 Engineering Physics I/Lab	4
PHYS 163/164 Engineering Physics II/Lab	4
PHYS 261/262 Modern Physics/Lab	4
PHYS 461 Quantum Mechanics	3

Engineering Physics & Engineering Topics (50 credits)

Engineering Breadth

Engineering Mechanics – One of the following options

BME 320, BME 420 Mechanics and Biomech	6
ESCI 210, 211 Statics and Dynamics	6

Computation – One of the following options

BME 200 Biomedical Computing	3
CSCI 145 Scientific Programming	3

Thermodynamics – One of the following options

PHYS 341 Thermo and Statistical Mechanics	3
ESCI 220 Thermodynamics	3

Electricity and Magnetism

PHYS 421 Electricity and Magnetism I	3
And one of the following options:	3
ECE 200/201 Electrical & Computer Engineering with Lab	4
PHYS 351 Analog and Digital Electronics	4

Optics

PHYS 331/332 Optics / Lab	4

And two of the following three Engineering Breadth Areas:

Materials Science – One of the following options

BME 340 Materials Science	3
ESCI 310 Mechanics of Solids	3

Transport/Fluids – One of the following options

BME 330 Transport Fundamentals	3
ESCI 322 Fluid Dynamics	3

Signals/Systems – One of the following options

BME 310 Signals and Systems	3
ECE 350 Signals and Systems	3

Engineering Depth

Focus Area:	
Three Upper Division Engineering courses	9

Two Engineering Physics Electives Selected From:

PHYS 312 Advanced Classical Mechanics	3
PHYS 422 Electricity and Magnetism II	3
PHYS 462 Application of Quantum Mechanics	3
PHYS 493 Special Topics (Selected with mentor)	3

Senior Design Project

Two Course Sequence	6

College Core (22 credits)

ENGL 1900 or 1920 Advanced Writing	3
CMM 220 Small Group Presentation	1
THEO 100 Theological Foundations	3
PHIL 205 Ethics	3
PHIL 340 Engineering Ethics	3
Social/Behavioral Science Elective	3
Humanities Elective	3
Cultural Diversity Elective	3

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