Aerospace & Mechanical Engineering

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Aerospace Engineering (B.S.)

Program Educational Objectives:

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

Student Outcomes for Aerospace Engineering

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

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

Program Criteria

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

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

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

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

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

Degree Requirements

Basic Engineering

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

Engineering Science Courses

ESCI	2100	Statics	3
ESCI	2150	Dynamics	3
ESCI	2300	Thermodynamics	3
ESCI	3100	Mechanics of Solids	3
ESCI	3101	Mechanics of Solids Lab	1
ESCI	3110	Linear Vibrations	3
ESCI	3200	Fluid Dynamics	3
ESCI	3201	Fluid Dynamics Lab	1
ESCI	3410	Analysis Control Linear Systems	3
MENG	2011	Engineering Shop Practice	1

Aerospace Engineering Courses

AENG	1001	Intro to Aerospace/Mechanical Eng	1
AENG	1002	Computer Aided Engineering Des	1
AENG	2000	Intro to Aero & Astro	3
AENG	3000	Performance	3
AENG	3100	Computer Aided Engineering	3
AENG	3150	Astrodynamics	3
AENG	3210	Gas Dynamics	3
AENG	3220	Aerodynamics	3
AENG	4004	Design I & Lab	3
AENG	4014	Design II & Lab	3
AENG	4110	Flight Vehicle Structures	3
AENG	4111	Aerospace Lab	1
AENG	4210	Propulsion	3
AENG	4400	Stability & Control	3
MENG	4300	Heat Transfer	3

Technical Electives
Choose 6 credits from an approved AE/ME list each semester.

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

Basic Science & Math

CHEM	1070	Engineering Chemistry I Lecture	3
CHEM	1075	Engineering Chemistry I Lab	1
PHYS	1610	Engineering Physics I Lecture	3
PHYS	1620	Engineering Physics I Lab	1
PHYS	1630	Engineering Physics II Lecture	3
PHYS	1640	Engineering Physics II Lab	1
MATH	1510	Calculus I	4
MATH	1520	Calculus II	4
MATH	2530	Calculus III	4
MATH	3550	Differential Equations	3
MATH	3270	Advanced Math for Engineers	3

Math/Science Elective **3**
Choose one 3-credit course from the AE/ME Department approved list.

Communications

ENGL	1920	Advanced Writing for Professionals	3

Liberal Arts

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

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

Humanistic Values courses shall be chosen from: Humanities or Social & Behavioral Sciences.

Humanities courses include:
Fine Arts (excludes applied, studio, and performance courses), Literature (ENGL 2000-2600, 3000-3950, 4100-4790), History, American Studies and Foreign Languages (excludes English or native language), Philosophy or Theology.

Social & Behavioral Sciences courses include:
1000/2000 level in Anthropology, Communication, Communication Disorders, Criminology and Criminal Justice, Economics, Education, Political Science,

Psychology, Sociology, Social Work or Public Policy Studies.

Mechanical Engineering (B.S.)

Program Educational Objectives:

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

Student Outcomes for Mechanical Engineering

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

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

Program Criteria

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

The Mechanical Engineering curriculum emphasizes Design and Manufacturing, which are the two most important functions of an engineer. Design is well integrated into all levels of the curriculum. An attempt is made to solicit industry-sponsored projects for the capstone senior design course. In addition to basic science, mathematics, and engineering science courses, the curriculum includes courses in both the thermal system and mechanical system. The humanistic value courses, including Engineering Ethics, provide a well-rounded engineering education. Since modern mechanical systems are controlled by electronic systems, a course on Principles of Mechatronics has been included to provide the necessary interdisciplinary experience. The technical electives in the curriculum allow the student to specialize in thermal system, mechanical system, or entrepreneurship. Designing and developing high speed transportation (cars, trains, ships, planes), automated manufacturing, rapid prototyping, advanced robots, energy efficient devices, alternate energy sources, smart materials, and artificial devices for humans are some of the future challenges for a mechanical engineer. This curriculum provides the necessary building blocks and prepares the graduates to be a part of this future.

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

Degree Requirements

Basic Engineering

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

Engineering Science Courses

ESCI	2100	Statics	3
ESCI	2150	Dynamics	3
ESCI	2300	Thermodynamics	3
ESCI	3100	Mechanics of Solids	3
ESCI	3101	Mechanics of Solids Lab	1
ESCI	3200	Fluid Dynamics	3
ESCI	3201	Fluid Dynamics Lab	1
ESCI	3110	Linear Vibrations	3
ESCI	3410	Analysis Control Linear Systems	3
MENG	2011	Engineering Shop Practice	1

Mechanical Engineering Courses

MENG1001 Intro to Aerospace/Mechanical Eng	1
MENG1002 Computer Aided Engineering Des	1
MENG 2000 Foundation to Engineering Design	3
MENG 2300 Applied Thermodynamics	3
MENG 2600 Manufacturing Process/Lab	3
MENG 3001 Mechanical Engineering Lab	1
MENG3010 Machine Design	3
AENG 3100 Computer Aided Engineering	3
MENG 3430 Measurements	3
MENG3510 Material Science	3
MENG4004 Design I & Lab	3
MENG4014 Design II & Lab	3
MENG4300 Heat Transfer	3
MENG4450 Principles of Mechatronics	3

Technical Electives
Choose 6 credits from an approved AE/ME list each semester.

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

BasicScience&Math

CHEM 1070 Engineering Chemistry I Lecture	3
CHEM 1075 Engineering Chemistry I Lab	1
PHYS 1610 Engineering Physics I Lecture	3
PHYS 1620 Engineering Physics I Lab	1
PHYS 1630 Engineering Physics II Lecture	3
PHYS 1640 Engineering Physics II Lab	1
MATH 1510 Calculus I	4
MATH 1520 Calculus II	4
MATH 2530 Calculus III	4
MATH 3550 Diff. Equations	3
MATH 3270 Advanced Math for Engineers	3

Math/Science Elective **3**
Choose one 3-credit course from the AE/ME Department approved list.

Communications

ENGL1920 Advanced Writing for Professionals	3

Liberal Arts

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

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

Humanistic Values courses shall be chosen from: Humanities or Social & Behavioral Sciences.

Humanities courses include:
Fine Arts (excludes applied, studio, and performance courses), Literature (ENGL 2000-2600, 3000-3950, 4100-4790), History, American Studies and Foreign Languages (excludes English or native language), Philosophy or Theology.

Social & Behavioral Sciences courses include:
1000/2000 level in Anthropology, Communication, Communication Disorders, Criminology and Criminal Justice, Economics, Education, Political Science, Psychology, Sociology, Social Work or Public Policy Studies.

Bachelor-Master's Degree and Double Major Options

Bachelor-Master's Degree Option:

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

The bachelor's-master's option requires completion of the standard requirements for a M.S. degree in addition to completion of the standard requirements of a B.S. degree. The M.S. degree requires 30 credits course work, of which up to 9 credits may be research credit. Up to 9 credits may be course work at the 4000 level; the remaining course credits must be at the 5000 level or above. For course only option, 30 credits of course work is required. Specific programs of study for each student are developed under the guidance of a faculty mentor.
A student pursuing two B.S. degrees from two different colleges should satisfy the requirements of both colleges.

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 2300	Applied Thermodynamics
MENG 2600	Manufacturing Process
MENG 3001	ME Lab
MENG 3010	Machine Design
MENG 3430	Measurements
MENG 3510	Material Science
MENG 4004	ME Design I/Lab
MENG 4014	ME Design II/Lab
MENG 4450	Principles of Mechatronics
MENG PRIMARY MAJOR AENG secondary major - Additional courses required:	
AENG 2000	Intro to Aero & Astro
AENG 3000	Performance
AENG 3150	Astrodynamics
AENG 3210	Gas Dynamics *
AENG 3220	Aerodynamics *
AENG 4004	AE Design I/Lab
AENG 4110	Flight Vehicle Structures
AENG 4111	Aerospace Lab
AENG 4210	Propulsion
AENG 4400	Stability & Control

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

Minor in Aerospace Engineering

To provide students pursuing a Bachelor's degree in Mathematics, Computer Science, Physics, Electrical and Computer Engineering, Biomedical Engineering, and Civil Engineering programs an opportunity to explore Aerospace Engineering.

The Minor in Aerospace Engineering requires at least 18 credits of coursework that include a course in Introduction to Aeronautics and Astronautics (AENG 2000) and at least five AENG or ESCI courses at the 2000 level or above (beyond the requirements for your major**). The grades in all AENG/ESCI courses must be C or better.**

To initiate a Minor in Aerospace Engineering, a student should consult with a faculty member in the Aerospace and Mechanical Engineering (AE/ME) department to discuss the minor courses and their prerequisites aligned with the interest of the student. The completion of a Minor in Aerospace Engineering must be certified by the chair of the AE/ME department as part of the graduation check

Minor in Mechanical Engineering

To provide students pursuing a Bachelor's degree in Mathematics, Computer Science, Physics, Electrical and Computer Engineering, Biomedical Engineering, and Civil Engineering programs an opportunity to explore Mechanical Engineering.

The Minor in Mechanical Engineering requires at least 18 credits of coursework that include a course in Foundations to Engineering Design (MENG 2000) and at least five MENG or ESCI courses at the 2000 level or above (beyond the requirements for your major). **The grades in all MENG/ESCI courses must be C or better.**

To initiate a Minor in Mechanical Engineering, a student should consult with a faculty member in the Aerospace and Mechanical Engineering department to discuss the minor courses and their prerequisites aligned with the interest of the student. The completion of a Minor in Mechanical Engineering must be certified by the chair of the AE/ME department as part of the graduation check.