

computing the GPA, and the course credit hours are counted only once. This requirement assures that the student has demonstrated overall competence in the chosen major.

To complete the B.S. degree program in four years, a student must take approximately 17 credit hours per semester. A typical B.S. degree program that completes degree requirements in four years is as follows.

Industrial and Management Systems Engineering

First Year

Common first year as listed on the *middle* of page 102.

Second Year

First Semester	Hrs.	Second Semester	Hrs.
MATH 251 <i>Multivariable Calculus</i>	4	MATH 261 <i>Elem. Differential Equat.</i> ...	4
CHEM 116 or PHYS 112.....	4	MAE 243 <i>Mech. of Materials</i>	3
MAE 241 <i>Statics</i>	3	IENG 213 <i>Engineering Statistics</i>	3
ENGL 102 <i>Comp. & Rhetoric</i>	3	IENG 377 <i>Engineering Economy</i>	3
IENG 200 <i>Fundamentals of IE</i>	1	GEC Elective	3
IENG 220 <i>Re-Engineering</i>	3	Total	16
Total	18		

Third Year

First Semester	Hrs.	Second Semester	Hrs.
ECON 201 <i>Microeconomics</i>	3	ECON 202 <i>Macroeconomics</i>	3
IENG 304 <i>Materials and Costing</i>	3	IENG 302 <i>Mfg. Processes</i>	2
IENG 314 <i>Adv. Analy. Eng. Data</i>	3	IENG 303 <i>Mfg. Processes Lab</i>	1
IENG 350 <i>Intro. Oper. Research</i>	3	IENG 316 <i>Ind. Quality Cont.</i>	3
IENG 360 <i>Human Factors Engr.</i>	3	IENG 331 <i>Computer Appl. IE</i>	3
Total	15	IENG 343 <i>Prod. Plan & Design</i>	3
		Total	15

Fourth Year

First Semester	Hrs.	Second Semester	Hrs.
EE 221 <i>Basic Electric Eng.</i>	3	IENG 472 <i>Design Prod. Systems</i>	3
EE 222 <i>Basic Electric Lab</i>	1	IENG <i>Technical Elective</i>	3
IENG <i>Technical Elective</i>	3	IENG 446 <i>Plant Layout/Mat'l Hand.</i> ...	3
IENG 455 <i>Simula. Digital Meth.</i>	3	Select 2 of the following courses.....	6
IENG 471 <i>Design Productive Sys.</i>	3	IENG <i>Technical Elective</i>	
GEC Elective	3	MAE 242 <i>Dynamics</i>	
Total	16	MAE 320 <i>Thermodynamics</i>	
		MAE 331 <i>Fluid Mechanics</i>	
		Total	15
		Grand Total	129

Department of Mechanical and Aerospace Engineering

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Degrees Offered

Bachelor of Science in Mechanical Engineering
Bachelor of Science in Aerospace Engineering

Curriculum in Aerospace Engineering

Aerospace travel, space exploration, and flight of manned or unmanned vehicles continue to gain significance. Aerospace engineering is involved with the science and technology of advanced vehicles, including aircraft, rockets, missiles, and spacecraft. Although a

specialized branch of engineering, it is also diverse. Aerospace technology has expanded to include design and development of new earthbound vehicles such as ground-effect machines, hydrofoil ships, and high-speed rail-type systems.

Objectives

The Department of Mechanical and Aerospace Engineering is highly committed to provide a foundation in aerospace engineering so that graduates will meet the following objectives:

- Graduates will be proficient in aerospace engineering.
- Graduates will be prepared to meet the varying demands of the workforce in the technological arena.
- Graduates will be prepared for the pursuit of lifelong learning.

The curriculum consists of a judicious combination of fundamentals, including mathematics and sciences, and practical laboratory experience which provides modern engineering tools. Aeronautical engineering subjects are to be the focus of the discipline along with significant exposure to space-related topics. The graduate will be able to critically analyze aerospace engineering problems and execute practical solutions. In addition to being able to function independently, it is expected that the graduate will be able to function with effective written and oral communication within a multidisciplinary team and be equipped with several factors such as environmental, social, and economic considerations due to a thorough education in the humanities, social sciences, ethics, safety, and professionalism.

The aerospace engineering curriculum includes studies in the disciplines encountered in the design of aerospace vehicles, missiles, rockets, and spacecraft. Undergraduate students extensively study the basic principles of fluid dynamics, solid mechanics and structures, stability and control, and thermal sciences and propulsion. The senior year includes a capstone flight vehicle design course.

The student is involved in both theoretical and experimental studies, and trained to integrate knowledge with practical engineering design. With the breadth and depth of education in aerospace engineering, the student becomes a versatile engineer, competent to work in many areas. The curriculum may serve as a terminal program by incorporating design-oriented courses for technical electives, or it may be used as a preparatory program for advanced study by the selection of science-oriented courses.

While the undergraduate curriculum is sufficiently broad to permit the graduate to select from a wide variety of employment opportunities, it contains sufficient depth to prepare a student to enter a graduate school to pursue an advanced degree. As modern science and engineering become more complex, the desirability of graduate-level preparation is being recognized by most advanced industries and government agencies.

Students can simultaneously pursue B.S. degrees in both aerospace engineering and mechanical engineering by completing additional courses. Information on this 155 credit-hour, four-and-one-half-year option can be seen at the end of this department description.

Students who plan a career in medicine, dentistry, or related areas, but who desire an aerospace engineering degree before entering the appropriate professional school, may substitute eight hours (from a combination of biology and organic chemistry courses) for the required six hours of technical electives. This selection will help the student satisfy admission requirements to the professional schools in the health sciences.

The aerospace engineering program at WVU is administered by the faculty of the Department of Mechanical and Aerospace Engineering.

Minimum Grade Point Average Requirement for Graduation (B.S.A.E.)

A requirement for graduation in aerospace engineering is a departmental GPA of at least 2.0 in all required mechanical and aerospace engineering departmental courses. If a required MAE course is repeated, only the hours credited and the grade received for the last completion of the course will be counted in computing the student's departmental GPA.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. To complete the B.S.A.E. degree program in four years, a student must take approximately 16 credit hours per semester. A typical B.S.A.E. degree program which completes degree requirements in four years is as follows.

Aerospace Engineering

First Year

Common first year as listed on the *middle* of page 102.

Second Year

First Semester	Hrs.
MAE 215 <i>Intro. to Aerospace Engr.</i> ...	3
MAE 241 <i>Statics</i>	3
MATH 251 <i>Multivariable Calculus</i>	4
PHYS 112 <i>General Physics</i>	4
ENGL 102 <i>Comp. and Rhetoric</i>	3
Total	17

Second Semester	Hrs.
MAE 242 <i>Dynamics</i>	3
MAE 243 <i>Mechanics of Materials</i>	3
MAE 244 <i>Dynam. and Strength Lab.</i> ..	1
MATH 261 <i>Elem. Differential Equat.</i> ..	4
GEC Elective	3
Total	14

Third Year

First Semester	Hrs.
MAE 320 <i>Thermodynamics</i>	3
MAE 335 <i>Incompressible Aerodyn.</i> ...	3
MAE 343 <i>Intermed. Mech. of Matls.</i> ...	3
EE 221 <i>Basic Electrical Engr.</i>	3
EE 222 <i>Basic Electrical Lab</i>	1
GEC Elective	3
Total	16

Second Semester	Hrs.
MAE 316 <i>Analy. of Engr. Sys.</i>	3
MAE 336 <i>Compress. Aerodyna.</i>	3
MAE 345 <i>Aerospace Structures</i>	3
MAE 365 <i>Flight Dynamics</i>	3
GEC Elective	3
Total	15

Fourth Year

First Semester	Hrs.
MAE 426 <i>Flight Vehcl Propulsion</i>	3
MAE 434 <i>Experimental Aerodyna.</i> ...	2
MAE 456 <i>CAD/Finite Elem. Anal.</i>	3
MAE 475 <i>Flight Vehicle Design</i>	3
Technical Elective.....	3
Total	14

Second Semester	Hrs.
MAE 423 <i>Heat Transfer</i>	3
MAE 460 <i>Automatic Controls</i>	3
MAE 476 <i>Space Flight and Sys.</i>	3
Technical Elective	3
GEC Elective	3
Total	15
Grand Total	125

Note: The six hours of technical electives must be selected from a list of approved aerospace engineering technical electives after consulting with the advisor; the courses selected should form a clear and consistent pattern according to the career objectives of the student. The 12 hours of General Education Curriculum (GEC) courses must be selected to meet the University and college GEC requirements.

Curriculum in Mechanical Engineering

Mechanical engineering is a broad technical discipline. It integrates knowledge of the physical sciences and mathematics for the design, construction, and manufacture, testing, analysis, use, and operation of a device, structure, a machine, a process, or a system in service to mankind. Its development parallels the growth of industry. Modern society needs mechanical engineers who have broad and deep training in the fundamentals of engineering and related sciences, and have developed a versatility in analyzing and solving complex problems. The mechanical engineer must not only possess a high level of professional expertise but also have an appreciation for vital human and economic considerations.

Mechanical engineers are problem-solvers who are scientifically informed and mathematically minded. The mechanical engineering curriculum prepares students to deal effectively with a broad range of engineering problems rather than with narrow specialties. Graduates find employment in a wide range of industries, government agencies, and educational institutions where they are concerned with many functions: the use and economic conversion of energy from natural sources into useful energy for power, light, heating, cooling, and transportation; the design and production of machines to lighten the burden of human work; the planning and development of systems for using energy machines and resources; the processing of materials into products useful to mankind; and the education and training of specialists who deal with mechanical systems.

Objectives

The Department of Mechanical and Aerospace Engineering is highly committed to provide a foundation in mechanical engineering so that graduates will meet the following objectives:

- Graduates will be proficient in mechanical engineering.
- Graduates will be prepared to meet the varying demands of the workforce in the technological arena.
- Graduates will be prepared for the pursuit of lifelong learning.

The curriculum consists of a judicious combination of fundamentals, including mathematics and sciences, and practical laboratory experience which provides modern engineering tools. Mechatronics, which is a study of the interdependence between mechanical engineering and electrical/electronics engineering, is a key part of the mechanical engineering curriculum. The graduate will be able to critically analyze mechanical engineering problems and execute practical solutions. In addition to being able to function independently, it is expected that the graduate will be able to function with effective written and oral communication within a multidisciplinary team and be equipped with several factors such as environmental, social, and economic considerations due to a thorough education in the humanities, social sciences, ethics, safety, and professionalism.

While the undergraduate curriculum is sufficiently broad to permit the graduate to select from a wide variety of employment opportunities, it contains sufficient depth to prepare a student to enter a graduate school to pursue an advanced degree. As modern science and engineering become more complex, the desirability of graduate-level preparation is being recognized by most advanced industries and government agencies.

Students can simultaneously pursue B.S. degrees in both aerospace engineering and mechanical engineering by completing additional courses. Information on this 155 credit-hour, four-and-one-half-year option can be seen at the end of this section.

Students who plan a career in medicine, dentistry, or related areas, but who desire a mechanical engineering degree before entering the appropriate professional school, may substitute eight hours (from a combination of biology and organic chemistry courses) for the required six hours of technical electives. This selection will help the student satisfy admission requirements to the professional schools in the health sciences.

The mechanical engineering program at WVU is administered by the faculty of the Department of Mechanical and Aerospace Engineering.

Minimum Grade Point Average Requirement for Graduation (B.S.M.E.)

A requirement for graduation in mechanical engineering is a departmental grade point average of 2.0 or better for all required mechanical and aerospace engineering (MAE) courses. If a required MAE course is repeated, only the hours credited and the grade received for the last completion of the course is used in computing the grade point average.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. To complete the B.S.M.E. degree program in four years, a student must take approximately 16 credit hours per semester. A typical B.S.M.E. degree program which completes degree requirements in four years is as follows.

Mechanical Engineering

First Year

Common first year as listed on the *middle* of page 102.

Second Year

First Semester	Hrs.	Second Semester	Hrs.
MAE 211 <i>Mechtron.</i> or GEC Elect....	3	MAE 242 <i>Dynamics</i>	3
MAE 241 <i>Statics</i>	3	MAE 243 <i>Mechanics of Materials</i>	3
MATH 251 <i>Multivariable Calculus</i>	4	MAE 244 <i>Dynam. and Strength Lab.</i> ..	1
PHYS 112 <i>General Physics</i>	4	MATH 261 <i>Elem. Differential Equat.</i> ..	4
ENGL 102 <i>Comp. and Rhetoric</i>	3	MAE 211 <i>Mechtron.</i> or GEC Elect.....	3
Total	17	Total	14

Third Year

First Semester	Hrs.
MAE 320 <i>Thermodynamics</i>	3
MAE 331 <i>Fluid Mechanics</i>	3
MAE 343 <i>Intermed. Mech. Matls.</i>	3
EE 221 <i>Basic Electrical Engr.</i>	3
EE 222 <i>Basic Electrical Lab</i>	1
GEC Elective	3
Total	16

Second Semester	Hrs.
MAE 316 <i>Analy. of Engr. Sys.</i>	3
MAE 321 <i>Applied Thermodynamics</i> ..	3
MAE 322 <i>Thermal and Fluids Lab</i>	1
MAE 342 <i>Dynamics of Machines</i>	3
IENG 302 <i>Manufacturing Process</i>	2
IENG 303 <i>Manufact. Process Lab</i>	1
GEC Elective	3
Total	16

Fourth Year

First Semester	Hrs.
MAE 454 <i>Machine Design & Mfg.</i>	3
MAE 456 <i>CAD/Finite Elem. Ana. or.</i> ..	3
MAE 423 <i>Heat Transfer</i>	
MAE 471 <i>Prin. of Engr. Design</i>	3
Technical Elective.....	3
GEC Elective	3
Total	15

Second Semester	Hrs.
MAE 411 <i>Advanced Mechatronics</i>	3
MAE 423 <i>Heat Transfer or</i>	3
MAE 456 <i>CAD/Finite Elem. Ana.</i>	
MAE 460 <i>Automatic Controls</i>	3
Technical Elective	3
Total	12
Grand Total	124

Note: The six hours of technical electives must be selected from a list of approved mechanical engineering technical electives after consulting with the advisor; the courses selected should form a clear and consistent pattern according to the career objectives of the student. The 12 hours of General Education Curriculum (GEC) courses must be selected to meet the University and college GEC requirements.

Curriculum for a Dual Major in Aerospace Engineering and Mechanical Engineering

In the modern technical marketplace, college graduates must attain every competitive edge possible to enhance their career opportunities. One way to do this is with a master's degree following the bachelor's degree; however, this often results in more specialization than may be desired, and may take an additional two years. Another option is to broaden the undergraduate experience, thus opening more opportunities for the graduate. The dual B.S.A.E./B.S.M.E. program awards both the aerospace engineering and mechanical engineering degrees at the completion of a planned curriculum.

Students under this option pursue the B.S.A.E. and B.S.M.E. degrees simultaneously. This can be accomplished by declaring intentions as a freshman requesting admission to the programs, or by informing an MAE advisor of the dual-degree preference. Maximum scheduling flexibility will result when this decision is made as early as possible in the student's academic career. Dual-degree students must take all courses listed in the 155-hour dual curriculum below and satisfy the other requirements of the two individual programs.

The state of West Virginia is a member of a group of Academic Common Market (ACM) states. WVU allows residents of states within the ACM to enroll in the dual B.S.A.E./B.S.M.E. program on an in-state tuition basis. Application must be made through the higher education authority of the state of residence.

Curriculum for a Dual Major in Aerospace and Mechanical Engineering

First Year

Common first year as listed on the *middle* of page 102.

Second Year

First Semester	Hrs.
MAE 215 <i>Intro. Aerospace Engr.</i>	3
MAE 241 <i>Statics</i>	3
MATH 251 <i>Multivariable Calculus</i>	4
PHYS 112 <i>General Physics</i>	4
ENGL 102 <i>Comp. and Rhetoric</i>	3
Total	17

Second Semester	Hrs.
MAE 211 <i>Mechatronics</i>	3
MAE 242 <i>Dynamics</i>	3
MAE 243 <i>Mechanics of Materials</i>	3
MAE 331 <i>Fluid Mechanics</i>	4
MATH 261 <i>Elem. Differential Equat.</i> ..	3
GEC Elective	3
Total	19

Third Year

First Semester	Hrs.
MAE 244 <i>Dynam. & Strength Lab</i>	1
MAE 320 <i>Thermodynamics</i>	3
MAE 335 <i>Incompressible Aerodyn.</i> ...	3
MAE 343 <i>Intermed. Mech of Matls.</i> ...	3
EE 221 <i>Basic Electrical Engr.</i>	3
EE 222 <i>Basic Electrical Lab.</i>	1
GEC Elective	3
Total	17

Second Semester	Hrs.
MAE 316 <i>Analy. of Eng. Sys.</i>	3
MAE 336 <i>Compressible Aero.</i>	3
MAE 342 <i>Dynamics of Machines</i>	3
MAE 345 <i>Aerospace Structures</i>	3
MAE 365 <i>Flight Dynamics</i>	3
GEC Elective	3
Total	18

Fourth Year

First Semester	Hrs.
MAE 322 <i>Thermal & Fluids Lab</i>	1
MAE 426 <i>Flight Vehicle Propulsion</i> ...	3
MAE 434 <i>Experimental Aerodyn</i>	2
MAE 456 <i>CAD/Finite Elem Anal.</i>	3
MAE 475 <i>Flight Vehicle Design</i>	3
Technical Elective.....	3
Technical Elective.....	3
Total	18

Second Semester	Hrs.
MAE 411 <i>Advanced Mechatronics</i>	3
MAE 423 <i>Heat Transfer</i>	3
MAE 460 <i>Automatic Controls</i>	3
MAE 476 <i>Space Flight and Sys.</i>	3
IENG 302 <i>Mfg. Process</i>	2
IENG 303 <i>Mfg. Process Lab</i>	1
Technical Elective	3
Total	18

Fifth Year

First Semester	Hrs.
MAE 454 <i>Machine Design & Mfg</i>	3
MAE 471 <i>Prin. of Engr. Design</i>	3
Technical Elective.....	3
Technical Elective.....	2
GEC Elective	3
Total	14
Grand Total	155

Note: Six hours of technical electives must be selected from a list of approved aerospace engineering technical electives and other six hours from a list of approved mechanical engineering technical electives after consulting with the advisor; the courses selected should form a clear and consistent pattern according to the career objectives of the student. The 12 hours of General Education Curriculum (GEC) courses must be selected to meet the University and college GEC requirements

Department of Mining Engineering

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Degree Offered

Bachelor of Science in Mining Engineering

Curriculum in Mining Engineering

Mining engineering deals with discovering, extracting, beneficiating, marketing, and utilizing mineral deposits from the earth's crust. The role of the mining engineer may be quite diversified, and the field offers opportunities for specialization in a large number of technical areas. The trained professional in this field is well versed in mining and geology and also in the principles of civil, electrical, and mechanical engineering as applied to the mining industry. With the present trend toward the use of engineers in industrial management and administrative positions, the mining engineer's training also includes economics, business, personnel management, and the humanities.

The educational objectives of the B.S.Min.E. program have been established to produce graduates who are thoroughly prepared to meet the operational and engineering challenges of the mining industry and to continue their studies in graduate programs. Graduates will meet the following objectives: