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College of Engineering and Mineral Resources

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Degrees Offered

Bachelor of Science in Aerospace Engineering
Bachelor of Science in Chemical Engineering
Bachelor of Science in Civil Engineering
Bachelor of Science in Computer Engineering
Bachelor of Science in Computer Science
Bachelor of Science in Electrical Engineering
Bachelor of Science in Biometric Systems
Bachelor of Science in Industrial Engineering
Bachelor of Science in Mechanical Engineering
Bachelor of Science in Mining Engineering
Bachelor of Science in Petroleum and Natural Gas Engineering

Dual Degrees Offered

Aerospace Engineering and Mechanical Engineering
Civil Engineering and Mining Engineering
Computer Engineering and Electrical Engineering
Computer Engineering and Biometrics Systems
Computer Science and Computer Engineering
Electrical Engineering and Biometric Systems
Mining Engineering and Civil Engineering
Mining Engineering and Geology

Nature of Program

The College of Engineering and Mineral Resources (CEMR) undergraduate degree programs are administered through seven academic departments: chemical engineering; civil and environmental engineering; computer science and electrical engineering; industrial and management systems engineering; mechanical and aerospace engineering; mining engineering; and petroleum and natural gas engineering. All undergraduate programs are recognized by industry as providing excellent preparation for the engineering profession. The curricula are planned to give students a balanced background in the basic sciences, engineering sciences, engineering analysis, the humanities, and the social sciences. In addition, each curriculum features creative programs in engineering synthesis and design. This blend of science and practice gives students the tools to solve today's problems and the background to develop the expertise needed for their future success in the profession. Our graduates enjoy a multitude of career opportunities in our nation's most vital industries.

The college is committed to providing high-quality programs of engineering science education for all undergraduate students so that graduates of the college will:

be proficient in their chosen field;
develop and maintain professional ethics and understand the comprehensive impact of engineering solutions on a diverse and global society; and
continue in their education on a life-long basis through both formal study and self-directed inquiry.

The faculty uses modern teaching techniques including programmed material, guest lectures by visiting authorities, team projects, and in-house industrial assignments to provide a breadth of training experiences. Teaching laboratories are equipped with modern instruments, machines, and tools to improve and enrich the student's understanding of engineering principles and problems. Numerous computer laboratories and facilities are available for classroom work.

College programs are geared to provide graduates with a sound background upon which to enter the industrial workforce or to pursue graduate study in engineering, medicine, law, or business. A number of industries in West Virginia and the region provide meaningful and financially rewarding summer employment for students. These training opportunities often lead to professional positions upon graduation.

Accreditation

The Accreditation Board for Engineering and Technology (ABET) is recognized by the U.S. Department of Education and the Council on Postsecondary Accreditation (COPA) as the sole agency responsible for accreditation of educational programs leading to degrees in engineering. ABET accomplishes its accreditation mission through one of its commissions, the Engineering Accreditation Commission (EAC). ABET is concerned with the enhancement of the status of the engineer and the engineering profession, and the establishment of criteria and standards for accreditation of engineering programs at colleges and universities. All baccalaureate engineering programs in the College of Engineering and Mineral Resources at WVU are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Admission Requirements

The College of Engineering and Mineral Resources will admit freshmen students to study under one of three distinct programs: Engineering; General Engineering or Pre-Computer Science. Admission is based on a combination of high school grade point average (un-weighted 4.0 scale) and standardized ACT/SAT test scores. The objective of having two "engineering programs" is to be able to provide a freshman curriculum suitably tailored to the level of academic preparation of the student. This maximizes the chance to complete a successful freshman experience. Each program provides students the coursework necessary to meet coursework requirements to move into their intended major.

Students interested in pursuing a degree in Biometrics Systems should apply to the Engineering or General Engineering Program as appropriate for your high school GPA and ACT or SAT test scores.

The following table summarizes the admission requirements for each program.

Program	Residency	High School	ACT		SAT	
		GPA	Math	Composite	Math	Total
Engineering	West Virginia	3.0	27	24	620	1110
	Out-of-State	3.0	27	24	620	1110
General Engineering	West Virginia	2.5	23	22	540	1030
	Out-of-State	2.5	23	22	540	1030
Pre-Computer Science	West Virginia	3.0	27	24	620	1110
	Out-of-State	3.0	27	24	620	1110

In addition, students must have high school credits for:

- Four units of English (including grammar, composition, and literature).
- Three units of social studies (including U.S. history).
- Three units of college preparatory mathematics (algebra I and II and geometry).
- Two units of laboratory sciences (including physics, chemistry, biology, or other laboratory courses).

First-Year Program Curricula

Engineering Curriculum

The engineering program curriculum is designed for students who have similar math and science backgrounds so they can effectively work in teams, solve problems, and undertake challenging projects in the Freshman Engineering Design course (ENGR 101).

First year

First Semester	Hrs	Second Semester	Hrs
MATH 155 Calculus I	4	MATH 156 Calculus II	4
CHEM 115 Fundamtl. of Chem.	4	CHEM 116 Fundamtl. of Chem.** or GEC elective	4/3
ENGR 101 Engr. Problem Solving I	2	GEC Elective*	3
ENGR 199 Orientation to Engr.	1	ENGR 102 Engr. Problem Solving II.	3
ENGL 101 Comp. and Rhetoric	3	PHYS 111 General Physics	4
GEC Elective*	3	Total	17/18
Total	17		

* Students intending to pursue a mining engineering degree or dual civil and mining engineering degrees should take GEOL 101 and 102 in place of one GEC elective. Students pursuing dual mining engineering and geology degrees need to take Geol 101, 102 103 and 104 in place of both GEC electives. Students intending to pursue a petroleum and natural gas engineering degree should take GEOL 101 in place of one GEC elective.
** Students intending to pursue a chemical engineering degree or petroleum and natural gas engineering degree must take CHEM 116. Students intending to pursue a civil engineering or industrial engineering degree can take either PHYS 112 (taken in sophomore year) or CHEM 116, but do not need both. Students wishing to pursue an aerospace, computer, electrical, mechanical, dual aerospace and mechanical or dual electrical and computer degrees do not need CHEM 116.

General Engineering Curriculum

The general engineering program curriculum is tailored for those students who are not ready to take the Calculus (MATH 155) course and the Fundamentals of Chemistry course (CHEM 115). Based on standardized test scores or the University's Math Placement exam scores, students will be placed in algebra and trigonometry courses, or a pre-calculus course and are advised to achieve a grade of C or better in each class to move into Calculus (Math 155).

First year

First Semester	Hrs	Second Semester	Hrs
MATH 126 and Math 128	6	MATH 155 Calculus I	4
ENGR 100 Intro. to Engineering Applications	3	CHEM 115 Fundamtl of Chem	4
ENGR 199 Orientation to Engr.	1	ENGR 101 Engr. Problem Solving I	2
ENGL 101 Comp. and Rhetoric	3	GEC Electives*	6
GEC Elective	3	Total	16
Total	16		

Second year

First Semester	Hrs
MATH 156 Calculus II	4
CHEM 116 Fundamtl. of Chem.** or GEC elective	4/3
GEC Elective*	3
ENGR 102 Engr. Problem Solving II.	3
PHYS 111 General Physics	4
Total	17/18

* Students intending to pursue a mining engineering degree or dual civil and mining engineering degrees should take GEOL 101 and 102 in place of one GEC elective. Students pursuing dual mining engineering and geology degrees need to take Geol 101, 102 103 and 104 in place of both GEC electives. Students intending to pursue a petroleum and natural gas engineering degree should take GEOL 101 in place of one GEC elective.
** Students intending to pursue a chemical engineering degree or petroleum and natural gas engineering degree must take CHEM 116. Students intending to pursue a civil engineering or industrial engineering degree can take either PHYS 112 (taken in sophomore year) or CHEM 116, but do not need both. Students wishing to pursue an aerospace, computer, electrical, mechanical, dual aerospace and mechanical or dual electrical and computer degrees do not need CHEM 116.

Admission to a Discipline Major

During the second semester of the engineering curriculum or the third semester of the general engineering curriculum, all students are encouraged to choose an engineering major. To be admitted into an engineering major, at a minimum a student must successfully complete MATH 155, with a grade of "C" or better, CHEM 115, ENGR 101, ENGR 199, ENGR 102, ENGL 101, and earn a cumulative GPA of at least 2.0. Each department will assign a faculty advisor to help these students achieve their academic goals. Students not accepted into an engineering major by the end of a prescribed time will be transferred out of the college. Students will not be permitted to enroll in upper-division engineering courses until they have been accepted into a major.

Early Advancement to Discipline Major

Freshman students having outstanding academic performance during their first semester may elect to move into their selected major at the end of the first semester and substitute a departmentally approved course for ENGR 102. Advancement can be based on the following prior credit and academic performance:

Have 7 credit hours or more of AP or prior college credit including at least 4 credit of MATH 155, CHEM 115-116, PHYS 111, or PHYS 112; and
Pass all first semester MATH (≥155) and science courses (CHEM 115 or 116; PHYS 111 or 112; or GEOL 101, 102) plus ENGR 199 and ENGR 101 with a C or better, and
Achieve an overall GPA ≥ 3.0.

Or advancement can be based on the following exceptional performance:

Pass all first semester MATH (≥155) and science courses (CHEM 115 or 116; PHYS 111 or 112; or GEOL 101, 102) plus ENGR 199 and ENGR 101 with a C or better; and
Achieve an overall GPA ≥ 3.5.

Transfer Students

Students wishing to transfer into the engineering or pre-computer science program from other programs must have a GPA of at least 2.0 in all college work attempted. Students who meet the freshman admission requirements to the engineering program (shown in the table) are eligible to transfer into the college at any time. Others must have completed at least one semester of college work and present evidence that they are eligible to enroll in MATH 155 Calculus. Students wishing to transfer into a major must have a GPA of at least 2.0 and have completed ENGR 101, ENGR 199, ENGR 102, MATH 155, with a grade of "C" or better, CHEM 115, and ENGL 101.

If transfer students are sophomore level or above have credit for completing CHEM 115, and have earned a C or better in MATH 155, MATH 156, and PHYS 111, and have completed at least 3 credits in a discipline major course, then they may take a major elective as a substitute for ENGR 101 and 102. If the combination of multiple engineering courses transferred to WVU matches the content of ENGR 101 or ENGR 102, those courses may be approved as a course substitution for ENGR 101 or ENGR 102. Other transferred courses that are not an exact match may be approved as technical electives to substitute for ENGR 101 or ENGR 102 at the discretion of the Freshman Engineering coordinator.

Admission Petitions

Students not meeting the minimum admission and transfer requirements as described above may request to be admitted to the college by written petition to the Dean.

Scholarships

The College of Engineering and Mineral Resources and its constituent departments offer numerous competitive scholarships to undergraduate students of any rank. Typically scholarships are based on both academic performance and on financial need and are awarded on a one year basis unless the scholarship award specifies otherwise. Scholarship awards are typically made in June for the upcoming academic year. Certain scholarships for freshman require the recipient to be pursuing a specific major. In these cases, the student must be taking freshman courses consistent with those required for entry into that specific major.

Curricula

During the first two years, students acquire fundamental knowledge in mathematics, basic sciences, and introductory engineering topics. Engineering design, computer-based experience, and communication skills are integrated throughout the curriculum. In the third and fourth years, the curriculum builds upon the fundamental engineering concepts toward an integrated educational experience, preparing students to pursue a successful professional career and life-long learning. Study in humanities and social sciences are also an integral part of the engineering education, enabling students to understand and appreciate the technological, social, and cultural changes that challenge the world.

Cooperative (Co-op) Education and Internship Programs

The co-op program is available to any student attending a college or university in West Virginia. The co-op opportunity is available to any qualified student interested in pursuing a degree in any of nine engineering majors or computer science. The five-year professional development experience combines practical on-the-job experience with the classroom education of a four-year engineering curriculum. Internships are arranged with an employer for various work periods and may involve an academic semester or summer term.

Dual Degree Majors

The college has formal programs for students wishing to receive two undergraduate degrees simultaneously. Currently those programs are in:

- Aerospace and Mechanical Engineering;
- Biometrics and Computer Engineering or Electrical Engineering
- Civil and Mining Engineering;
- Electrical and Computer Engineering;
- Computer Engineering and Biometrics;
- Computer Science and Computer Engineering;
- Electrical Engineering and Biometrics; and
- Mining Engineering and Geology.

Each dual-degree program requires at least one semester of additional work over and above that required for a single degree. Please refer to the actual curriculum of each dual program to determine the additional time requirement.

Academic Minor

The College of Engineering and Mineral Resources offers a minor in computer science to all undergraduate students. A student must consult with his or her major advisor to develop a scheduling plan for courses that satisfy the requirements for the computer science minor. The requirements for the minor in computer science

can be found under the computer science program description. The completed minor will be recorded on the student's permanent transcript.

International Exchange Programs

The college participates in two international exchange programs for undergraduates as well as the International Student Exchange Program (ISEP). These exchanges are with the University of Hertfordshire in England and the University of Aalborg in Denmark. Both of these universities have international reputations for the strength of their instruction in the area of engineering design. Program details vary, but WVU engineering students can obtain full credit for their junior year while studying abroad. Students pay normal WVU tuition, but housing costs to their host institution are not included. At present, the college has organized exchanges for students in civil, computer, electrical, industrial, mechanical engineering, and computer science.

Undergraduate General Education Curriculum

All engineering undergraduate students must satisfy the University General Education Curriculum (GEC) requirements. Students and advisors should consult the latest Schedule of Courses for the most current list of courses included in the General Education Curriculum Program. The most recent list of approved courses in the GEC Program can be found at the GEC site at WVU Admissions and Records.

Time to Completion of Degree

All undergraduate, single degree programs in the college are structured so that they can be completed in eight semesters of full-time study. However, students who are not prepared to enter MATH 155 Calculus 1 or CHEM 115 Fundamentals of Chemistry in their first semester may not be able to complete an engineering degree within eight semesters. Applicants to the college are strongly urged to take the required prerequisites to calculus and chemistry in the summer before entering WVU or plan on attending summer school after their freshman year in order to avoid delays in their graduation.

Degree Requirements

To be eligible to receive a bachelor's degree, a student is required to complete satisfactorily the number of semester hours of work as specified in the curriculum of the program leading to the degree for which the student is a candidate. Students must achieve an overall 2.0 grade point average and a 2.0 grade point average (2.25 in mining engineering, and petroleum and natural gas engineering) in all courses completed within the student's major department.

Application for Graduation and Diploma

All candidates for degrees in the College of Engineering and Mineral Resources must complete a Graduation Eligibility Worksheet in the semester prior to the semester in which they plan to graduate. Candidates should complete this form in consultation with their academic advisor during the advising appointment. Candidates must complete an Application for Graduation and Diploma within the first six-weeks of the semester in which the candidate will complete all requirements for the degree. No candidate can graduate without application.

Probation, Suspension, Readmission and Expulsion Policy

Uniform Probation

Students with a cumulative grade point average below 2.0 in all University course work or their major course work will be subject to probation by the College of Engineering and Mineral Resources. Students have the right to have the sanction of academic probation reviewed and explained by the academic official who imposed the sanction. Academic probation is not recorded on a student's permanent record and essentially constitutes a warning to the student of standards which must be met.

Uniform Academic Suspension Regulations

The student on probation whose cumulative GPA continues below 2.0 in all University course work or their major course work is subject to suspension from their academic program by the College of Engineering and Mineral Resources. Normally, students are suspended at the end of a semester or summer school session. The College can waive suspension in favor of probation if in its judgment the circumstances of individual cases so warrant. The suspension rule will be set aside only under extraordinary conditions.

Academic suspension identifies the status of a student who has failed to meet the University and College of Engineering and Mineral Resources minimum standards and who has been notified formally by the College of academic suspension. Suspension from the University or College means that a student will not be permitted to register for any classes, including those in summer sessions, offered by the University for academic credit until the student has been officially reinstated. The normal period of suspension is a minimum of one academic semester but will not exceed one calendar year from the date of a student's first suspension. A student who has been suspended for academic deficiencies and who takes courses at other institutions during the period of suspension cannot automatically transfer such credit toward a degree at WVU upon readmission to the University. Students are not eligible for readmission if they earn less than a 2.0 at other institutions while on suspension from WVU. After one semester of satisfactory performance (C average or better on a minimum of 12 credit hours earned during a regular semester or during the summer sessions) the appropriate transfer credit will be entered into the student's record upon certification by the advisor and dean that the above conditions have been met. A student who has preregistered and is subsequently suspended shall have his or her registration automatically cancelled.

Reinstatement after Suspension

During the semester immediately following the effective date of suspension, suspended students may petition the College in writing for early reinstatement. Details for petitioning the College for early reinstatement will be provided in the student's letter of suspension. After one calendar year from the effective date of suspension, any student who has been suspended one time shall, upon written application, be reinstated to the University and to the College of Engineering and Mineral Resources unless the student petitions for admission to another college or school.

A suspended student who is reinstated under the provisions above will be placed on academic probation unless the terms of probation agreed to by the student and that college stipulate otherwise. After the second or any subsequent suspension, a student will be permanently suspended from the College of Engineering and Mineral Resources.

Department of Chemical Engineering

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Degree Offered

Bachelor of Science in Chemical Engineering

Curriculum in Chemical Engineering

The chemical engineering curriculum is designed to give graduates a broad background in chemical engineering processes and to prepare them to become practicing engineers. Graduates are prepared for positions in operation, development, design, construction, and management of chemical, environmental, life-science, materials, and other industrial plants. These industries subject raw materials to chemical and physical changes to produce economically desirable products. Students with this background are also prepared for graduate school in engineering and science as well as for any professional school.

The program objectives of the chemical engineering curriculum are:

Graduates will be successful in their professional careers, and/or post graduate training as demonstrated by their abilities to solve important chemical engineering problems, to solve problems in areas different from their training, and to develop new and valuable ideas.
Graduates will be able to work in a variety of professional environments, as demonstrated by their abilities to work on teams, to work alone, to provide leadership, to mentor junior co-workers, and to communicate effectively.
Graduates will possess professional character, as demonstrated by their ethical behavior, their pursuit of professional registration, and their commitment to life-long learning, safety, and their commitment to the environment.

The program outcomes of the chemical engineering curriculum are as follows:

- Graduates will understand and be able to analyze entire chemical processes.
- Graduates will be proficient in the oral and written communication of their work and ideas.
- Graduates will be proficient in the use of computers, computer software, and computer-based information systems.
- Graduates will have the ability to learn independently but will also be able to participate effectively in groups.
- Graduates will be able to design effective laboratory experiments, to perform laboratory experiments, gather and analyze data, and test theories.
- Graduates will be prepared for a lifetime of continuing education.
- Graduates will understand the safety and environmental consequences of their work as chemical engineers and will be able to design safe processes.
- Graduates will understand their professional and ethical responsibilities.
- Graduates will have the broad education necessary to understand the impact of engineering solutions in a global and societal context.

These outcomes are achieved via rigorous individual courses in all basic areas of chemical engineering, the natural and life sciences, mathematics, humanities and social sciences. A flexible electives program allows specialization in areas such as environment and safety, polymers and materials, biological applications, and coal processes.

Practical work on process and product design and synthesis is incorporated into all chemical engineering classes. One element is the series of group design projects that require sophomores and juniors to use their knowledge as it is gained. Another element is the series of individual design projects that require seniors to synthesize their knowledge of chemical engineering and to correct any deficiencies in their knowledge of chemical engineering, and which provide faculty a method of assessing the success of the sophomore and junior years. The third element is a group project in which seniors work under the direction of a student chief engineer on a year-long, comprehensive design. In conjunction with these projects, there are required written and oral presentations and required computer applications integrated throughout the curriculum. Completion of these projects also trains students to work in groups of all sizes and gives them experience in self-directed learning. Additionally, in the senior year, elements of professional practice, ethics, and safety are introduced in the classroom.

The chemical engineering curriculum also contains a significant laboratory component aimed at reinforcing the knowledge gained in the classroom. In addition to basic chemistry and physics laboratories, the chemical engineering laboratories involve simple laboratory experiments or demonstrations in the junior year followed by a two-semester laboratory sequence in the senior year in which the principles of experimental design, laboratory and safety procedures, data analysis, and report writing are stressed.

The chemical engineering department uses an outcomes-assessment plan for continuous program improvement. The design projects, in conjunction with yearly interviews and questionnaires plus follow-up questionnaires after graduation to alumni and employers, provide the measures of learning outcomes. These outcomes-assessment results provide feedback to the faculty to improve teaching and learning processes.

To receive a degree of Bachelor of Science in chemical engineering, a student must take all of the courses indicated below and must obtain a grade point average of 2.0 or better for all required chemical engineering courses. (If a course is repeated, only the most recent grade received is considered in computing this grade

point average. Chemical engineering courses used to satisfy technical or engineering electives are not considered in this grade point average.) This requirement helps assure that the student has demonstrated overall competence in the chosen major.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.Ch.E. degree program which completes degree requirements in four years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year
First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

First Semester	Hrs	Second Semester	Hrs
MATH 251 Multivariable Calculus	4	MATH 261 Elem. Differential Equat.	4
CHEM 233 Organic Chem	3	CHE 202 Matrl. & Energy Bal. 2	3
CHEM 235 Organic Chem. Lab.	1	CHE 230 Numerical Methods	3
PHYS 112 General Physics	4	GEC Electives	6
CHE 201 Matrl. & Energy Bal.1	3	**Total**	**16**
ENGL 102 Comp. & Rhetoric	3		
Total	**18**		

Third Year

First Semester	Hrs	Second Semester	Hrs
CHE 310 Proc. Fluid Mechanics	3	CHE 312 Separation Process	4
CHE 311 Proc. Heat Trans.	3	CHE 315 ChE Transport Analysis	3
CHE 320 ChE Thermodynamics	3	CHE 325 Chem. Reaction Engineering	3
Advanced Science Elective	4	CHE 326 ChE Reaction Phenomena	3
GEC Elective	3	Engineering Science Elective	3
Total	**16**	**Total**	**16**

Fourth Year

First Semester	Hrs	Second Semester	Hrs
CHE 435 Chem. Process Control	3	CHE 451 Unit Operations Lab. 2	2
CHE 450 Unit Operations Lab.1	2	CHE 456 Chem. Process Design 2	3
CHE 455 Chem. Process Design 1	4	GEC Elective	3
GEC Elective	3	Technical Elective	3
Technical Elective	3	Advanced Science Elective	3
Total	**15**	Engineering Science Elective	3
		Total	**17**
Grand Total	**133**		

Note: Electives in junior and senior years must be selected to complete requirements of non-technical electives (21 hrs.), technical electives (six hrs.), engineering science electives (six hrs.), and advanced science electives (seven hrs.). All electives must be selected from a list approved by the Department of Chemical Engineering. A 2.0 grade-point average in required chemical engineering courses is necessary before a student can register for CHE 310, 311, 320, 435, 450, or 455.

Biomedical Engineering Certificate offered in Chemical Engineering

The Department of Chemical Engineering administers a certificate program in Biomedical Engineering that is open to all students with appropriate prerequisites, which are: basic biology (BIOL 115), mathematics through MATH 261 (differential equations), CHEM 115 and CHEM 116 and a working knowledge of organic chemistry, specifically the naming conventions for, and a knowledge of charge distribution in, organic molecules. Currently, the certificate program consists of 6 required courses listed below. As other courses are added in the Biomedical Engineering area, more choices of elective courses will be made available.

Core Courses (must take all four)

Human Physiology – *BIOL 235* (3 h)
Human Phys: Quantitative Laboratory – *BIOL 236* (1 h - lab)
Introduction to Biomedical Engineering– *ChE 381* (3 h)
Biomaterials – *ChE 382* (3 h)

Elective Courses (pick any 2)

Applied Bio-Molecular Modeling – *ChE 481* (3 h)
Intro. to Tissue Engineering – *ChE 482* (3 h)

For chemical engineering undergraduates, the certificate program can be completed with the addition of 5 additional credit hours (138 hours total). In addition, chemical engineering students with the biomedical certificate will satisfy all the prerequisite requirements for Medical School.

Department of Civil and Environmental Engineering

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Degree Offered

Bachelor of Science in Civil Engineering

Curriculum in Civil Engineering

Civil engineering historically encompassed all engineering endeavors not associated with military activities. Because of its origin and history, civil engineering still embraces a wide variety of technological areas. These include environmental engineering, hydro-technical engineering, geotechnical engineering, transportation engineering, and structural engineering.

Civil engineers work with problems that directly impact the health and economic vitality of people and communities. These problems include waste disposal, environmental pollution, transportation systems analysis and design, water resource development, and the design, construction, and rehabilitation of constructed facilities such as dams, bridges, buildings, and highways. Thus, the challenges and opportunities for a civil engineer lie in combining technical competence with a human concern for the applications of technology. To help students to understand their role in the community, to be effective in working with design teams involving other engineers and other professionals, and to be effective in written and spoken communications, the curriculum attempts to give a meaningful educational experience in the humanities, social studies, English, and economics.

The goal of the undergraduate curriculum in civil and environmental engineering is to prepare graduate civil engineers to meet the present and the future infrastructure and environmental needs of society. This requires an education based on scientific and engineering fundamentals as well as one that incorporates experience in engineering design using modern technology. Because the systems they design impact the public directly, civil engineers must be aware of the social and environmental consequences of their designs. Graduates must be prepared to work and communicate with other professionals in a variety of associations and organizations. Ethics and life-long learning are essential components in the education of civil engineers. During the course of study, civil engineering students are given a solid grounding in mathematics, physics, and chemistry. Added to this is extensive development of the fundamentals of materials science, environmental, soils, hydro-technical, structural, and transportation systems engineering. This broad base of knowledge is provided to insure that civil engineers are educated in all branches of the profession and to permit continuous learning throughout a professional lifetime. Throughout the program, each student works with an academic advisor in the selection of electives. Specialization in one or more of the branches of civil engineering is possible by selection of a sequence of technical electives during the junior and senior years.

The program objectives of the civil engineering curriculum are:

- Have a strong understanding of basic engineering principles. This includes the ability to apply in practice the fundamentals of mathematics, computing, basic science, engineering science, and economics.
- Have a strong understanding of the fundamental principles, scope, and techniques of the major areas of civil engineering.
- Have an understanding of the relationship of the civil engineering profession to society, industry, government, and the environment.
- Have a strong commitment to professionalism and ethics.
- Have the ability to be competitive in the civil engineering profession, to achieve professional registration, and to engage in life-long learning.
- Have the ability to work productively in teams, developing solutions to engineering problems, employing creative thinking, analysis, design, and evaluation.
- Have the ability to communicate at a professional level using oral and written prose and engineering graphics.

The program outcomes of the civil engineering curriculum are as follows:

- Graduates will have an ability to apply knowledge of mathematics, science and engineering.
- Graduates will be able to design and conduct experiments, as well as to analyze and interpret data.
- Graduates will be able to design civil engineering projects or components of projects to meet desired needs.
- Graduates will have an ability to function on teams involving multiple civil engineering specialties.
- Graduates will have an ability to identify, formulate and solve civil engineering problems.
- Graduates will have an understanding of professional and ethical responsibility.
- Graduates will have an ability to communicate effectively in oral, written and electronic formats.
- Graduates will have an ability to understand the impact of engineering solutions in global and societal context.
- Graduates will have recognition of the need for, and ability to, engage in life-long learning.
- Graduates will have a knowledge of contemporary issues.
- Graduates will have an ability to use techniques, skills and modern engineering tools necessary for engineering practice.

Undergraduate Student Minimum Performance Policy

All Civil and Environmental Engineering students matriculating at WVU, including transfer students and second-degree students, must complete each tracking course with a grade of C or better, with the exception that one D among them is permitted. Tracking courses are identified as: Math 155, 156, 251, and 261; Chemistry 115; Physics 111; and MAE 241, 242, and 243. Any tracking course transferred from outside of WVU must be a C or better.

All tracking courses must be completed collectively before taking any 300-level or higher civil engineering course. However, as an exception to the collective prerequisite requirement, environmental engineering (CE 347) and transportation engineering (CE 332) may be taken before completing all tracking courses.

Second-degree students may petition for a waiver to the collective prerequisite requirement for 300-level or higher civil engineering courses, but must meet individual course prerequisites. The petition must include a plan for completing the tracking courses and be approved by the student's academic advisor and the Department Chairman. When a course is repeated, the last grade earned in that course will be used for determining compliance with this minimum performance policy.

To be eligible for graduation in civil engineering, a student must attain a grade point average of 2.0 or better for all civil engineering courses attempted, except for those courses in which a grade of W or WU was received. If a course is repeated, only the last grade received is counted in computing the grade point average, and the course credit hours are counted only once. This requirement assures that the student has demonstrated overall competence in the chosen major.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.C.E. degree program which completes degree requirements in four years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year
First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

First Semester	Hrs	Second Semester	Hrs
MAE 241 Statics	3	MAE 243 Mechanics of Materials	3
MATH 251 Calculus	4	MAE 242 Dynamics	3
CE 210 CAD	2	GEC Elective*	3
CE 201 Introduction to CE	1	MATH 261 Differential Equations	4
ENGL 102 Composition and Rhetoric	3	CE Core Class CE 332 or CE 347	4
PHYS 112/CHEM 116/ BIOL115	4	**Total**	**17**
Total	**17**		

Third Year

First Semester	Hrs	Second Semester	Hrs
CE 321 Fluid Mechanics	3	CE Core Class**	4
CE Core Class**	4	CE Core Class**	4
STAT 215 Statistics	3	CE 301 Engr Professional Development	1
ECON 201 Principles of Microeconomics	3	GEC Elective*	3
IENG 377 Engineering Economics	3	CE Design Elective†	3
Total	**16**	ENGL 305 Sci and Technical Writing	3
		Total	**18**

Fourth Year

First Semester	Hrs	Second Semester	Hrs
CE Design Elective†	3	CE Open Elective††	3
CE Open Elective††	3	CE479 Integrated Design	3
CE Open Elective††	3	GEC Elective*	3
ENGR/MATH/Science Elective	3	ENGR/MATH/Science/ Elective	3
Science Elective*	3	ENGR Elective (outside CEE Dept.)	3
Total	**15**	**Total**	**15**
Grand Total	**132**		

* GEC Elective and the Science Elective may be taken in assignment shown or swapped.
** CE Core Classes are: CE 332 Introduction to Transportation Engineering; CE 347 Environmental Engineering; CE 351 Introductory Soil Mechanics; CE 361 Structural Analysis I
†CE Design Electives – Any approved CE 400 level design course – see adviser for approved list
†† CE Open Electives – Any approved CE 300 or CE 400 level course – see advisor for approved list

Curriculum for a Dual Major in Civil and Mining Engineering

Students can simultaneously pursue B.S. degrees in Civil Engineering and Mining Engineering by completing additional courses. The dual degree program requires satisfactory completion of 158 credit hours. A suggested schedule for the dual curriculum in Civil Engineering and Mining Engineering is shown below.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical dual B.S.C.E. and B.S.Min.E. program which completes both degree requirements in five years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year
First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

Fall Semester	Hrs	Spring Semester	Hrs
CE 201 Introduction to CE	1	ENGL 102 Composition and Rhetoric	3
MAE 241 Statics	3	MAE 242 Dynamics	3
MATH 251 Multivariate Calculus	4	MATH 261 Elem. Differential Equat.	4
MINE 201 Mine Surveying	3	MINE 206 Surface Mining Systems	4
MINE 205 Underground Mining Systems	3	PHYS 112 General Physics	4
MINE 261 Engineering CAD	2	**Total Hours:**	**18**
Total Hours:	**16**		

Third Year

Fall Semester	Hrs	Spring Semester	Hrs
CE 321 Fluid Mechanics	3	CE Core*	4
GEOL 342 Structural Geology	3	CE Core*	4
MAE 243 Mechanics of Materials	3	MINE 331 Mine Ventilation	3
MAE 320 Thermodynamics	3	MINE 427 Coal Preparation	4
STAT 215 Statistics	3	MINE 480 Interdisciplinary Team Project	1
Total Hours:	**15**	**Total Hours:**	**16**

Fourth Year

Fall Semester		Spring Semester	
CE Core*	4	CE Seminar	1
CE Core*	4	CE Design Elective†	3
MINE 306 Mining Exploration & Eval	3	CE Design Elective†	3
MINE 382 Mine Power System	3	CE 322 Hydrotechnical Engineering	3
Total Hours:	**14**	GEC Elective	3
		IENG 377 Engineering Economy	3
		Total Hours:	**16**

Fifth Year

Fall Semester	Hrs	Spring Semester	Hrs
GEC Elective	3	CE Technical Elective††	3
GEC:ECON 201 Prin of Microeconomics	3	CE 479 Integrated Design	3
MINE 411 Rock Mech & Ground Control	4	GEC Elective	3
MINE 471 Mine and Safety Management	3	GEC Elective	3
MINE 483 Mine Design-Exploration	2	MINE 484 Mine Design-Report (W)	4
Total Hours:	**15**	**Total Hours:**	**16**
Grand Total	**158**		

Notes:
1. Discipline substitutions are:
MINE 306 fulfills requirement of CE Engr/Math/Sci Elective 1
MINE 411 fulfills requirement of CE Engr/Math/Sci Elective 2
MINE requirement for AGRN 455 is fulfilled through CE 322 and CE 351
MINE 382 fulfills requirement of CE Engineering Elective outside CE
MINE 461 is fulfilled by CE 322
MINE 484W fulfills CE requirement of ENGL 305
MINE requirement for STAT 211 is fulfilled by CE requirement of STAT 215
CE 321 fulfills MINE requirement for MAE 331

MINE Technical Elective and MINE Eng/Sci Technical Elective requirements are fulfilled by any two of the following; CE 332, 347 or 361.
GEOL 342 fulfills requirement of CE Basic Science Elective
MINE 261 substitutes for CE 210
2. *CE Core Classes are: CE 332 Introduction to Transportation Engineering; CE 347 Environmental Engineering; CE 351 Introductory Soil Mechanics; CE 361 Structural Analysis I
† CE Design Electives – Any approved CE 400 level design course – see adviser for approved list
†† CE Open Electives – Any approved CE 300 or CE 400 level course – see advisor for approved list

Lane Department of Computer Science and Electrical Engineering

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Degrees Offered

Bachelor of Science in Biometric Systems
Bachelor of Science in Computer Engineering
Bachelor of Science in Computer Science
Bachelor of Science in Electrical Engineering

The department offers undergraduate degrees in computer science, computer engineering, and electrical engineering. It also houses the biometric systems major of the University-level Bachelor of Science in forensic identification.

Curriculum in Biometric Systems

Biometric systems are composed of complex hardware and software designed to measure a signature of the human body, compare the signature to a database, and render a decision for a given application based on the identification achieved from this matching process. Uses of biometric systems for positive personal identification are experiencing rapid growth in such areas as law enforcement, access control, banking, and a wide range of business and administrative systems. In an even broader application context, biometric systems are having a revolutionary impact on health care and the enhancement of the human computer interface including in vivo identification of specific human conditions via implantable devices and the automated administration of life-saving medical therapies. The continued rapid advance of integrated sensor, signal/image processing, computer, and mass storage technology promises to extend these applications further into our daily lives with even the most inanimate objects able to identify, interact with, and assist their users.

Biometric systems for personal identification are based upon fundamental biometric features which are typically unique and time invariant, such as features derived from fingerprints, faces, irises, retinas, and voices. Biometrics for biomedical, human computer interface, and other applications may include these but will necessarily extend to a wide range of physiological signals which possess identifiable patterns that may change in time, albeit predictably. The spectrum of usable biometrics is defined by human physiology, the bioengineering implied by their measurement, and the application. As biometric system capabilities and applications evolve, biometrics will extend to any known measurement of the human body.

Biometric identification is a highly interdisciplinary field mixing traditional engineering with the forensic sciences. As a result, the engineering design and development of biometric systems requires knowledge of the biometric as well as the engineering disciplines. Designers work with the physics of the sensor to obtain measurements of the biometric defined by human physiology. Signal and image processing techniques are applied to the sensor signal to extract features usable for identification. Databases combined with artificial intelligence enable rapid storage, retrieval, and pattern matching while decision theory supports the mechanisms whereby systems can provide the needed identification results. Underlying the entire system is a foundation of statistics and mathematics which provides the language for implementing and evaluating biometric technology and systems.

Overview of the Major

The biometric systems major at WVU will provide students with a firm foundation in electrical and computer engineering and computer science meshed with an understanding of biology, physiology, forensics, and the interaction between living and nonliving materials and systems necessary to design, implement, and evaluate biometric systems. This foundation is built on a strong framework of mathematics, statistics, and physical sciences appropriate to biometric systems and complemented by an appropriate general studies component. Areas of emphasis established through choice of specific course sets in the junior and senior year enable students to tailor their degree to follow their interests in key areas of biometric system development. Emphasis areas currently include sensors and circuits, signal processing, statistics, and software systems. Engineering design experiences will be a central part of many of the curriculum's courses beginning in the very first semester of the major and concluding with a capstone design course in the senior year enabling the students to integrate their understanding through application of their core and emphasis area coursework knowledge to realize biometric systems and subsystems of their own design.

Areas of Emphasis

Presently, four specialization paths have been identified for the biometric systems curriculum. Each emphasis area enables students to develop an in-depth technical background in an area of their own choosing which is central to biometric system development. Currently designated areas of emphasis are sensors and circuits, signal processing, statistics, and software systems. Each emphasis area is fulfilled by the successful completion of three courses. Students may obtain at most one emphasis area designation from this four-course set in their degree curriculum. Each emphasis area curriculum is defined by three courses chosen from a set of classes prescribed for that area. At least one of these three courses is a required course. Successful completion of an emphasis area's requirements is designated on the student's transcript. Students may elect not to choose an emphasis area in which case no transcript designation is received and students complete three courses from the collective list of classes from all emphasis areas.

Dual Majors

Dual majors are available in which a student may obtain a B.S. in biometric systems and a B.S. in either computer engineering or electrical engineering in four and one-half years.

Curriculum

The required curriculum of the Bachelor of Science degree in biometric systems is given below in the form of a recommended four-year sequence. The total credit hours required of the major is 133. Four courses (or twelve credits) are devoted to the emphasis areas selected by individual students based upon their educational objectives. Six of the credit hours required to satisfy the University GEC requirements have been devoted to economics in order that students may develop an understanding of system engineering economics.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.B.S. degree program which completes degree requirements in four years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First Year			
First Semester	Hrs	Second Semester	Hrs
BIOL 115 Intro to Biology*	4	CHEM 115 Fund. of Chemistry	4
MATH 155 Calculus I	4	MATH 156 Calculus II	4
ENGR 101 Fresh. Design. Engr.	2	CS 110 Intro. to Comp Science	4
ENGR 199 Orientation to Engr.	1	PHYS 111 General Physics	4
ENGL 101 Comp and Rhetoric	3	BIOL 493 DNA to Diversity+	3
GEC Elective	3	**Total**	**19**
Total	**17**		

Second Year

First Semester	Hrs	Second Semester	Hrs
CS 111 Intro. to Data Structures	4	ENGL 102 Comp and Rhetoric	3
EE 221/222 Intro. Elec. Engineering	4	EE 223/224 Circuits*	4
MATH 251 Multivariable Calculus	4	MATH 261 Elem. Differential Equat.	4
PHYS 112 General Physics	4	STAT 215 Prob. and Statistics	3
Total	**16**	CPE 271/272 Intro. Digital Log.	4
		Total	**18**

Third Year

First Semester	Hrs	Second Semester	Hrs
CPE 310/311 Microproc. Systems	4	EE 465 Image Processing*	3
STAT 316 Forensic Statistics*	3	MATH 375 Applied Mod Algebra	3
EE 327 Signals & Systems I*	3	Assigned GEC Elective**	3
BIOM 426 Biometric Systems	3	Emphasis Course 1	3
CS 350 Computer Syst. Concepts	3	Emphasis Course 2	3
Total	**16**	**Total**	**15**

Fourth Year

First Semester	Hrs	Second Semester	Hrs
BIOM 480 Senior Design Seminar	2	BIOM 481 Senior Design Project	3
EE 425 Bioengineering*	3	Emphasis Course 3	3
CS 465 Computer Security*	3	ECON 202 Macroeconomics	3
ECON 201 Microeconomics	3	GEC Elective	6
GEC Elective	3	**Total**	**15**
Free Elective	3		
Total	**17**	**Grand Total**	**133**

*Offered once per year in the semester shown.
**One from the following list: POLS 210, PSYC 101, SOCA 101, or SOCA 232.
[+]May be deferred

Curriculum in Computer Engineering

Computer engineers design, develop, test, and oversee the manufacture and maintenance of embedded computer hardware and software. As such, the computer engineer is part electrical engineer and part computer scientist. Embedded computer systems include applications in the automotive, communications, radio and television, consumer electronics, aircraft, robotics, and health-care industries. In addition, computer engineers design, develop, test, manufacture, and maintain complex systems including digital communications systems such as cell phone networks, computer networks such as the Internet, and system level software such as operating systems and applications software.

The objective of the bachelor's degree program in computer engineering is to produce graduates who have the knowledge, skills, and attitudes that will ensure success in professional positions in business, industry, research, government service, or graduate study as well as professional schools. We carry out this mission by providing our students with a sound education in mathematics and the sciences, a broad foundation in the fundamentals of engineering, elective opportunities to develop expertise in one or more emphasis areas, and the general education necessary to put technical knowledge into perspective. Theoretical work is complemented by an emphasis on the practice of engineering, and design activity is integrated throughout the curriculum. The computer engineering program is accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET).

It is our goal that by the time they graduate, B.S. computer engineering students will achieve the following learning outcomes:

- Have the ability to apply knowledge of math, engineering, and science.
- Have the ability to design and conduct experiments on both hardware and software.
- Have the ability to analyze and interpret data.
- Have the ability to design a system, component, or process to meet desired needs, including the planning, specification, detail design, implementation, and evaluation to meet most of the following needs: cost, environmental, performance, safety, and quality requirements.
- Have the ability to function on multi-disciplinary teams.
- Have the ability to identify, formulate, and solve a range of computer engineering problems.
- Have an understanding of professional and ethical responsibility.
- Have the ability to communicate effectively, i.e., to convey technical material through formal written papers/reports which satisfy accepted standards for writing style, and to convey technical material through oral presentation and interaction with an audience.
- Have the broad education necessary to understand the impact of engineering solutions in a global and societal context.
- Have a recognition of the need for, and an ability to engage in life long learning.
- Have knowledge of contemporary issues.
- Have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (including computer-based tools, for analysis and design).
- Have knowledge of the breadth and depth across the range of computer engineering topics.
- Have knowledge of mathematics through differential and integral calculus, basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components.
- Have knowledge of probability and statistics.
- Have knowledge of discrete mathematics.

Fundamental courses in the computer engineering areas of hardware and software are taken during the second year with general fundamental engineering courses included. The third and fourth years in the curriculum concentrate on areas of computer engineering in both software and hardware, with technical electives provided to allow the student to acquire more depth in a preferred area of expertise.

The computer engineering technical electives must be taken from 400-level CPE regular courses. The other technical electives should be selected from 400-level regular courses in electrical engineering, computer engineering, or computer science. However, students with special career objectives can petition the department through their advisors for prior written permission to select technical electives from upper-division courses in mathematics, the sciences, or other areas of engineering.

To be eligible for graduation in computer engineering a student must attain a grade point average of 2.0 or better for all required computer engineering, electrical engineering, and computer science courses. If a required CPE, EE, or CS course is repeated, only the hours credited and the grade received for the last completion of the course are used in computing the grade point average.

A total of five humanities and social science electives (GEC electives) must be selected. The humanities and social science electives must be chosen so as to meet the University General Education Curriculum requirements and Accreditation Board for Engineering and Technology accreditation guidelines.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.Cp.E. degree program which completes degree requirements in four years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year
First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

First Semester	Hrs	Second Semester	Hrs
EE 221 Intro. to EE Lec.	3	EE 223 Electrical Circuits Lec.*	3
EE 222 Intro. to EE Lab	1	EE 224 Electrical Circuits Lab*	1
CPE 271 Int. Dig. Logic Dsgn. Lec	3	EE 251 Digital Elect. Lec.*	3
CPE 272 Digital Logic Lab	1	EE 252 Digital Elect. Lab*	1
MATH 251 Multivariable Calculus	4	MATH 261 Elem. Differential Equat.	4
PHYS 112 General Physics	4	ENGL 102 Comp. and Rhetoric	3
Total	**16**	CS 110 Intro. to Computer Science	4
		Total	**19**

Third Year

First Semester	Hrs	Second Semester	Hrs
EE 327 Signals & Syst. 1 Lec.*	3	CS 350 Comp. Sys Concepts	3
MATH 375 Applied Mod Algebra 3		CPE 312 Mcrcmpt Strc/Intrfcng.*	3
CPE 310 Micropr. Sys. Lec	3	CPE 313 Mcrcmp Strc/Int Lab*	1
CPE 311 Microprocessor Lab	1	STAT 215 Intro. Prob. & Stat.	3
EE 355 Analog Elec. Lec.*	3	CS 230 Intro. Software Engr.	4
EE 356 Analog Elec. Lab.*	1	ECON 201 Microeconomics	3
CS 111 Intro. Data Structures	4	**Total**	**17**
Total	**18**		

Fourth Year

First Semester	Hrs	Second Semester	Hrs
ECON 202 Macroeconomics	3	CPE 481 Senior Design Project	3
GEC Elective	3	Engr. Science Elect.	3
Tech. Elective	3	CPE Tech. Elect.	3
CPE 480 Senior Design Seminar	2	GEC Elective	3
CS 450 Oper. Syst. Struct.	3	Free Elective	3
Total	**14**	**Total**	**15**
Grand Total	**133**		

*Offered once per year in the semester shown.

Curriculum in Computer Science

Computer science is a discipline that involves the understanding and design of computational processes. The discipline ranges from a theoretical study of algorithms and information processing in general, to a practical design of efficient and reliable software that meets given specifications. This differs from most physical sciences, engineering included, that separate theoretical underpinnings of the science from applications within it.

Partly because of the broad nature of computer science, and partly because students need flexibility in choosing a plan that best fits their needs, the department offers two tracks in the B.S. degree program: one track is with the College of Engineering and Mineral Resources (CEMR), and one track is with the Eberly College or Arts and Science (ECAS).

The B.S.C.S. track through CEMR introduces students to engineering principles through Engineering 101/199 and required courses in computer engineering. Chemistry and a two-semester sequence in physics is also required, but the student gains flexibility in choosing senior-level computer science (CS) courses, which leaves open the opportunity to explore much of software engineering or other areas. This option is well-suited for freshman engineering students who meet pre-computer science entrance requirements, and for engineering students who want to double major in computer science and computer engineering.

The B.S.C.S. track through ECAS offers flexibility in choosing more of a liberal education that could include courses, even dual majors, offered in many colleges: Eberly College of Arts and Sciences, Business and Economics, Creative Arts, or any others for which course prerequisites are satisfied. The required two-semester sequence in science can be fulfilled through a variety of science disciplines, but a few requirements on selection

of senior level CS courses lean to the theoretical side of the discipline. This track is best suited for students who want a more liberal education with the opportunity to pursue minors or double majors outside of engineering.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.C.S. degree program which completes degree requirements in four years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

CEMR Track for B.S.C.S.

First Year

First Semester	Hrs	Second Semester	Hrs
CS 110 Intro. Computer Science*	4	CS 111 Intro. Data Structures*	4
MATH 155 Calculus I*	4	MATH 156 Calculus II*	4
CHEM 115 Fundamentals Chem	4	PHYS 111	4
ENGL 101 Comp. and Rhetoric	3	GEC Elective	3
ENGR 101 Fresh. Engr. Design	2	GEC Elective	3
ENGR 199 Orientation to Engr.	1	**Total**	**18**
Total	**18**		

Second Year

First Semester	Hrs	Second Semester	Hrs
CPE 271 Digital Logic Design*	3	CPE 310 Microprocessor Systems*	3
CPE 272 Digital Logic Design Lab*	1	CPE 311 Microprocessor Sys. Lab.*	1
PHYS 112 Gen. Physics	4	ENGL 102 Comp. and Rhetoric	3
CS 210 Adv. Data and File Structures*	4	CS 221 Analysis of Algorithms*	3
CS 220 Discrete Mathematics*	3	CS 230 Intro. Software Engineering*	4
Total	**15**	Math 251 Multivariable Calculus*	4
		Total	**18**

Third Year

First Semester	Hrs	Second Semester	Hrs
CS 310 Prin. Program Language*	3	CS 4xx Technical Elective*	3
CS 350 Comp. Sys. Concepts*	3	CS 4xx Technical Elective*	3
STAT 215 Intro Prob & Statistics*	3	Discipline Elective 1	3
GEC Elective	3	GEC Elective	3
GEC Elective	3	GEC Elective	3
Total	**15**	**Total**	**15**

Fourth Year

First Semester	Hrs	Second Semester	Hrs
CS 480 Sr. Design Project*	2	CS 481Sr. Design Project*	3
CS 4xx Technical Elective*	3	CS 4xx Technical Elective*	3
Discipline Elective 2	3	2xx level or above Elective	3
GEC Elective	3	2xx level or above Elective	3
Extra GEC Elective	3	2xx level or above Elective	3
Total	**14**	**Total**	**15**
Grand Total	**128**		

* Course must be completed with a grade of C or better

ECAS Track for B.S.C.S.

First Year

First Semester	Hrs	Second Semester	Hrs
CS 110 Intro. Computer Science*	4	CS 111 Intro. Data Structures*	4
MATH 155 Calculus I*	4	MATH 156 Calculus II*	4
UNIV 101 Orientation	1	ENGL 101 Composition & Rhetoric	3

GEC Elective	3	GEC Elective	3
GEC Elective	3	GEC Elective	3
Total	**15**	**Total**	**17**

Second Year

First Semester	Hrs	Second Semester	Hrs
CS 210 Adv. Data and File Structures*	4	CPE 271 Digital Logic Design*	3
CS 220 Discrete Mathematics*	3	CPE 272 Digital Logic Design Lab*	1
ENGL 102 Composition & Rhetoric II	3	CS 221 Analysis of Algorithms*	3
Laboratory Science, sequence 1	4	CS 230 Intro. Software Engineering*	4
Math 251 Multivariable Calculus*	4	GEC Elective	3
Total	**18**	Laboratory Science, sequence 2	4
		Total	**18**

Third Year

First Semester	Hrs	Second Semester	Hrs
CS 310 Prin. Program Language*	3	CS 4xx Tech Elective, systems group*	3
CS 350 Comp. Sys. Concepts*	3	CS 4xx Technical Elective*	3
STAT 215 Intro Prob & Statistics*	3	Laboratory Science, sequence 3	4
CS 4xx Technical Elective, theory group*	3	GEC Elective	3
GEC Elective	3	2xx level or above Elective	3
Total	**15**	**Total**	**16**

Fourth Year

First Semester	Hrs	Second Semester	Hrs
CS 480 Sr. Design Project (W)*	2	CS 481Sr. Design Project*	3
CS 4xx Technical Elective*	3	Discipline Elective 2	3
CS 4xx Technical Elective (or approved equivalent)*	3	Discipline Elective 3	3
Discipline Elective	3	2xx level or above Elective	3
2xx level or above Elective	3	Extra GEC Elective	3
Total	**14**	**Total**	**15**
Grand Total	**128**		

* Course must be completed with a grade of C or better

Transfer Students

Students wishing to transfer into pre-computer science or computer science must satisfy admission requirements and must petition the Lane Department of Computer Science and Electrical Engineering for admission. If petitioning:

- In person, come to the department's office and ask for the undergraduate coordinator. Bring a transcript of all college-level coursework attempted.
- By mail, be sure to include a transcript of all college-level coursework attempted and an indication of when the transfer is desired. On the envelope in the lower-left corner write Transfer petition for UG CS. Mail to Lane Department of Computer Science and Electrical Engineering, WVU, P.O. Box 6109, Morgantown, WV 26506-6109.
- Transfer students are expected to meet the following requirements:
    - A grade point average of at least 3.0 in all college-level work attempted.
    - A grade of C or better in any transfer course that will count as pre-CS or CS.

The number of transfer students accepted is governed by the enrollment capacities of each of the degree tracks. First admission priority is given to those students currently matriculated at WVU; second priority, to students enrolled in computer science curricula at external colleges and universities; third priority, to students enrolled in

other degree programs at external colleges and universities. Within the last two priorities, preferential admission is in the following order: West Virginia residents, U.S. citizens or permanent residents, and international students.

Minor in Computer Science

Any student may take a minor in computer science by taking the following courses and making a C or better. The symbol "/" means sequence courses:

- CS 110 / 111.
- Pick one from: CS 210, CS 220, or CS 230.
- CS 310 and 350.
- At least one CS 400-level course.

Curriculum in Electrical Engineering

Electrical engineers design, develop, test, and oversee the manufacture and maintenance of equipment that uses electricity. Electrical equipment includes power generating and transmission equipment, motors, machinery controls, instrumentation in cars and aircraft, robots, computers, communications equipment, and health-care equipment.

The objective of the bachelor's degree program in electrical engineering (EE) is to produce graduates who have the knowledge, skills, and attitudes that will ensure success in professional positions in business, industry, research, government service, or graduate study as well as professional schools.

We carry out this objective by providing our students with a sound education in mathematics and the sciences, a broad foundation in the fundamentals of engineering, elective opportunities to develop expertise in one or more emphasis areas, and the general education necessary to put technical knowledge into perspective. Theoretical work is complemented by an emphasis on the practice of engineering, and design activity is integrated throughout the curriculum. The electrical engineering program is accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET).

We expect that all students in the B.S.E.E. program at WVU will have achieved the following outcomes by the time they graduate:

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct engineering and scientific experiments.
- An ability to analyze and interpret engineering and scientific data.
- An ability to design, including the planning, specification, detail design, implementation, and evaluation of components, processes, or systems to meet performance, cost, safety, and quality requirements.
- An ability to function on multi-disciplinary teams.
- An ability to identify, formulate, and solve a range of electrical engineering problems.
- An understanding of professional and ethical responsibility.
- An ability to convey technical material through formal written papers/reports which satisfy accepted standards for writing style.
- An ability to convey technical material through oral presentation and interaction with an audience.
- Knowledge of the wisdom represented by the humanities and fine arts.
- A recognition of the need for, and an ability to engage in, life-long learning.
- Knowledge of contemporary social issues necessary to understand the impact of electrical/computer engineering solutions in a global and societal context.
- An ability to use modern engineering techniques and tools, including computer-based tools, for analysis and design.

- Knowledge of electrical engineering fundamental concepts, with advanced knowledge in at least one sub-discipline of electrical engineering.
- Knowledge of mathematics through differential and integral calculus, basic sciences, and engineering sciences necessary to design complex electrical and electronic devices and systems containing hardware and software components.
- Knowledge of probability and statistics, including electrical engineering applications.
- Knowledge of differential equations and other advanced mathematics such as linear algebra, complex variables, or discrete mathematics.

In the first two years of electrical engineering, coursework is limited to those subjects which are essential as preparatory courses for more technical courses in the third and fourth years. Fundamental courses in electrical engineering are introduced in the second year. In the third and fourth years, the curriculum provides advanced instruction through required courses and electives. These electives are included in the curriculum to allow the student to acquire additional depth in the student's selected field of electrical engineering. Five technical electives are required for a total of 15 credits. At least three must come from one of the EE Emphasis areas. Two additional technical electives may be selected from upper-division engineering, science, or math areas. However, a student with special career objectives may petition the Lane Department through his/her advisor for prior written permission to select one upper division course meeting those objectives.

The mathematics/science elective and engineering science elective are selected from department-approved lists. Students should consult with their advisors to select a course from this list. To be eligible for graduation in electrical engineering a student must attain a grade point average of 2.0 or better for all required electrical engineering courses. If a required EE 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.

A total of five humanities and social science electives (GEC electives) must be selected. The humanities and social science electives must be chosen so as to meet University General Education Curriculum requirements and Accreditation Board for Engineering and Technology accreditation guidelines.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.E.E. degree program which completes degree requirements in four years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year
First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

First Semester	Hrs	Second Semester	Hrs
EE 221 Intro. to EE Lec.	3	EE 223 Electrical Circuits Lec.*	3
EE 222 Intro. to EE Lab	1	EE 224 Electrical Circuits Lab*	1
CPE 271 Intro. Dig. Log. Design	3	MATH 261 Elem. Differential Equat.	4
CPE 272 Dig. Log. Lab	1	CS 110 Intro. to Computer Science	4
MATH 251 Multivariable Calculus	4	ENGL 102 Comp. and Rhetoric	3
PHYS 112 General Physics	4	EE 251 Digital Elect.*	3
Total	**16**	EE 252 Digital Elect. Lab*	1
		Total	19

Third Year

First Semester	Hrs	Second Semester	Hrs
EE 335 Elec. Enrgy Conv. & Sys.*	3	EE 329 Signals and Systems 2*	3
EE 336 Elec. Enrgy Conv. Lab*	1	EE 328 Signals and Systems Lab*	1
EE 345 Engr. Electromagnetics*	3	CPE 310 Microprosessors Sys.	3
EE 327 Signals & Systems 1*	3	CPE 311 Microprosessors Lab	1
EE 355 Analog Elec.*	3	Engr. Science Elective	3

EE 356 Analog Elec. Lab*	1	ECON 201 Microeconomics	3
STAT 215 Intro. Prob. & Stat	3	Math/Science Elective	3
Total	**17**	**Total**	**17**

Fourth Year

First Semester	Hrs	Second Semester	Hrs
ECON 202 Macroeconomics	3	EE 481 Senior Design Project	3
Technical Elective	3	GEC Elective	3
Technical Elective	3	Free Elective	3
EE 480 Senior Design Seminar	2	Technical Elective	3
GEC Elective	3	Technical Elective	3
Total	**14**	**Total**	**15**
Grand Total	**132**		

*Offered once per year in semester shown

Curriculum for a Dual Major in Electrical and Computer Engineering

Students can simultaneously pursue B.S. degrees in two majors within the department by completing a small number of additional classes. The student must satisfactorily complete at least 158 credits and meet all the requirements for both degrees. A suggested schedule for the dual curriculum in electrical engineering and computer engineering is shown below.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical dual B.S.Cp.E. and B.S.E.E. program which completes both degree requirements in four and one-half years is as follows.. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year

First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

First Semester	Hrs	Second Semester	Hrs
EE 221 Intro. to EE Lec.	3	EE 223 Electrical Circuits Lec.*	3
EE 222 Intro. to EE Lab	1	EE 224 Electrical Circuits Lab*	1
PHYS 112 General Physics	4	ENGL 102 Comp. and Rhetoric	3
CPE 271 Intro. Dig. Log Design	3	EE 252 Digital Elect. Lab*	1
CPE 272 Dig. Log Lab	1	EE 251 Digital Elect.*	3
MATH 251 Multivariable Calculus	4	MATH 261 Elem. Differential Equat.	4
Free Elective***	3	CS 110 Intro. Comp Science**	4
Total	**19**	**Total**	**19**

Third Year

First Semester	Hrs	Second Semester	Hrs
EE 327 Signals & Systems 1*	3	CPE 312 Micro. Struc. & Interface*	3
CPE 310 Microprocessor Sys.	3	CPE 313 Micro. Struc. & Inter. Lab*	1
CPE 311 Microprocessor Lab	1	CS 350 Computer Sys. Concepts	3
MATH 375 Applied Mod Algebra	3	CS 230 Intro. Software Engr.	4
STAT 215 Intro. Prob. & Stat.	3	EE 329 Signals & Systems II*	3
CS 111 Intro. Data Structures**	4	EE 328 Signals & Systems Lab*	1
Total	**17**	ECON 201 Microeconomics	3
		Total	**18**

Fourth Year

First Semester	Hrs	Second Semester	Hrs
EE 355 Analog Elect. Lec.*	3	CPE 480 Senior Design Seminar	2

EE 356 Analog Elect. Lab*	1	Technical Elective	3
EE 335 Elect. Enrgy Conv. & Sys.*	3	Engr. Science Elective	3
EE 336 Elec. Enrgy Conv. Lab*	1	GEC Elective	3
EE 345 Engr. Electomagnetics*	3	ECON 202 Macroeconomics	3
CS 450 Operating Sys. Structures	3	Technical Elective[ǂ]	3
CPE Technical Elective	3	**Total**	**17**
Total	**17**		

Fifth Year

First Semester	Hrs
CPE 481 Senior Design Project	3
GEC Elective	3
Free Elective***	3
Technical Elective[ǂ]	3
Technical Elective[ǂ]	3
Free Elective***	3
Total	**18**
Grand Total	**159**

*Only taught once per year, in the semester shown.
** Students may wish to schedule CS 110 and CS 111 in the first year and move the GEC electives to the later years.
*** Nine hours of any University scheduled course(s).

[ǂ] Technical Electives: Five technical electives are required. At least three must come from one of the electrical engineering emphasis areas other than computers. One additional technical elective must be a 400-level computer engineering course, and one technical elective may be selected from upper-division engineering, science, or math areas. However, a student with special career objectives can petition the department through his or her advisor for prior written permission to select one upper-division course meeting his or her career objectives.

Department of Industrial and Management Systems Engineering

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Degree Offered

Bachelor of Science in Industrial Engineering

Curriculum in Industrial Engineering

Industrial engineering is the discipline of engineering concerned with the design, improvement, and installation of integrated systems of people, material, information, equipment, and energy to assure performance, reliability, maintainability, schedule adherence, and cost control. Industrial engineers look at the “big picture” of an operation or system and bridge the gap between management and operations. They deal with and motivate people as well as determine what tools should be used and how they should be used. Industrial engineers use computers and sophisticated software as tools to solve complicated problems to design, quantify, predict, and evaluate the performance of all types of complex technologies and systems.

The mission of the industrial engineering program at WVU is to advance the industrial engineering profession through innovative and high-quality academic programs, relevant research, and professional services that

address the needs of West Virginia, the nation, and the world. The industrial and management system engineers at WVU are taught to draw upon specialized knowledge and skills in the mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems. They are introduced to state-of-the-art software in their coursework for data analysis, information management, scheduling, quality control, optimization, and other practices and procedures used by the industrial engineering profession in highly evolving industries of the early 21st century.

The discipline of industrial engineering has a rich, ever-increasing diversity of applications. Traditionally, industrial engineers have been employed by manufacturing companies to do facilities and plant design, plant management, quality control, ergonomics, and production engineering. Today, however, industrial engineers are employed in almost any type of industry, business, or institution. Because of their skills, industrial engineers are more widely distributed and in greater demand among more industries than any other engineering discipline.

As an industrial engineer educated at WVU you can expect to have employment opportunities in manufacturing companies, insurance companies, banks, hospitals, technical sales, pharmaceutical companies, retail organizations including e-business, airlines, government agencies, consulting firms, construction, transportation, public utilities, social service, electronics, digital and wireless communications, etc. The diverse orientation of industrial engineering coupled with the skills and training you receive at WVU make you a prime source of management talent that offers unique professional advancement opportunities.

The industrial engineering program at WVU devotes considerable attention to the individual needs of the student. It is committed to develop student strengths in technical abilities, personal development, problem solving, and practical experience preparing them for careers in industry, business, government, or advanced professional degrees. One of the defining attributes in the success of the department is the dedication and talent of its faculty and staff. The aggregate careers of our faculty and staff represent nearly 300 years of service to students at WVU. In these 300 years of service are embodied the wisdom and experience to successfully prepare industrial engineers for the 21st century.

The faculty works extensively with our 150 to 170 sophomore, junior, and senior students in such areas as communication skills, personal growth and development, creation of summer internship opportunities, senior capstone project experience, and permanent job opportunities. As faculty and staff we are committed to provide for our students:

- A friendly, open-door collegial environment.
- Personable faculty mentoring students.
- Teaching concepts and techniques for today's demands.
- Quality courses that are innovative and challenging.
- Placement in the jobs they want.
- Notable life-long successes.

The program objectives of the industrial engineering curriculum are as follows:
A graduate of the industrial engineering baccalaureate program at WVU will be prepared to:

- Practice industrial engineering and initiate and develop leadership roles in business, industry, and/or government.
- Continue professional development and life-long learning
- Interact in society and business in a professional, ethical manner
- Be proficient in written and oral communication and utilize people-oriented skills in individual and team environments.
- Apply the skills from industrial engineering to be proficient in his/her chosen field or graduate studies.

The program outcomes of the industrial engineering curriculum are as follows:
At the time of their graduation, students will have acquired:

- The ability to use modern and classical Industrial Engineering methodologies such as operations research, manufacturing systems, computer programming and simulation, production systems, human factors and ergonomics, engineering statistics and quality control, and engineering economics.
- The ability to apply knowledge of math, science, and general engineering.

- The ability to design and conduct experiments, analyze and interpret data, develop implementation strategies, shape recommendations so that results will be achieved and findings will be communicated effectively.
- The ability to work individually, on teams, and/or on multi-disciplinary teams to identify, formulate and solve problems using industrial engineering knowledge, skills and tools.
- The ability to design and implement or improve integrated systems that include people, materials, information, equipment and energy using appropriate analytical, computational, and experimental practices.
- The broad education necessary to develop and maintain professional ethics and understand the comprehensive impact of their solutions on individuals and the society.
- A recognition of the need for and an ability to engage in life-long learning.
- The professional characteristics expected of a successful Industrial Engineer.

To be eligible for graduation with a bachelor of science in industrial engineering a student must attain a grade point average of 2.0 or better for all industrial and management systems engineering courses attempted. If a course is repeated, only the last grade received is counted in computing the grade point average, and the course credit hours are counted only once. This requirement assures that the student has demonstrated overall competence in the chosen major.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.I.E. degree program which completes degree requirements in four years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year
First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

First Semester	Hrs	Second Semester	Hrs
MATH 251 Multivariable Calculus	4	MATH 261 Elem. Differential Equat.	4
CHEM 116/GEC Elect. or PHYS 112	4(3)	MAE 243 Mech. of Materials	3
MAE 241 Statics	3	IENG 213 Engineering Statistics	3
ENGL 102 Comp. & Rhetoric	3	IENG 377 Engineering Economy	3
IENG 200 Fundamentals of IE	1	GEC Elective	3
IENG 220 Re-Engineering	3	**Total**	**16**
Total	**17/18**		

Third Year

First Semester	Hrs	Second Semester	Hrs
ECON 201 Microeconomics	3	ECON 202 Macroeconomics	3
IENG 301 Materials and Costing	1	IENG 302 Mfg. Processes	2
IENG 314 Adv. Analy. Eng. Data	3	IENG 303 Mfg. Processes Lab	1
IENG 305 Intro. to Systems Engineering	2	IENG 316 Industrial Quality Control	3
IENG 350 Intro. Oper. Research	3	IENG 331 Computer Appl. IE	3
IENG 360 Human Factors Engr.	3	IENG 343 Prod. Plan & Design	3
Total	**15**	**Total**	**15**

Fourth Year

First Semester	Hrs	Second Semester	Hrs
EE 221 Basic Electric Eng.	3	IENG 472 Design Prod. Systems	3
EE 222 Basic Electric Lab	1	IENG Tech. Elective	3
IENG Tech. Elective	3	IENG 446 Plant Layout/Mat'l Hand.	3
IENG 455 Simulation Digital Meth.	3	Select 2 of the following courses	6
IENG 471 Design Productive Sys.	3	IENG Tech. Elective	
GEC Elective	3	MAE 242 Dynamics	
Total	**16**	MAE 320 Thermodynamics	

		MAE 331 Fluid Mechanics	
		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.

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 grade point average 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 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. A typical B.S.A.E. degree program which completes degree requirements in four years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year
First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

First Semester	Hrs	Second Semester	Hrs
MAE 215 Intro. to Aerospace Engr.	3	MAE 242 Dynamics	3
MAE 241 Statics	3	MAE 243 Mechanics of Materials	3
MATH 251 Multivariable Calculus	4	MAE 244 Dynam. and Strength Lab	1
PHYS 112 General Physics	4	MATH 261 Elem. Differential Equat.	4
ENGL 102 Comp. and Rhetoric	3	GEC Elective	3
Total	**17**	**Total**	**14**

Third Year

First Semester	Hrs	Second Semester	Hrs
MAE 316 Analy. of Engr. Sys.	3	EE 221 Basic Electrical Engr.	3
MAE 320 Thermodynamics	3	EE 222 Basic Electrical Lab	1
MAE 335 Incompressible Aerodyn.	3	MAE 336 Compress. Aerodyna.	3
MAE 343 Intermed. Mech. of Matls.	3	MAE 345 Aerospace Structures	3
GEC Elective	3	MAE 365 Flight Dynamics	3

Total	**15**	GEC Elective	3
		Total	**15**

Fourth Year

First Semester	Hrs	Second Semester	Hrs
MAE 426 Flight Vehcl Propulsion	3	MAE 423 Heat Transfer	3
MAE 434 Experimental Aerodyn	2	MAE 460 Automatic Controls	3
MAE 456 CAD/Finite Elem. Anal.	3	MAE 476 Space Flight and Sys.	3
MAE 475 Flight Vehicle Design	3	Technical Elective	3
Technical Elective	3	GEC Elective	3
Total	**14**	**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.

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. A typical B.S.M.E. degree program which completes degree requirements in four years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year

First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

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

Third Year

First Semester	Hrs	Second Semester	Hrs
MAE 316 Analy. of Engineering Sys.	3	MAE 321 Applied Thermodynamics	3
MAE 320 Thermodynamics	3	MAE 322 Thermal and Fluids Lab	1
MAE 343 Intermed. Mech. Matls.	3	MAE 331 Fluid Mechanics	3

EE 221 Basic Electrical Engr.	3	MAE 342 Dynamics of Machines	3
EE 222 Basic Electrical Lab	1	IENG 302 Manufacturing Process	2
GEC Elective	3	IENG 303 Manf. Process Lab	1
Total	**16**	GEC Elective	3
		Total	**16**

Fourth Year

First Semester	Hrs	Second Semester	Hrs
MAE 454 Machine Design & Mfg.	3	MAE 411 Advanced Mechatronics	3
MAE 456 CAD/Finite Elem. Ana or MAE 423 Heat Transfer	3	MAE 423 Heat Transfer or MAE 456 CAD/Finite Elem. Anal	3
MAE 471 Prin. of Engr. Design	3	MAE 460 Automatic Controls	3
Technical Elective	3	Technical Elective	3
GEC Elective	3	**Total**	**12**
Total	**15**	**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 21 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.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical dual B.S.A.E. and B.S.M.E. degrees program which completes both degree requirements in four and one-half years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year

First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

First Semester	Hrs	Second Semester	Hrs
MAE 215 Intro. Aerospace Engr.	3	MAE 211 Mechatronics	3
MAE 241 Statics	3	MAE 242 Dynamics	3
MATH 251 Multivariable Calculus	4	MAE 243 Mechanics of Materials	3
PHYS 112 General Physics	4	MAE 331 Fluid Mechanics	4
ENGL 102 Comp. and Rhetoric	3	MATH 261 Elem. Differential Equat.	3
Total	**17**	GEC Elective	3
		Total	**19**

Third Year

First Semester	Hrs	Second Semester	Hrs
MAE 316 Analysis of Eng. Sys.	3	MAE 244 Dynamics. & Strength Lab	1
MAE 320 Thermodynamics	3	MAE 322 Thermal & Fluids Lab	1
MAE 335 Incompressible Aerodynamics.	3	MAE 336 Compressible Aero.	3
MAE 343 Intermed. Mech of Materials.	3	MAE 342 Dynamics of Machines	3
EE 221 Basic Electrical Engr.	3	MAE 345 Aerospace Structures	3
EE 222 Basic Electrical Lab.	1	MAE 365 Flight Dynamics	3
GEC Elective	3	GEC Elective	3
Total	**19**	**Total**	**17**

Fourth Year

First Semester	Hrs	Second Semester	Hrs
MAE 426 Flight Vehicle Propulsion	3	MAE 411 Advanced Mechatronics	3
MAE 434 Experimental Aerodynamics	2	MAE 423 Heat Transfer	3
MAE 456 CAD/Finite Elem Anal.	3	MAE 460 Automatic Controls	3
MAE 475 Flight Vehicle Design	3	MAE 476 Space Flight and Sys.	3
Technical Elective	3	IENG 302 Mfg. Processes	2
Technical Elective	3	IENG 303 Mfg. Process Lab	1
Total	**17**	Technical Elective	3
		Total	**18**

Fifth Year

First Semester	Hrs
MAE 454 Machine Design & Mfg.	3
MAE 471 Prin. of Engr. Design	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 (B.S.Min.E.)
Dual Bachelor of Science in Mining Engineering (B.S.Min.E.) and Civil Engineering (B.S.C.E.)
Dual Bachelor of Science in Mining Engineering (B.S.Min.E.) and Geology (B.S.)

Mining Engineering Program

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 Mission of the Mining Engineering undergraduate program at West Virginia University (BS MinE) has 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.

The Mining Engineering Program Educational Objectives have been designed:

- To deliver curriculum material that is of sufficient science and engineering rigor to ensure that graduates have the basis for entering the private or public sector as mining engineers, or higher education, if they so choose.
- To enable graduates to comprehend the interrelationships among geology, exploration, valuation, development, exploitation, reclamation, and processing of mineral deposits in a coordinated manner, from the introductory mining courses to the capstone mine-design course.
- To encourage graduates in the use of computer and information technology, in a comprehensive manner, as it relates to engineering applications for mineral resources.
- To encourage graduates in the development of their awareness, appreciation, and communication capabilities to address societal concerns with regard to the total environment, health and safety, lifelong learning, and the conservation of our natural resources.

The Program Outcomes of the BS MinE program have been designed to assure that:

- Students are well prepared in application of mathematics, science, and engineering.
- Students are well prepared to design and conduct experiments, as well as to analyze and interpret data.
- Students are well prepared to design a system, component, or process to meet desired needs.
- Students have an ability to function on multidisciplinary teams.
- Students have an ability to identify, formulate, and solve engineering problems.
- Students have an understanding of professional and ethical responsibility.
- Students have an ability to communicate effectively.
- Students have the broad education necessary to understand the impact of engineering solutions in a global and societal context.
- Students have recognition of the need for, and an ability to engage in life-long learning.
- Students have knowledge of contemporary issues.
- Students have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

- Students have an understanding of the importance of economics, environmental, health, and safety issues in the operations of modern mines.
- Students have an ability to learn independently.

Professional technical courses include surface and underground mining systems, engineering principles of blasting, materials handling, ventilation, roof control, rock mechanics, mining equipment, coal and mineral preparation, plant and mine design, geology, and water control. In addition, students receive a foundation in the managerial, financial, environmental, and social aspects of the operation of a mining enterprise. Local coal fields, mines, and preparation plants provide extensive opportunity for research, instruction, and field work in a real-world situation.

In the fourth year, the student may specialize in such career areas as coal mining, ore mining, or other phases of mining engineering through the proper selection of design problems and electives. The student will be assigned an advisor who will assist in this phase of the program.

A student admitted to the program, including the dual degree programs with Civil Engineering or Geology, must achieve a grade point average of 2.25 or better in all Mining (MINE) courses in order to qualify for the bachelor's degree.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.Min.E. degree program which completes degree requirements in four years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year

First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

First Semester	Hrs	Second Semester	Hrs
MINE 205 Undergrd. Mining Systems	3	MINE 206 Surface Mining Systems	4
MINE 201 Mine Surveying	3	MAE 242 Dynamics	3
MINE 261 Engineering CAD	2	MATH 261 Elem. Differential Equat.	4
MAE 241 Statics	3	PHYS 112 General Physics	4
GEOL 342 Struct. Geol. for Engr.	3	MAE 331 Fluid Mechanics	3
MATH 251 Multivariable Calculus	4	**Total**	**18**
Total	**18**		

Third year

First semester	Hrs	Second semester	Hrs
MINE 306 Mining Expl. and Eval	3	MINE 331 Mine Ventilation	3
MINE 382 Mine Power System	3	MINE 427 Coal Preparation	4
Mine 461 Appl. Mineral Computer Method	3	Engl 102 Composition & Rhetoric	3
MAE 320 Thermodynamics	3	MAE 243 Mech. of Materials	3
GEC Elective	3	GEC Elective	3
Total	**15**	**Total**	**16**

Fourth year

First semester	Hrs	Second semester	Hrs
MINE 411 Rock Mechanics	4	MINE 484 Mine Design-Report	4
MINE 483 Mine Design-mapping	2	AGRN 455 Recl. of Disturbed Soils	3
MINE 471 Mine & Safety Mngmt	3	Mine 480 Multidisciplin. Team Prjt.	1
Technical Elective*	3	Eng/Sci Technical Elective**	3

GEC Elective	3	GEC Elective	6
Total	**15**	**Total**	**17**
Grand Total	**134**		

* Technical Elective options are MINE 407, MINE 414, or other courses from mining engineering approved by the Department.

** Eng/Sci Technical Elective may be selected from non-mining engineering/science courses, or mining engineering courses approved by the Department.

For the most recent list of approved courses in the General Education Curriculum, visit the GEC site at WVU Admissions and Records.

Curriculum for a Dual Major in Mining and Civil Engineering

Students can simultaneously pursue B.S. degrees in Mining Engineering and Civil Engineering by completing additional courses. The dual degree program requires satisfactory completion of 158 credit hours.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical dual B.S.C.E. and B.S.Min.E. program which completes both degree requirements in five years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year

First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

Fall Semester	Hrs	Spring Semester	Hrs
CE 201 Introduction to CE	1	ENGL 102 Composition and Rhetoric	3
MAE 241 Statics	3	MAE 242 Dynamics	3
MATH 251 Multivariate Calculus	4	MATH 261 Elem. Differential Equat.	4
MINE 201 Mine Surveying	3	MINE 206 Surface Mining Systems	4
MINE 205 Underground Mining Systems	3	PHYS 112 General Physics	4
MINE 261 Engineering CAD	2	**Total Hours:**	**18**
Total Hours:	**16**		

Third Year

Fall Semester	Hrs	Spring Semester	Hrs
CE 321 Fluid Mechanics	3	CE Core†	4
GEOL 342 Structural Geology	3	CE Core†	4
MAE 243 Mechanics of Materials	3	MINE 331 Mine Ventilation	3
MAE 320 Thermodynamics	3	MINE 427 Coal Preparation	4
STAT 215 Statistics	3	MINE 480 Interdisciplinary Team Project	1
Total Hours:	**15**	**Total Hours:**	**16**

Fourth Year

Fall Semester	Hrs	Spring Semester	Hrs
CE Core†	4	CE Seminar	1
CE Core†	4	CE Design Elective*	3
MINE 306 Mining Exploration & Eval	3	CE Design Elective*	3
MINE 382 Mine Power System	3	CE 322 Hydrotechnical Engineering	3

Total Hours:	**14**	GEC Elective	3
		IENG 377 Engineering Economy	3
		Total Hours:	**16**

Fifth Year

Fall Semester	Hrs	Spring Semester	Hrs
GEC Elective	3	CE Technical Elective**	3
GEC:ECON 201 Prin of Microeconomics	3	CE 479 Integrated Design	3
MINE 411 Rock Mech & Ground Control	4	GEC Elective	3
MINE 471 Mine and Safety Management	3	GEC Elective	3
MINE 483 Mine Design-Exploration	2	MINE 484 Mine Design-Report (W)	4
Total Hours:	**15**	**Total Hours:**	**16**

Total Credit Hours for the BS CE & MINE Double Major Program: 158

Notes:

1. Discipline substitutions are:
MINE 306 fulfills requirement of CE Engr/Math/Sci Elective 1
MINE 411 fulfills requirement of CE Engr/Math/Sci Elective 2
MINE requirement for AGRN 455 is fulfilled through CE 322 and CE 351
MINE 382 fulfills requirement of CE Engineering Elective outside CE
MINE 461 is fulfilled by CE 322
MINE 484W fulfills CE requirement of ENGL 305
MINE requirement for STAT 211 is fulfilled by CE requirement of STAT 215
CE 321 fulfills MINE requirement for MAE 331
MINE Technical Elective and MINE Eng/Sci Technical Elective requirements are fulfilled by any two of the following; CE 332, 347 or 361.
GEOL 342 fulfills requirement of CE Basic Science Elective
MINE 261 substitutes for CE 210
2.† CE Core Classes are: CE 332 Introduction to Transportation Engineering; CE 351 Introductory Soil Mechanics; CE 347 Environmental Engineering; CE 361 Structural Analysis I
* CE Design Electives may be selected from Civil Engineering design courses approved by the CE Department. See your advisor for a list of acceptable courses in CE Department.
** CE Technical Electives may be selected from Civil Engineering courses approved by the CE Department. See your advisor for a list of acceptable courses in CE Department.

Dual Degree Curriculum for Mining Engineering and Geology

This curriculum allows students to simultaneously pursue B.S. degrees in both Mining Engineering and Geology. The dual degree program requires satisfactory completion of 158 credits, and fulfilling all the requirements for both degrees.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical dual B.S.Min.E. and B.S.Geol. program which completes both degree requirements in five years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year

First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

Fall Semester	Hrs	Spring Semester	Hrs
GEOL 284 Mineralogy	3	CHEM 116 Fundamentals of Chemistry	4
MAE 241 Statics	3	GEOL 285 Introductory Petrology	3
MATH 251 Multivariate Calculus	4	MAE 331 Fluid Mechanics	3
MINE 201 Mine Surveying	3	MINE 206 Surface Mining Systems	4
MINE 205 Underground Mining Systems	3	PHYS 112 General Physics	4
MINE 261 Engineering CAD	2	Total Hours:	18
Total Hours:	18		

Third Year

Fall Semester	Hrs	Spring Semester	Hrs
GEOL 341 Structural Geology	3	GEC Elective	3
MAE 320 Thermodynamics	3	GEOL 311 Stratigraphy and Sedimentation (W)	3
MATH 261 Elem. Differential Equat.	4	MAE 243 Mechanics of Materials	3
MINE 461 Applied Mineral Computer Methods	3	MINE 331 Mine Ventilation	3
STAT 211 Elem. Statistical Inference	3	MINE 427 Coal Preparation	4
Total Hours:	16	MINE 480 Interdisciplinary Team Project	1
		Total Hours	17

Summer

GEOL 404 Geology Field Camp***	6
Total Hours:	6

Fourth Year

Fall Semester	Hrs	Spring Semester	Hrs
GEC Elective	3	GEC Elective	3
GEC Elective (ECON 201 Principle of Microeconomics)	3	GEC Elective	3
		GEOL 321 Geomorphology	3
GEOL 331 Paleontology, or GEOL 454 Environmental and Exploration Geophysics	3	GEOL Elective*	3
MINE 382 Mine Power System	3	MAE 242 Dynamics	3
MINE 306 Mining Exploration & Evaluation	3	MINE 483 Mine Design-Exploration	2
Total Hours:	15	Total Hours:	17

Fifth Year

Fall Semester	Hrs
GEC Elective	3
GEOL 495 or MINE 495 Independent Study**	1
MINE 411 Rock Mechanics & Ground Control	4
MINE 471 Mine and Safety Management	3
MINE 484 Mine Design-Report (W)	4
Total Hours:	15

Total Credit Hours for the Geology and Mining Engineering Dual Major: 158

Notes:

1. Discipline substitutions are:

GEOL 311 and other GEOL Upper-division Elective courses fulfill the requirements for MinE Technical Elective and Eng/Sci Technical Elective.

GEOL requirement for GEOL 341 is substituted for MINE requirement for GEOL 342.

MinE requirement of ARGN 455 is fulfilled through GEOL 321

MinE 205 and MinE 206 fulfill the requirement of GEOL Upper-division Technical Electives.

MinE 484W and GEOL 311W fulfill the requirement of writing course.

Econ 201 and GEOL 101 fulfill two of the GEC requirements in the Mining Curriculum

2.*GEOL Technical Elective may be any GEOL Upper-division Elective courses including GEOL 493, but not GEOL 351.

** One credit hour from GEOL 495, MINE 495, or Eng/Sci Technical Electives or others approved by GEOL or MINE Department can be used to satisfy 158 total credit hours requirement.

*** GEOL 404 Summer Field Camp is GEOL capstone course.

Department of Petroleum and Natural Gas Engineering

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Degree Offered

Bachelor of Science in Petroleum and Natural Gas Engineering

Curriculum in Petroleum and Natural Gas Engineering

Petroleum and natural gas engineering is concerned with design and application aspects of the discovery, production, and transportation of oil and natural gas resources.

Professionals in this field must have a thorough understanding of the geological principles relating to the occurrence, discovery, and production of fluid hydrocarbons. The petroleum and natural gas engineer must know and be capable of applying both conventional engineering design principles as well as those pertaining specifically to the field of petroleum and natural gas engineering. These are developed in the petroleum engineering courses in the curriculum. In addition, a strong foundation in mathematics and the sciences broadens the future engineer's professional capabilities. Because many engineers will be employed as supervisors or executives, managerial and social skills are also emphasized.

Students are offered the opportunity to enter all phases of the petroleum and natural gas industry in meaningful and important jobs, continue their education towards advanced degrees, or in some cases pursue a combination of professional employment and continued education.

The petroleum and natural gas engineering undergraduate program educational objectives are to:

- The graduates will be successful in their professional careers as petroleum engineers in the energy industry, government agencies, and/or post-graduate education.
- The graduates will be successful in effectively formulating, communicating, and implementing solutions to engineering problems in a variety of professional environments.

- The graduates will be successful in demonstrating their obligations to the profession, to their employer, and to society.

The foundation for achieving program objectives is established through a rigorous curriculum that provides the students with:

- An understanding of scientific and engineering principles and the application of these principles in solving petroleum and natural gas engineering problems using modern tools.
- An integrated design experience leading to a capstone design course.
- A balanced and rounded education to recognize the need for developing technical communication and teamwork skills, as well as understanding the engineer's professional, ethical, and societal obligations.

The outcomes of the petroleum and natural gas engineering undergraduate program are as follows:

- The graduates will have a thorough understanding of scientific and engineering principles and their application to petroleum and natural gas engineering problems.
- The graduates will have the ability to integrate their scientific and engineering knowledge to design and conduct experiments, and interpret and analyze data.
- The graduates will have the ability to apply scientific and engineering fundamentals to formulate solutions to petroleum and natural gas engineering problems.
- The graduates will have the ability to use techniques, skills and modern petroleum and natural gas engineering tools.
- The graduates will have the ability to integrate their scientific and engineering knowledge to solve petroleum and natural gas engineering design problems.
- The graduates will have the ability to communicate effectively.
- The graduates will have the ability to function on multi-disciplinary teams.
- The graduates will recognize the professional and ethical responsibilities of a petroleum engineer.
- The graduates will have an understanding of the impact of petroleum and natural gas engineering solutions in societal and global context.
- The graduates will recognize the need to acquire the knowledge of contemporary issues.
- The graduates will recognize the need to engage in life long learning.

These outcomes are achieved by enrolling in rigorous individual courses in all basic areas of petroleum and natural gas engineering, basic science, mathematics, geology, and humanities and social sciences. The petroleum and natural gas engineering curriculum also contains significant laboratory components aimed at reinforcing the knowledge gained in the classroom. In the senior year, electives are offered in which the student may obtain additional depth of knowledge in specific areas of petroleum and natural gas technology. Each student is individually assisted in course selection by an advisor who is a member of the petroleum and natural gas engineering faculty.

Students gain practical experience and first-hand knowledge of many aspects of petroleum and natural gas engineering through close proximity to the industry in West Virginia and surrounding states. Production sites, secondary and enhanced oil recovery projects, compressor stations, gas storage fields, and corporate offices all provide excellent opportunities for study. Additional experience is provided through modern, well-equipped laboratories within the department and the University. Students are urged to gain field experience through summer employment in the industry.

A student admitted to the program must achieve a grade point average of 2.25 or better and a grade of C or better in all petroleum and natural gas engineering (PNGE) courses in order to qualify for the bachelor's degree.

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.PNGE degree program which completes degree requirements in four years is as follows. For the most recent list of approved courses in the GEC Program, visit the GEC site at WVU Admissions and Records.

First year

First-Year Program courses and credit hours are listed in the Engineering or General Engineering Curriculums.

Second Year

First Semester	Hrs	Second Semester	Hrs
PHYS 112 General Physics	4	MATH 261 Elem. Differential Equat.	4
MATH 251 Multivariable Calculus	4	MAE 243 Mech. of Materials	3
MAE 241 Statics	3	MAE 331 Fluid Mech.	3
ENGL 102 Comp & Rhetoric	3	IENG 213 or STAT 215	3
GEOL 101 Planet Earth or GEC Elective	3	PNGE 200 Intro. Pet. Engr.	3
Total	**17**	**Total**	**16**

Third Year

First Semester	Hrs	Second Semester	Hrs.
PNGE 332 Pet. Prop./Phase Beh.	3	PNGE 310 Drilling Engr.	4
EE 221 Basic Elec. Engr.	3	PNGE 312 Drilling Fl. Lab	1
ECON 201 Microeconomics	3	PNGE 333 Elem. Res. Engr.	3
GEOL 342 Struct. Geol.	3	GEOL Elective*	3
MAE 320 Thermodynamics	3	ECON 202 Macroeconomics	3
Total	**15**	GEC Elective	3
		Total	**17**

Fourth Year

First Semester	Hrs	Second Semester	Hrs.
	.		
PNGE 420 Production Engr.	3	PNGE 400 Pet. Engr. Ethics	1
PNGE 434 App. Res. Engr.	3	PNGE 405 Multidis. Team Project	1
PNGE 441 O&G Property Eval.	3	PNGE 432 Pet. Res. Lab	1
PNGE 450 Formation Eval.	3	PNGE 480 Pet. Engr. Design	3
PNGE 470 Nat. Gas. Engr.	4	Technical Elective**	3
Total	**16**	GEC Elective	6
		Total	**15**
Grand Total	**131**		

*Recommended geology electives are GEOL 365, 454, or 472.
**Recommended technical electives are PNGE 460, 471, 501, or 532.