

# 2010-2011 UNDERGRADUATE STUDENT HANDBOOK

*for*  
**Computer Engineering, Electrical Engineering,  
Biometric Systems and Computer Science**  
*and*  
**the Dual Degree Programs**  
**EE/CpE, Biometrics/EE, Biometrics/CpE, and CS/CpE.**

Revised: Fall 2010

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**INTRODUCTION:** This handbook is a digest of those items most commonly encountered in advising and registering. It is not a legal instrument. This version supercedes all previous versions. For more complete information, **consult your academic advisor** and the WVU Undergraduate Catalog, available from <http://coursecatalog.wvu.edu/>. This handbook is available from <http://www.lcsee.cemr.wvu.edu/ugrad/UGHandbook.pdf>

**STUDENT RESPONSIBILITY:** Each student is ultimately personally responsible for determining that all course requirements are fulfilled. Failure to plan ahead may result in delay of graduation. Courses may not be taken until prerequisites are passed.

## I. LANE DEPARTMENT OF COMPUTER SCIENCE AND ELECTRICAL ENGINEERING

### A. Department Overview

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**Student Advisors: Consult the list posted outside 817 ESB**

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## II. CURRICULUM FOR A BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING, BSEE (3025).

The objective of the bachelor's degree program in electrical engineering (EE) at West Virginia University is to produce graduates who have the knowledge, skills, and attitudes that will ensure success in professional positions in business, industry, research, governmental service, or graduate study or professional school. We carry out that 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.

**We expect that all students in the BSEE program at WVU will have achieved the following outcomes by the time they graduate:**

- EE.a.** An ability to apply knowledge of mathematics, science, and engineering
- EE.b1.** An ability to design and conduct engineering and scientific experiments
- EE.b2.** an ability to analyze and interpret engineering and scientific data
- EE.c.** 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
- EE.d.** An ability to function on multi-disciplinary teams
- EE.e.** An ability to identify, formulate, and solve a range of electrical engineering problems
- EE.f.** An understanding of professional and ethical responsibility
- EE.g1.** An ability to convey technical material through formal written papers/reports which satisfy accepted standards for writing style
- EE.g2.** An ability to convey technical material through oral presentation and interaction with an audience
- EE.h.** Broad education necessary to understand the impact of engineering solutions in a global economic, environmental, and societal context.
- EE.i.** A recognition of the need for, and an ability to engage in, life-long learning
- EE.i.** Knowledge of contemporary issues necessary to understand the impact of electrical/computer engineering solutions in a global and societal context
- EE.k.** An ability to use modern engineering techniques and tools, including computer-based tools, for analysis and design
- EE1.** Knowledge of electrical engineering fundamental concepts, with advanced knowledge in at least one subdiscipline of electrical engineering
- EE2.** Knowledge of mathematics through differential and integral calculus, basic sciences, computer science, and engineering sciences necessary to design complex electrical and electronic devices and systems containing hardware and software components
- EE3.** Knowledge of probability and statistics, including electrical engineering applications
- EE4.** Knowledge of differential equations and other advanced mathematics such as linear algebra, complex variables, and discrete mathematics

Students should consult with their advisors **at least once per semester** to insure that they are meeting degree requirements. It is important for students to take courses as closely as possible to the order specified below. All pre-requisites and co-requisites must be observed (see flowcharts, Appendix II). To be eligible for graduation with a BSEE, students must attain a grade-point-average of 2.0 or better for all required departmental courses, as well as a 2.0 cumulative GPA. If a required departmental course is repeated, only the hours credited and the grade received for the last completion of the course are used in computing the departmental grade-point average.

<b>1<sup>st</sup> Semester Fresh.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Fresh.</b>	<b>HRS</b>
ENGR 101 Engr. Problem Solving 1	2	ENGR 102 Engr. Problem Solving 2	3
ENGR 199 Engineering Orientation	1	PHYS 111 Gen. Physics I	4
ENGL 101 Comp. and Rhetoric	3	GEC Elective	3
CHEM 115 Fund. of Chemistry I	4	GEC Elective	3
GEC Elective	3	MATH 156 Calculus II	4
MATH 155 Calculus I	4		
	17		17

<b>1<sup>st</sup> Semester Soph.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Soph.</b>	<b>HRS</b>
EE 221 Intro. to EE Lecture	3	EE 223 Electrical Circuits Lecture*	3
EE 222 Intro. to EE Lab	1	EE 224 Electrical Circuits Lab*	1
CPE 271 Intro. Digital Logic Design	3	EE 251 Digital Electronics*	3
CPE 272 Intro. Digital Logic Design Lab	1	EE 252 Digital Electronics Lab*	1
MATH 251 Multivariable Calculus	4	CS 110 Intro to Computer Science+	4
PHYS 112 Gen. Physics II	4	MATH 261 Elem. Diff. Equations	4
		ENGL 102 Comp. and Rhetoric	3
	16		19

<b>1<sup>st</sup> Semester Jr.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Jr.</b>	<b>HRS</b>
EE 327 Signals & Systems I*	3	EE 329 Signals & Systems II*	3
EE 335 Electromech Enrgy Conv & Sys*	3	EE 328 Signals & Systems Lab*	1
EE 336 Elecmech Enrgy Conv & Sys Lab*	1	CPE 310 Microprocessor Systems Lec.	3
EE 345 Engineering Electromagnetics*	3	CPE 311 Microprocessor Lab	1
EE 355 Analog Electronics Lecture*	3	Math/Science Elective	3
EE 356 Analog Electronics Lab*	1	Engineering. Science Elective	3
STAT 215 Intro. Probability & Statistics	3	ECON 201 Microeconomics	3
	17		17

<b>1<sup>st</sup> Semester Sr.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Sr.</b>	<b>HRS</b>
EE 480 Senior Design Semester	2	EE 481 Senior Design Project	3
Technical Elective	3	Technical Elective	3
Technical Elective	3	Technical Elective	3
GEC Elective	3	Technical Elective	3
ECON 202 Macroeconomics	3	GEC Elective	3
	14		15

+ - For students who first entered CEMR in fall 2006 or after.

Total Hours = 132

\*Courses shown above are taught only once per year, in the semester shown.

#### **A. General Education Curriculum (GEC) Requirements**

Students who enrolled at WVU beginning in the Fall 2005 term or after are required to fulfill General Education Curriculum (GEC) requirements. Appropriate courses must be completed to satisfy nine learning outcomes, four of which are automatically fulfilled by required courses. Students choose 15 hours of elective credit in outcomes 3,5,6,7, and 9. For complete details, see [http://registrar.wvu.edu/current\\_students/general\\_education\\_curriculum](http://registrar.wvu.edu/current_students/general_education_curriculum) or the rules stated in Section X.

## B. Engineering Science Elective

The Engineering Science Elective (ESE) for Electrical Engineering majors should be chosen from the following:

MAE 241	Statics	CE 443	Environmental Science & Technology
MAE 320	Thermodynamics	IENG 316	Industrial Quality Control
CHE 201	Material & Energy Balance	IENG 377	Engineering Economy
CHE 366	Engineering, Materials Science		

## C. Mathematics/Science Elective

The Math/Science Elective should be chosen from the following list. All prerequisites must be observed.

ASTR 355	Intermediate Astronomy	PHYS 211	Intro. to Mathematical Physics
BIOL 115	Principles of Biology	PHYS 314	Intro. to Modern Physics
CHEM 116	Fundamentals of Chemistry II	PHYS 321	Optics
MATH 343	Introduction to Linear Algebra	PHYS 331	Theoretical Mechanics
MATH 375	Applied Modern Algebra	PSIO 241	Elementary Physiology
MATH 367	Applied Mathematical Analysis	PSIO 441	Mechanisms of Body Function
MATH 420	Numerical Analysis I	STAT 312	Intermediate Statistical Methods
MATH 441	Applied Linear Algebra	STAT 331	Sampling Methods
MATH 455	Advanced Real Calculus	STAT 461	Theory of Probability
MATH 456	Complex Variables		
MATH 465	Partial Differential Equations		

## D. Technical Electives

Five technical electives are required for a total of 15 credit hours. At least three of these must come from one of the emphasis areas described below. Two additional technical electives may be selected from any upper division LCSEE course, or any permanently numbered upper division engineering, science, statistics, or math course. Non-LCSEE courses numbered 493x or designated "Special Topics" must receive prior approval by the Curriculum Committee to be counted as technical electives.

## E. Emphasis Areas

Each student must have an emphasis area from the list below. Students should check with instructors of the newly developed courses that are being offered under EE/CpE/CS 493 to determine their emphasis areas. Students should also be certain that this information is being recorded in their advising file. Note that there are restrictions on the undergraduate enrollment in 500-level courses. All prerequisites must be observed.

**1. Power Systems:** The cost and reliability of electricity plays a critical role in the quality of life and price of all manufactured goods. Advances in power electronics devices and computers are improving the efficiency of electromechanical devices. Electric deregulation in many states is offering retail customers an opportunity to select their electricity supplier and reduce cost. Improvements in technologies such as fuel cells, micro-turbines, wind turbines and photovoltaic systems offer new choices for power generation. Siting of distributed generation sources near the loads and operation of power system under deregulation offer new challenges for power engineers.

*Choose 9 hours according to the following provisions:*

Core Course: Must take the following

EE 435 Introduction to Power Electronics

Choose one from the following list

EE 431 Electrical Power Distribution Systems

EE 436 Power Systems Analysis

Choose one from the following list

EE 411 Control Fundamentals

EE413 Intro to Digital Control EE

EE 431 Electrical Power Distribution Systems

EE 436 Power Systems Analysis

EE 461 Introduction to Communications Systems

CS 453 Data & Computer Communications

CS 465 Intro to Computer Security

**2. Control Systems:** Control theory is fundamental to any system that is required to behave in a desired manner. Such systems include all engineering systems such as mechanical, chemical, electrical and computer systems as well as many other dynamical systems such as economic markets. Control theory therefore has a broad range of applications. This track interests those students who wish to apply technology to control dynamical systems. Signals from sensors, usually processed by a computer, are necessary for proper control of a system. Consequently, the student interested in the control systems track will take a course in digital control and at least two additional courses in control systems, digital signal processing and/or applications such as control of power systems. Additional courses that are useful are mathematical courses such as linear algebra and complex variable analysis.

*Choose 9 hours according to the following provisions:*

Core Courses: Must take at least one of the following

EE 413 Introduction to Digital Control

EE 411 Control Fundamentals

Must take one from the following list

EE 435 Introduction to Power Electronics

EE 463 Digital Signal Processing

EE 461 Introduction to Communications Systems

**3. Electronics:** Electronics spans a number of large technical specialties within CSEE. A solid understanding of device operation and their limitations is key to good electronic design, be it the design of individual devices or the design of complex electronic systems. Several programming tools will be introduced to the students during their training in this emphasis area to support the development of this understanding. In the core course required in this emphasis area, the students will model devices using pSpice and layout electronic circuits using VLSI design rules. Additional electronic design concepts will be introduced in the technical electives. The following areas within electronics are emphasized at WVU based upon the expertise of the CSEE faculty members - electronic device design and fabrication, analog electronic circuit design and applications, and optical device design and applications.

*Choose 9 hours according to the following provisions:*

Core Course: Must take the following

EE 450 Electronic Device Simulation and Integration

Choose any two from the following list

*For further studies in electronic device theory and fabrication*

EE 455 Introduction to Microfabrication

Phys 471 Solid State Physics

*For further studies in analog electronic circuit design and applications*

EE 435 Introduction to Power Electronics

*For further studies in optical device design and applications*

EE 457 Fundamentals of Photonics

EE 437 Fiber Optic Communications

Phys 321 Optics

*For further studies in Electromagnetics*

EE 445 Introduction to Antennas

**4. Communications and Signal Processing:** Communications and signal processing are interrelated fields that play an important role in today's information driven economy. Signal processing involves the use of programmable computer architectures to operate on physical-world signals. Signal processors are found within modern control systems, biomedical applications, and communication devices. Communications is the conveyance of information from one location to another. The capacity of a communications system is limited by the random noise in the channel. The communication channel may be a fiber optic cable, a local or wide area computer network, or the radio frequency spectrum. The following set of courses supply the student with a depth of understanding in the field of communications and signal processing.

## Communications and Signal Processing, cont'd:

*Choose 9 hours according to the following provisions:*

Core Courses: Must take at least one of the following

EE 437	Fiber Optic Communications	EE 463	Digital Signal Processing Fundamentals
EE 461	Introduction to Communication Systems		

Choose at least one from the following list

EE 411	Fundamentals of Control Systems	BIOM 426	Biometrics
EE 413	Intro to Digital Control	CpE 442	Intro to Digital Computer Architecture
EE 445	Intro to Antennas	CpE 462	Wireless Networking
EE 465	Intro to Digital Image Processing	CpE 560	Introduction to Information Systems
EE 467	Digital Speech Processing	CS 453	Data and Computer Communications

**5. Bioengineering and Biometrics:** Bioengineering is the multidisciplinary application of engineering to medicine and biology, including such areas as biomedical signal and image processing, medical informatics, and biomedical instrumentation. Bioengineering work can include the development of new technologies for use in medicine and biology or the use of engineering techniques to study issues in biology and medicine. Biometrics is a specific area of bioengineering in which biological signatures (fingerprint, voice, face, DNA) are used for identification or authentication in criminal justice, e-commerce, and medical applications. Specific LCSEE projects in these areas include signal processing for prediction of sudden cardiac death in an animal model of heart failure, development of algorithms for arrhythmia detection in implanted medical devices, telemedicine for rural health care delivery in West Virginia, analysis of temporal fingerprint images for determination of vitality, CMOS fingerprint sensor design and modeling, neural net fingerprint matching, and 3-D cranofacial reconstruction. At the undergraduate level, these projects impact courses and create opportunities for senior design projects and undergraduate research experiences.

*Choose 9 hours according to the following provisions:*

Core Course: Must take the following

EE 425	Bioengineering
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Choose two courses from the following list

BIOM 426	Biometrics	EE 465	Image Processing
EE 463	Digital Signal Processing		

**or**

Choose one from the above list and take one of the following

BIOC 531	General Biochemistry	PSIO 241*	Elementary Physiology
CHEM 231	Organic Chemistry: A Brief Course	PSIO 441*	Mechanisms of Body Function
CHEM 233	Organic Chemistry I		
CHEM 234	Organic Chemistry II		

\* Students may take one or the other, but not both of these courses

**6. Computers:** Computers have become an important part of the technology used by engineers and a very important part of many technological systems and products. The computer emphasis area is designed to provide an electrical engineer with the basic understanding of how to use computers and microprocessors. When this track is completed, the electrical engineer should be able to develop, program, and use systems with embedded microcomputers.

Core Courses: choose three from the following list:

CpE 312/313*	Structures and Interfacing	CS 465	Intro to Computer Security
CpE 442	Intro to Computer Architecture	CpE 435	Computer Incident Response
CS 453	Data Computer Communications	CpE 484	Real-Time Systems Development

\*CpE 312/313 may not be counted as a Technical Elective by CpE majors.

### III. CURRICULUM FOR BACHELOR OF SCIENCE IN COMPUTER ENGINEERING, BSCpE (3020)

The objective of the bachelor's degree program in computer engineering (CpE) at West Virginia University is to produce graduates who have the knowledge, skills, and attitudes that will ensure success in professional positions in business, industry, research, governmental service, or graduate study or professional school. We carry out that 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 at an advanced level, 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 ABET, the international engineering accrediting organization.

**It is our goal that by the time they graduate, CpE students will achieve the following learning outcomes:**

- CpE-a:** Have the ability to apply knowledge of math, science, and engineering.
- CpE-b1:** Have the ability to design and conduct experiments on both hardware and software.
- CpE-b2:** Have the ability to analyze and interpret data.
- CpE-c:** Have the ability to design a system, component, or process to meet desired needs, including planning, specification, detail design, implementation, and evaluation to meet most of the following considerations: cost, environment, performance, safety, and quality requirements
- CpE-d:** Have the ability to function on multi-disciplinary teams.
- CpE-e:** Have the ability to identify, formulate, and solve a range of computer engineering problems.
- CpE-f:** Have an understanding of professional and ethical responsibility.
- CpE-g1:** Have the ability to communicate effectively, to convey technical material through formal written papers/reports which satisfy accepted standards for writing style
- CpE-g2:** Have the ability to convey technical material through oral presentation and interaction with an audience
- CpE-h:** Have a broad education necessary to understand the impact of engineering solutions in a global and societal context
- CpE-i:** Have recognition of the need for, and ability to engage in, life-long learning
- CpE-j:** Have knowledge of contemporary issues.
- CpE-k:** Have the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- CpE-1:** Have knowledge of the breadth and depth across the range of computer engineering topics, including computer-based tools for analysis and design.
- CpE-2:** 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.
- CpE-3:** Have knowledge of probability and statistics.
- CpE-4:** Have knowledge of discrete mathematics.

At least once per semester, students should consult with their advisors to insure that they meet the degree requirements in a timely manner. It is important for students to take the courses in the order specified; all pre-requisites and co-requisites must be observed. To be eligible for graduation with a BSCpE, students must attain a grade-point-average (GPA) of 2.0 or better for all required departmental courses, as well as a cumulative 2.0 GPA. 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 GPA.

1 <sup>st</sup> Semester Fresh.	HRS	2 <sup>nd</sup> Semester Fresh.	HRS
ENGR 101 Engr. Problem Solving 1	2	ENGR 102 Engr. Problem Solving 2	3
ENGR 199 Engineering Orientation	1	PHYS 111 General Physics I	4
ENGL 101 Composition and Rhetoric	3	GEC Elective	3
CHEM 115 Fundamentals of Chemistry I	4	GEC Elective	3
GEC Elective	3	MATH 156 Calculus II	4
MATH 155 Calculus I	4		
	17		17



<b>1<sup>st</sup> Semester Soph.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Soph.</b>	<b>HRS</b>
EE 221 Intro. to EE Lecture	3	EE 223 Electrical Circuits Lecture*	3
EE 222 Intro. to EE Lab	1	EE 224 Electrical Circuits Lab*	1
CPE 271 Intro. Digital Logic Design	3	EE 251 Digital Electronics*	3
CPE 272 Intro. Digital Logic Design Lab	1	EE 252 Digital Electronics Lab*	1
MATH 251 Multivariable Calculus	4	CS 110 Intro. to Computer Science	4
PHYS 112 Gen. Physics II	4	MATH 261 Elem. Diff. Equations	4
		ENGL 102 Composition and Rhetoric	3
	16		19

<b>1<sup>st</sup> Semester Jr.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Jr.</b>	<b>HRS</b>
CPE 310 Microprocessor Systems Lecture	3	CpE 312 Microcomp. Struc. & Interfac.*	3
CPE 311 Microprocessor Lab	1	CpE 313 Microcomp. Struc. & Inter.Lab*	1
EE 327 Signals & Systems 1*	3	CS 230 Intro to Software Engineering	4
EE 355 Analog Electronics Lecture*	3	CS 350 Computer Systems Concepts	3
EE 356 Analog Electronics Lab*	1	ECON 201 Microeconomics	3
CS 111 Intro to Data Structures	4	STAT 215 Intro. Prob. & Stat.	3
Math 375 Applied Modern Algebra	3		
	18		17

<b>1<sup>st</sup> Semester Sr.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Sr.</b>	<b>HRS</b>
CpE 480 Senior Design Seminar	2	CpE 481 Senior Design Project	3
CS 450 Operating Systems Structures	3	Technical Elective	3
CpE 4xx Technical Elective	3	Engr. Science Elective	3
ECON 202 Macroeconomics	3	GEC Elective	3
GEC Elective	3		
	14		12

TOTAL HOURS = 130

\* Courses shown above are taught only once per year, in the semester shown.

#### **A. General Education Curriculum (GEC) Requirements**

Students who enrolled at WVU beginning in the Fall 2005 term or after are required to fulfill General Education Curriculum (GEC) requirements. Appropriate courses must be completed to satisfy nine learning outcomes, four of which are automatically fulfilled by required courses. Students choose 15 hours of elective credit in outcomes 3,5,6,7, and 9. For complete details, see [http://registrar.wvu.edu/current\\_students/general\\_education\\_curriculum](http://registrar.wvu.edu/current_students/general_education_curriculum) or the rules stated in Section X.

## **B. Engineering Science Elective**

The Engineering Science Elective (ESE) for Computer Engineering majors should be chosen from the following list:

MAE 241	Statics
MAE 320	Thermodynamics
IENG 377	Engineering Economy
CHE 201	Material & Energy Balances 1.
CHE 366	Engineering. Materials Science

## **C. Technical Electives**

Two technical electives for a total of 6 credit hours are required. One must be a 400-level course in Computer Engineering. The other must be selected from any upper division LCSEE course. All prerequisites must be observed.

**IV. CURRICULUM FOR A BACHELOR OF SCIENCE IN ELECTRICAL/COMPUTER ENGINEERING,  
BSEE/CpE (3025/3020, Dual Major)**

Students who wish may pursue both the BSEE degree and the BSCpE degree simultaneously. This can be accomplished by declaring your intentions to your advisor (normally by the middle of your sophomore year) and taking all classes necessary to complete the joint requirements for both degrees. Any student pursuing both degrees must be officially listed as primary CpE and secondary EE.

<b>1<sup>st</sup> Semester Fresh.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Fresh.</b>	<b>HRS</b>
ENGR 101 Engr. Problem Solving 1	2	ENGR 102 Engr. Problem Solving 2	3
ENGR 199 Engineering Orientation	1	PHYS 111 Gen. Physics I	4
ENGL 101 Comp. And Rhetoric	3	GEC Elective	3
CHEM 115 Fund. of Chemistry. I	4	GEC Elective	3
GEC Elective	3	MATH 156 Calculus	4
MATH 155 Calculus	4		
	17		17

<b>1<sup>st</sup> Semester Soph.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Soph.</b>	<b>HRS</b>
EE 221 Intro. to EE Lecture	3	EE 223 Electrical Circuits Lecture*	3
EE 222 Intro. to EE Lab	1	EE 224 Electrical Circuits Lab*	1
CPE 271 Intro. Digital Logic Design	3	EE 251 Digital Electronics *	3
CPE 272 Intro. Digital Logic Design Lab	1	EE 252 Digital Electronics Lab *	1
MATH 251 Multivariable Calculus	4	CS 110 Intro. to Computer Science	4
PHYS 112 Gen. Physics II	4	MATH 261 Elem. Diff. Equations	4
Free Elective ***	3	ENGL 102 Comp. And Rhetoric	3
	19		19

<b>1<sup>st</sup> Semester Jr.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Jr.</b>	<b>HRS</b>
EE 327 Signals & Systems I*	3	CpE 312 Microcomp. Struc. & Interfac.*	3
CPE 310 Microprocessor Systems Lecture	3	CpE 313 Microcomp. Struc. & Inter.Lab*	1
CPE 311 Microprocessor Lab	1	CS 230 Intro. to Software Engineering	4
CS 111 Introduction to Data Structures	4	CS 350 Computer Systems Concepts	3
Math 375 Applied Modern Algebra	3	EE 329 Signals & Systems II *	3
STAT 215 Intro. Probability & Statistics	3	EE 328 Signals & Systems Lab*	1
		ECON 201 Principles of Microeconomics	3
	17		18

1 <sup>st</sup> Semester Sr.	HRS	2 <sup>nd</sup> Semester Sr.	HRS
EE 335 Electromech Energy Conv & Sys*	3	CpE 480 Senior Design Seminar	2
EE 336 Elecmech Enrgy Conv & Sys Lab*	1	Technical Elective	3
EE 345 Engineering Electromagnetics*	3	Technical Elective	3
EE 355 Analog Electronics Lecture*	3	Engr. Science Elective	3
EE 356 Analog Electronics Lab*	1	Economics 202 Macroeconomics	3
CS 450 Operating Systems Structures	3	GEC Elective	3
CpE 4xx Technical Elective	3		
	17		17

3 <sup>rd</sup> . Semester Sr.	HRS
CpE 481 Senior Design Project	3
Technical Elective	3
Technical Elective	3
GEC Elective	3
Free Elective	3
Free Elective ***	2
	17

TOTAL HOURS = 158

\* Courses shown above are taught only once per year, in the semester shown

\*\* CpE students may wish to schedule CS 110 and CS 111 in the FIRST year and move tGEC electives to the later years.

\*\*\* Any University scheduled course(s)

#### A. General Education (GEC) Requirements

Students who enrolled at WVU beginning in the Fall 2005 term or after are required to fulfill General Education Curriculum (GEC) requirements. Appropriate courses must be completed to satisfy nine learning outcomes, four of which are automatically fulfilled by required courses. Students choose 15 hours of elective credit in outcomes 3,5,6,7, and 9. For complete details, see [http://registrar.wvu.edu/current\\_students/general\\_education\\_curriculum](http://registrar.wvu.edu/current_students/general_education_curriculum), or the rules stated in Section X.

#### B. Technical Electives

Five technical electives are required. Three must fulfill one of the EE emphasis areas other than computers. One additional TE must be a 400-level Computer Engineering course, and one TE may be selected from any upper division LCSEE course, or any permanently numbered upper division engineering, science, or math course. Non-LCSEE courses numbered 493x or designated "Special Topics" must receive prior approval by the Curriculum Committee to be counted as technical electives. All prerequisites must be observed.

**V. CURRICULUM FOR BACHELOR OF SCIENCE IN BIOMETRIC SYSTEMS, BSBS (3088)**

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 of the program number 133.

Four courses or 12 credits are devoted to the emphasis areas selected by individual students based upon their educational objectives. Six of the 24 four credit hours required to satisfy the university cluster requirements have been devoted to economics in order that students may develop an understanding of system engineering economics.

It is our objective that all graduates with a BS in Biometric Systems will have a technical understanding of the design, operation and application of biometric systems.

**It is our goal that by the time they graduate, Biometric Systems students will achieve the following learning outcomes:**

- Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
- Understand and analyze biometric systems at the component level and be able to analyze and design basic biometric system applications.
- Be able to work effectively in teams and express their work and ideas orally and in writing.
- Identify the sociological and acceptance issues associated with the design and implementation of biometric systems

<b>1<sup>st</sup> Semester Fresh.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Fresh.</b>	<b>HRS</b>
ENGR 101 Freshman Engr. Design	2	ENGR 102 Engr. Problem Solving 2***	3
ENGR 199 Engineering Orientation	1	CS 110 Intro to Computer Science	4
ENGL 101 Composition and Rhetoric	3	CHEM 115 Fundamentals. Of Chemistry	4
BIOL 115 Intro to Biology*	4	PHYS 111 General Physics I	4
MATH 155 Calculus I	4	MATH 156 Calculus II	4
GEC Elective	3		
	17		19

<b>1<sup>st</sup> Semester Soph.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Soph.</b>	<b>HRS</b>
CS 111 Intro to Data Structures	4	EE 223 Electrical Circuits Lecture*	3
EE 221 Intro to Electrical Engineering	3	EE 224 Electrical Circuits Lab*	1
EE 222 Intro to Electrical Engineering Lab	1	CpE 271 Intro to Digital Logic Design	3
MATH 251 Multivariable Calculus	4	CpE 272 Intro to Dig. Logic Design Lab	1
PHYS 112 General Physics II	4	ENGL 102 Composition and Rhetoric 2	3
		MATH 261 Elem. Diff. Equations	4
		STAT 215 Probability & Statistics	3
	16		18

1 <sup>st</sup> Semester Jr.	HRS	2 <sup>nd</sup> Semester Jr.	HRS
BIOM 426 Biometric Systems*	3	EE 465 Intro to Dig. Image Processing*	3
CPE 310 Microprocessor Systems	3	BIOL 324 Molecular Genetics* <sup>1</sup>	3
CPE 311 Microprocessor Lab	1	MATH 375 Discrete Math	3
CS 350 Computer Systems Concepts	3	Emphasis Course 1 **	3
EE 327 Signals & Systems 1*	3	Emphasis Course 2 **	3
STAT 316 Forensic Statistics*	3	Assigned GEC <sup>2</sup>	3
	16		18

<sup>2</sup> - Choose from POLS 210, PSYC 101, SOCA 101, or SOCA 232

1 <sup>st</sup> Semester Sr.	HRS	2 <sup>nd</sup> Semester Sr.	HRS
BIOM 480 Senior Design Seminar	2	BIOM 481 Senior Design Project	3
EE 425 Bioengineering*	3	Emphasis Course 3**	3
CS 465 Intro to Computer Security*	3	ECON 202 Macroeconomics	3
ECON 201 Microeconomics	3	GEC Elective	3
GEC Elective	3		
GEC Elective	3		
	17		12

Total Hours = 130

\* Courses shown above are taught only once per year, in the semester shown

\*\* Courses are chosen according to guidelines inset forth in section B below

\*\*\* Pending final approval

#### A. General Education Curriculum (GEC) Requirements

Students who enrolled at WVU beginning in the Fall 2005 term or after are required to fulfill General Education Curriculum (GEC) requirements. Appropriate courses must be completed to satisfy nine learning outcomes, four of which are automatically fulfilled by required courses. Students choose 15 hours of elective credit in outcomes 3,5,6,7, and 9. For complete details, see [http://registrar.wvu.edu/current\\_students/general\\_education\\_curriculum](http://registrar.wvu.edu/current_students/general_education_curriculum) or the rules stated in Section X.

#### B. Areas of Emphasis

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 that is central to biometric system development. Designated areas of emphasis are Microsensors 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 three 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. The fourth course of each emphasis area is designated as a Biometrics technical elective, which may be chosen from the superset of classes collectively defined by all those of all emphasis areas. Note that there are restrictions on the undergraduate enrollment in 500-level courses. All prerequisites must be observed.

**1. Emphasis in Sensors and Circuits:** Three emphasis area courses are to be chosen from the following list. One of these courses is a required course and the other two courses are electives.

<i>Required Course:</i>	EE 251/252	Digital Electronics and Lab (4 hrs)
<i>Area Technical Electives:</i>	Physics 314	Modern Physics (3 hrs)
	Physics 321	Optics (3 hrs)
	EE 355/356	Analog Electronics and Lab (4 hrs)
	EE 450	Electronic Devices (3 hrs)
	EE 455	Microfabrication (3 hrs)

**2. Emphasis in Signal Processing** Three emphasis area courses are to be chosen from the following list. Two of these courses are required courses and the other course is an elective.

<i>Required Courses:</i>	EE 251/252	Digital Electronics and Lab (4 hrs)
	EE 329/328	Signals and Systems II and Lab (4 hrs)
<i>Area Technical Electives:</i>	EE 463	Digital Signal Processing (3 hrs)
	EE 565	Advanced Image Processing (3 hrs)
	CS 453	Data and Computer Communications (3 hrs)

**3. Emphasis in Statistics:** The Biometrics Systems Major will meet the requirements for the Statistics Area of Emphasis if one of the following options is successfully completed.

Applied Option: Emphasis area course and a technical electives are to be chosen from the following list.

<i>Must take the following:</i>	Stat 312	Intermediate Statistics Methods (3 hrs)
<i>Choose two additional technical electives:</i>	Stat 313	Introductory Design and Analysis (3 hrs)
	Stat 331	Sampling Methods (3 hrs)
	Stat 421	Statistical Analysis Systems (3 hrs)

Theory Option: Emphasis area courses requirements are listed below.

<i>Must take the following:</i>	Stat 312	Intermediate Statistics Methods (3 hrs)
	Stat 461	Theory of Probability (3 hrs)
	Stat 462	Theory of Statistics (3 hrs)

**4. Emphasis in Software Systems:** The Biometrics Systems Major will meet the requirements for the Software Systems Area of Emphasis by completion of three emphasis area courses as outlined below

<i>Must take the following:</i>	CS 230	Intro Software Engineering (4 hrs)
	or CpE 484	Real-Time Systems Development (3 hrs)
<i>Choose one additional emphasis course and one technical elective</i>	CS 450	Operating Systems Structures (3 hrs)
	CS 453	Data Communications and Networks (3 hrs)
	CS 430	Advanced Software Engineering (3 hrs)
	CS 472	Intro to Artificial Intelligence (3 hrs)
	CpE 442 or CS 455	Computer Architecture (3 hrs)

**VI. SUGGESTED CURRICULUM IN BIOMETRIC SYSTEMS/COMPUTER ENGINEERING, BSBS/CpE (3088/3020, Dual Major)**

<b>1<sup>st</sup> Semester Fresh.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Fresh.</b>	<b>HRS</b>
ENGR 101 Freshman Engr. Design	2	ENGR 102 Fresh Engr Des & Analysis	3
ENGR 199 Engineering Orientation	1	CHEM 115 Fundamentals of Chemistry	4
BIOL 115 Introduction to Biology*	4	MATH 156 Calculus II	4
MATH 155 Calculus I	4	PHYS 111 General Physics I	4
ENGL 101 Composition and Rhetoric	3	GEC Elective	3
GEC Elective	3		
	17		18

<b>1<sup>st</sup> Semester Soph.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Soph.</b>	<b>HRS</b>
EE 221 Intro. to Electrical Engineering	3	EE 223 Electrical Circuits Lecture*	3
EE 222 Intro. To Electrical Engr Lab	1	EE 224 Electrical Circuits Lab*	1
CPE 271 Intro. Digital Logic Design	3	EE 251 Digital Electronics Lecture*	3
CPE 272 Intro to Digital Logic Design Lab	1	EE 252 Digital Electronics Lab*	1
MATH 251 Multivariable Calculus	4	MATH 261 Elem. Diff. Equations	4
PHYS 112 General Physics II	4	STAT 215 Probability & Statistics	3
ENGL 102 Composition and Rhetoric II	3	CS 110 Intro to Computer Science	4
	19		19

<b>1<sup>st</sup> Semester Jr.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Jr.</b>	<b>HRS</b>
EE 327 Signals & Systems I*	3	EE 465 Digital Image Processing	3
CPE 310 Microprocessor Systems	3	Engineering Science Elective	3
CPE 311 Microprocessor Systems Lab	1	CS 230 Intro to Software Engr (Emph 1)	4
EE 355 Analog Electronics*	3	BIOL 324 Molecular Genetics *	3
EE 356 Analog Electronics Laboratory*	1	GEC Elective	3
STAT 316 Forensic Statistics*	3		
CS 111 Intro to Data Structures	4		
	18		16



<b>1<sup>st</sup> Semester Sr.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Sr.</b>	<b>HRS</b>
MATH 375 Applied Modern Algebra	3	BIOM 480 Senior Design Seminar	2
CS 350 Computer Systems Concepts	3	CS 450 Operating Sys. Struct (Emph 2)	3
BIOM 426 Biom Sys*/Tech Elective	3	CPE 312 Microcomp. Struc. & Interfac.*	3
EE 425 Bioengineering*	3	CPE 313 Microcomp. Struc. & Inter Lab*	1
Assigned GEC <sup>2</sup>	3	ECON 201 Microeconomics	3
GEC Elective	3	Free Elective	3
		Free Elective	3
	18		18

<sup>2</sup>- Choose from POLS 210, PSYC 101, SOCA 101, or SOCA 232

<b>3rd Semester Sr.</b>	<b>HRS</b>
BIOM 481 Senior Design Project	3
Emphasis Course 3 <sup>3</sup>	3
CpE Technical Elective <sup>3</sup>	3
CS 465 Computer Security*	3
ECON 202 Macroeconomics	3
	15

<sup>3</sup>- The CpE TE and Emphasis Course 3 may be combined under the Software emphasis area. If this option is exercised, an additional technical elective must be selected.

Total Hours = 158

Five technical electives are required. Three must fulfill one of the Biometric Systems emphasis areas. One additional TE must be a 400-level Computer Engineering course, and one TE may be selected from any upper division LCSEE course. All prerequisites must be observed.

Biometrics Emphasis Courses and CpE Technical Electives may overlap in some instances. It is recommended that students consult closely with their academic advisor to insure that all requirements are met in a timely manner. Failure to plan ahead may cause delays in graduation.

\*-Courses shown above are taught only once per year, in the semester shown.

\*\* -Credit hours may vary based on student's choice of technical electives and emphasis courses. A minimum of 158 credit hours are required for dual degree graduation.

**VII. SUGGESTED CURRICULUM IN BIOMETRIC SYSTEMS/ELECTRICAL ENGINEERING, BSBS/EE (3088/3025, Dual Major)**

<b>1<sup>st</sup> Semester Fresh.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Fresh.</b>	<b>HRS</b>
ENGR 101 Freshman Engr. Design	2	ENGR 102 Fresh Engr Des & Analysis	3
ENGR 199 Engineering Orientation	1	CHEM 115 Fundamentals of Chemistry	4
BIOL 115 Introduction to Biology*	4	MATH 156 Calculus II	4
MATH 155 Calculus I	4	PHYS 111 General Physics I	4
ENGL 101 Composition and Rhetoric	3	GEC Elective	3
GEC Elective	3		
	17		18

<b>1<sup>st</sup> Semester Soph.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Soph.</b>	<b>HRS</b>
EE 221 Intro. to Electrical Engr	3	EE 223 Electrical Circuits Lecture*	3
EE 222 Intro. To Electrical Engr Lab	1	EE 224 Electrical Circuits Lab*	1
CPE 271 Intro. Digital Logic Design	3	EE 251 Digital Electronics Lecture*	3
CPE 272 Intro to Digital Logic Design Lab	1	EE 252 Digital Electronics Lab*	1
MATH 251 Multivariable Calculus	4	MATH 261 Elem. Diff. Equations	4
PHYS 112 General Physics II	4	STAT 215 Probability & Statistics	3
ENGL 102 Composition and Rhetoric II	3	CS 110 Intro to Computer Science	4
	19		19

<b>1<sup>st</sup> Semester Jr.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Jr.</b>	<b>HRS</b>
EE 327 Signals & Systems I*	3	Engineering Science Elective	3
CPE 310 Microprocessor Systems	3	MATH 375 Discrete Math	3
CPE 311 Microprocessor Systems Lab	1	EE 329 Signals and Systems II*	3
EE 355 Analog Electronics*	3	EE 328 Signals and Systems Lab*	1
EE 356 Analog Electronics Laboratory*	1	CS 350 Computer System Concepts	3
STAT 316 Forensic Statistics/EE TE*	3	BIOL 324 Molecular Genetics*	3
CS 111 Intro to Data Structures	4		
	18		16

<b>1<sup>st</sup> Semester Sr.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Sr.</b>	<b>HRS</b>
EE 335 Electromechanical Energy Systems	3	EE 465 Image Processing/EE TE*	3
EE 336 Electromechanical Lab	1	BIOM 480 Senior Design Project	2
EE 345 Engineering Electromagnetics*	3	Assigned GEC <sup>2</sup>	3
EE 425 Bioengineering/EE TE*	3	Biometrics Emphasis Course 1/EE TE	3
BIOM 426 Biometric Systems/EE TE*	3	ECON 201 Economics I	3
GEC Elective	3	GEC Elective	3
	16		17

<sup>2</sup> -Choose from POLS 210, PSYC 101, SOCA 101, or SOCA 232

<b>3rd Semester Sr.</b>	<b>HRS</b>
BIOM 481 Senior Design Project	3
CS 465 Intro to Computer Security/EE TE*	3
Biometrics Emphasis Course 2	3
Biometrics Emphasis Course 3	3
Free Elective	3
ECON 202	3
	18

Total Hours = 158\*\*

Five technical electives are required. Three must fulfill one of the EE emphasis areas, and three must fulfill one of the Biometric Systems emphasis areas. These areas may overlap, and in that instance students must select additional technical electives from any upper division LCSEE course, or any permanently numbered upper division engineering, science, or math course. Non-LCSEE courses numbered 493x or designated "Special Topics" must receive prior approval by the Curriculum Committee to be counted as technical electives. All prerequisites must be observed.

Biometrics Emphasis Courses and EE Technical Electives may overlap in some instances. It is recommended that students consult closely with their academic advisor to insure that all requirements are met in a timely manor. Failure to plan ahead may cause delays in graduation.

\* -Courses shown above are taught only once per year, in the semester shown.

\*\* -Credit hours may vary based on student's choice of technical electives and emphasis courses. A minimum of 158 credit hours are required for dual degree graduation.

## VIII. SUGGESTED CURRICULA FOR A BACHELOR OF SCIENCE IN COMPUTER SCIENCE (BSCS)

The mission of the BS Computer Science degree program is to prepare students for professional positions in business, industry, research, government service, or graduate study in computer science as well as professional schools. Graduates will also gain knowledge and skills to ensure initial employment in a variety of computing-related fields, to adapt to fast technology changes, and be prepared for a career and lifelong learning.

It is our goal that by the time they graduate, CS students will achieve the following learning outcomes:

- A. Be exposed to a variety of programming languages and systems, and will be proficient in programming in at least two languages.
- B. Have the knowledge of the basic principles and methods of programming language translation.
- C. Have knowledge of the basic principles of data structures, discrete mathematics and algorithms, and be able to apply this knowledge to problem solving in relevant application areas.
- D. Be familiar with principles of computer organization, operating systems, and networks.
- E. Have the knowledge of software engineering principles and be able to design, implement and analyze moderately complex and robust systems.
- F. Have the knowledge of the basic principles of digital logic design.
- G. Be able to communicate ideas effectively: g1) in writing, g2) verbally, and g3) work and learn effectively as members of a team.
- H. Have knowledge of and a commitment to the social and ethical responsibilities of computing professionals.
- I. Have experienced a well-rounded education in areas outside of the computer science major, with emphasis on the arts, sciences, and humanities
- J. Be familiar with laboratory procedures and use of the scientific method in at least two different physical or biological sciences.
- K. Be familiar with *advanced* concepts of several specialized computer science areas.
- L. Have the knowledge of mathematics through differential and integral calculus, discrete mathematics and probability and statistics.

**The Lane Department of Computer Science and Electrical Engineering offers two tracks leading to a Bachelor of Science degree in Computer Science.** One track is offered through the Eberly College of Arts and Sciences (ECAS) and the other is offered through the College of Engineering and Mineral Resources (CEMR). Each of track provides a thorough education in the core areas of computer science, but there are differences in emphasis, shown especially by the choice of non-major requirements.

- If you are admitted to the Eberly College with major code 1434, you are in the Pre-Computer Science major, prepared to begin the BSCS, Arts & Sciences track.

The Arts & Sciences track combines the core major subjects with a more flexible liberal arts education. This track places a somewhat stronger emphasis on the theoretical foundations of computer science. Because it meets Eberly College requirements, it is easier to combine this BSCS track with a second major in the Eberly College.

- If you are admitted to the College of Engineering and Mineral Resources, with a major code of 3034, you are in the Pre-Computer Science major, prepared to begin the BSCS, Engineering track.

The CEMR track combines core major subjects with a stronger background in Computer Engineering and the physical sciences most relevant to engineering disciplines. This track is more closely matched to the Computer Engineering degree program, making it possible for students to obtain a dual BSCS/CpE degree (see section IX.) with only about one extra semester of study. Because the CEMR track meets core engineering requirements, a dual degree with other engineering disciplines is also easier.

**A. BSCS, Eberly College of Arts and Sciences Track (1434/1483)**

The required curriculum for the degree of Bachelor of Science in Computer Science in the Eberly College of Arts and Sciences is given below in a recommended four-year sequence. Your academic advisor must approve all electives. A total of 128 credit hours are required to complete the program.

<b>1<sup>st</sup> Semester Freshman</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Freshman</b>	<b>HRS</b>
CS 110 Intro to Computer Science	4	CS 111 Intro to Data Structures	4
MATH 155 Calculus I	4	MATH 156 Calculus II	4
ENGR 199 Orientation to Engineering	1	ENGL 101 Composition and Rhetoric	3
GEC Elective	3	GEC Elective	3
GEC Elective	3	GEC Elective	3
	15		17

<b>1<sup>st</sup> Semester Sophomore</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Sophomore</b>	<b>HRS</b>
CS 210 File Structures	4	CpE 271 Intro to Digital Logic	3
CS 220 Discrete Mathematics	3	CpE 272 Intro to Digital Logic Lab	1
ENGL 102 Composition and Rhetoric II	3	CS 221 Analysis of Algorithms	3
Lab Science, sequence 1	4	CS 230 Intro to Software Engineering	4
MATH 251 Multivariable Calculus	4	GEC Elective	3
		Lab Science, sequence 2	4
	18		18

<b>1<sup>st</sup> Semester Junior</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Junior</b>	<b>HRS</b>
CS 350 Computer System Concepts	3	CS 310 Prin of Programming Languages	3
CS 455 Computer Architecture	3	CS 450 Operating System Structure	3
CS 4xx Tech Elective, Applications group	3	CS 453 Data Computer Communication	3
STAT 215 Intro to Probability & Statistics	3	GEC Elective	3
GEC Elective	3	Lab Science 3	4
	15		16

<b>1<sup>st</sup> Semester Senior</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Senior</b>	<b>HRS</b>
CS 480 Senior Design Seminar (W)	2	CS 481 Senior Design Project	3
CS 4xx Tech Elective	3	CS 4xx Tech Elective, Theory group	3
CS 410 Compiler Construction	3	Extra GEC Elective	3
Single Discipline Elective 1	3	2xx Elective 2	3
2xx Elective 1	3	Single Discipline Elective 2	3
	14		15

**Total Hours = 128**

### 1. General Education Curriculum (GEC) Requirements

Students who enrolled at WVU beginning in the Fall 2005 term or after are required to fulfill General Education Curriculum (GEC) requirements. Appropriate courses must be completed to satisfy nine learning outcomes, two of which are automatically fulfilled by required courses. Students choose 21 hours of elective credit in outcomes 3, 4, 5, 6, 7, 8, and 9. For complete details, see [http://registrar.wvu.edu/current\\_students/general\\_education\\_curriculum](http://registrar.wvu.edu/current_students/general_education_curriculum), or the rules stated in Section X. Computer Science students are required to complete one additional 3 hour GEC elective beyond university requirements.

### 2. CS Arts & Sciences Track Required Courses

All CS students start out as Pre-CS majors. Pre-CS consists of the courses listed below, generally completed within the first three semesters of study. Each course (or transfer equivalent) must be **completed with a grade of C or better**:

- CS 110, 111, and 220
- Math 155

After satisfying pre-CS requirements, students are transferred into the CS major. The core major requirements are listed below:

- CpE 271/272
- CS 210, 221, 230, 310, 350, 450, 453, and 455
- Math 156 and 251
- Stat 215

All CS, CpE, MATH, and STAT courses required by the CS major **must be completed with a C or better**.

### 3. CS Arts & Sciences Track Electives

Arts & Sciences track students have choices of several electives, which are outlined below. Students should always consult their advisor to be certain electives will count for appropriate credit.

**Assigned Science Electives:** Arts & Sciences track students must choose one eight-hour, two-semester sequence plus an additional four hours from:

- BIOL 115 and 116
- CHEM 115 and 116, or 117 and 118
- GEOL 101/102 and 103/104
- GEOL/GEOG 110/111 and GEOL 103/104
- PHYS 111 and 112

**CS 4xx Technical Electives:** Arts & Sciences track students choose 15 hours of technical electives according to the following guidelines:

- Pick one technical elective (3 hrs) from the Applications group: CS 410, 430, 440, 470, 472
- Pick one technical elective (3 hrs) from the Theory group: CS 420, 422, 426
- Pick one technical electives (3 hrs) of CS 4xx
- CS 490, 491, 495, and 493C do not count as technical electives
- Any course used as a technical elective **must be completed with a C or better**.

**Other Electives:** Other electives must be chosen according to the following rules:

- Students must have 6 hrs in one discipline.
- Students must have 6 hrs of electives at the 200-level or higher.
- Completion of **any minor** satisfies the elective distribution requirements.
- If an elective sequence is chosen that does not total 18 hours, additional free electives must be chosen to make up the difference.

**B: BSCS College of Engineering and Mineral Resources Track (3034/3083)**

The required curriculum for the degree of Bachelor of Science in Computer Science in the College of Engineering and Mineral Resources is given below in a recommended four-year sequence. Your academic advisor must approve all electives. A total of 128 credit hours are required to complete the program.

<b>1<sup>st</sup> Semester Freshman</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Freshman</b>	<b>HRS</b>
ENGR 101 Freshman Engr. Design	2	CS 111 Intro to Data Structures	4
ENGR 199 Engineering Orientation	1	MATH 156 Calculus II	4
CS 110 Intro to Computer Science	4	PHYS 111 General Physics I	4
MATH 155 Calculus I	4	GEC Elective	3
CHEM 115 Fundamentals of Chemistry	4	GEC Elective	3
ENGL 101 Composition and Rhetoric	3		
	18		18

<b>1<sup>st</sup> Semester Sophomore</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Sophomore</b>	<b>HRS</b>
CPE 271 Intro to Digital Logic Design Lec	3	CPE 310 Microprocessor Systems	3
CPE 272 Digital Logic Design Lab	1	CPE 311 Microprocessor Systems Lab	1
PHYS 112 General Physics II	4	CS 221 Analysis of Algorithms	3
CS 210 Advanced File and Data Structures	4	CS 230 Intro. to Software Engineering	4
CS 220 Discrete Mathematics	3	ENGL 102 Composition and Rhetoric	3
		MATH 251 Multivariable Calculus	4
	15		18

<b>1<sup>st</sup> Semester Junior</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Junior</b>	<b>HRS</b>
CS 350 Computer System Concepts	3	CS 310 Principles of Pgm Languages	3
CS 4xx Technical Elective	3	CS 450 Operating System Structures	3
STAT 215 Probability and Statistics	3	CS 453 Data Computer Communicaton	3
GEC Elective	3	GEC Elective	3
GEC Elective	3	GEC Elective	3
	15		15

<b>1<sup>st</sup> Semester Senior</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Senior</b>	<b>HRS</b>
CS 480 Senior Design Project	2	CS 481 Senior Design Project	3
CS 410 Compiler Construction	3	CS 4xx Technical Elective	3
GEC Elective	3	CS 4xx Technical Elective	3
Extra GEC Elective	3	2xx Free Elective	3
2xx Free Elective	3	2xx Free Elective	3
	14		15

Total Hours = 128

### 1. General Education Curriculum (GEC) Requirements

Students who enrolled at WVU beginning in the Fall 2005 term or after are required to fulfill General Education Curriculum (GEC) requirements. Appropriate courses must be completed to satisfy nine learning outcomes, two of which are automatically fulfilled by required courses. Students choose 24 hours of elective credit; 3 hours in outcomes 3, 4, 5, 6, 7, 8, and 9, plus 3 extra hours from any outcome 3 through 9. For complete details, see [http://registrar.wvu.edu/current\\_students/general\\_education\\_curriculum](http://registrar.wvu.edu/current_students/general_education_curriculum), or the rules stated in Section X.

### 2. CS CEMR Track Required Courses

All CS students start out as Pre-CS majors. Pre-CS consists of the courses listed below, generally completed within the first three semesters of study. Each course (or transfer equivalent) must be **completed with a grade of C or better**:

- CS 110, 111, and 220
- Math 155

After satisfying pre-CS requirements, students are transferred into the CS major. The core major requirements are listed below:

- CpE 271/272 and 310/311
- CS 210, 221, 230, 310, 350, 410, 450, and 453
- Math 156 and 251
- Stat 215

All CS, CpE, MATH, and STAT courses required by the CS major **must be completed with a C or better**.

### 3. CS Engineering Track Electives

Engineering track students have choices of several electives, which are outlined below. Students should always consult their advisor to be certain electives will count for appropriate credit.

**CS 4xx Technical Electives:** Engineering track students choose 9 hours of technical electives according to the following guidelines:

- Pick three technical electives (9 hrs) of CS 4xx.
- CS 490, 491, 495, and 493C do not count as technical electives
- Any course used as a technical elective **must be completed with a C or better**.

**Other Electives:** Other electives must be chosen according to the following rules:

- Students must have 9 hrs of free electives at the 200-level or higher.
- Completion of **any minor** satisfies the elective distribution requirements.



**IX. CURRICULUM IN COMPUTER SCIENCE/COMPUTER ENGINEERING, BSCS/CpE  
(3083/3020, Dual Major).**

<b>1<sup>st</sup> Semester Fresh.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Fresh.</b>	<b>HRS</b>
ENGR 101 Freshman Engr. Design	2	CS 111 Intro to Data Structures	4
ENGR 199 Engineering Orientation	1	PHYS 111 General Physics I	4
ENGL 101 Composition and Rhetoric	3	GEC 3 Elective	3
CHEM 115 Fundamentals of Chemistry	4	MATH 156 Calculus II	4
CS 110 Intro to Computer Science	4	ENGR 102 Fresh. Engr Des. & Analysis	3
MATH 155 Calculus I	4		
	18		18

<b>1<sup>st</sup> Semester Soph.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Soph.</b>	<b>HRS</b>
CS 210 File Structures	4	CS 230 Intro to Software Engineering	4
CPE 271 Intro to Digital Logic Design Lec	3	EE 223 Electrical Circuits Lecture*	3
CPE 272 Intro to Digital Logic Design Lab	1	EE 224 Electrical Circuits Lab*	1
PHYS 112 Gen. Physics II	4	ENGL 102 Composition and Rhetoric II	3
MATH 251 Multivariable Calculus	4	MATH 261 Elem. Diff. Equations	4
EE 221 Intro to Electrical Engineering	3	EE 251 Digital Electronics*	3
EE 222 Intro to Electrical Engineering Lab	1	EE 252 Digital Electronics Lab*	1
	20		19

<b>1<sup>st</sup> Semester Jr.</b>	<b>HRS</b>	<b>2<sup>nd</sup> Semester Jr.</b>	<b>HRS</b>
CPE 310 Microprocessor Systems	3	CPE 312 Microcomp. Struc. & Interfac.*	3
CPE 311 Microprocessor Systems Lab	1	CPE 313 Microcomp. Struc. & Inter Lab*	1
EE 327 Signals & Systems I*	3	CS 350 Computer System Concepts	3
EE 355 Analog Electronics*	3	CS 221 Analysis of Algorithms	3
EE 356 Analog Electronics Lab*	1	CS 310 Prin. Of Programming Languages	3
MATH 375 Applied Modern Algebra	3	ECON 201 Microeconomics (GEC 4)	3
CS 220 Discrete Mathematics	3	GEC 5 Elective	3
	17		19

1 <sup>st</sup> Semester Sr.	HRS	2 <sup>nd</sup> Semester Sr.	HRS
CpE 4xx Technical Elective	3	CpE 480 Senior Design Seminar	2
CS 450 Operating Systems Structures	3	CS 453 Data Computer Communication*	3
CS 4xx Technical Elective	3	CS 4xx Technical Elective	3
ECON 202 Macroeconomics (GEC 8)	3	Engineering Science Elective	3
GEC 6 Elective	3	GEC 7 Elective	3
STAT 215 Probability and Statistics	3	GEC 9 Elective	3
	18		17

3rd Semester Sr.	HRS
CpE 481 Senior Design Project	3
CS 410 Compiler Construction*	3
CS 4xx Technical Elective	3
Extra GEC 3-9 Elective	3
	12

Total Hours = 158

\* Courses shown above are taught only once per year, in the semester shown.

### 1. CS/CpE Electives

Students pursuing dual CS/CpE degrees should choose electives as outlined below. Students should always consult their advisor to be certain electives will count for appropriate credit.

**CS 4xx Technical Electives:** Students must choose 9 hours according to the following guidelines:

- Pick three technical electives (9 hrs) of CS 4xx.
- CS 490, 491, 495, and 493C do not count as technical electives
- Any course used as a CS technical elective **must be completed with a C or better.**

#### **CpE Technical Elective**

- Pick one CpE 4xx technical elective (3 hrs)

**Engineering Science Elective:** Pick one elective (3hrs) from the following list:

- CHE 201 Material/Energy Balance
- CHE 366 Engr. Materials Science/ENG 377 Engineering Economy
- MAE 241 Statics
- MAE 320 Thermodynamics

## X. GENERAL EDUCATION CURRICULUM (GEC) Requirements

University requirements are given in the WVU undergraduate catalog, available from <http://coursecatalog.wvu.edu/>. The requirements below are specific for LCSEE undergraduate students.

### A. GEC Requirements

Students who first enrolled at WVU beginning in the Fall 2005 term or after are required to fulfill General Education Curriculum (GEC) requirements. Appropriate courses must be completed to satisfy nine learning outcomes, some of which are automatically fulfilled by required courses. BIOM, CpE, and EE students choose elective credit in outcomes 3,5,6,7, and 9, while CS students choose electives in 3-9. The table below shows which courses automatically fulfill GEC requirements. For further information, consult the 2005-2007 WVU Catalog, or [http://registrar.wvu.edu/current\\_students/general\\_education\\_curriculum](http://registrar.wvu.edu/current_students/general_education_curriculum).

Outcomes	Course	Hours
<b>1. Communication - 6 hrs</b>	Engl 101	3
	Engl 102	3
<b>2. Basic Math and Science - 13-15 hrs</b>	Math 156	4
	Phys 111 <b>or</b> ECAS 4-hr lab science	4
	Phys 112 <b>or</b> ECAS 4-hr lab science	4
	Stat 215	3
<b>3. The Past and Its Traditions - 3 hrs</b>	Elective	3
<b>4. Contemporary Society - 3-4 hrs</b>	Econ 201 (Elective for CS)	3
<b>5. Artistic Expression - 3 hr</b>	Elective	3
<b>6. The Individual in Society - 4 hr</b>	Engr 199 Univ 101	1
	Elective	3
<b>7. American Culture - 3 hrs</b>	Elective	3
<b>8. Western Culture - 3 hrs</b>	Econ 202 (Elective for CS)	3
<b>9. Non-Western Culture - 3 hrs</b>	Elective	3
	<b>Total:</b>	<b>43</b>

A master list of GEC courses by outcome is located online at [http://registrar.wvu.edu/current\\_students/general\\_education\\_curriculum](http://registrar.wvu.edu/current_students/general_education_curriculum). In addition, students may search for available GEC courses during the scheduling process at <http://www.arc.wvu.edu/courses/>.

A table of GEC courses by course number is located in **Appendix II** of this document, but the most up-to-date listing is available by visiting either of the links above.

### B. LSP Requirements

Students enrolled at WVU before the Fall 2005 term are required to fulfill Liberal Studies Program (LSP) requirements. Six humanities and social sciences electives (total of 18 hours) must be selected from Cluster A or B. The Cluster A or B electives must be chosen so as to meet the LSP requirements of West Virginia University and ABET program requirements. For complete details, see <http://www.arc.wvu.edu/courses/lspdetails.html>

Note: Forms in the following sections highlighted in **Bold Type** are available for download from the CEMR Student Services website at <http://www.cemr.wvu.edu/studentservices/>

## **XI. REGISTRATION AND ADVISING**

Students should meet with their academic advisor prior to registration. This helps insure that all requirements are being met in a timely fashion. To find your advisor, consult the posting outside 841 ESB. For a listing of advisors, visit the Lane Department web site at <http://www.lcsee.cemr.wvu.edu/ugrad/advisors.php>

### **A. Grade Point Requirements**

1. Students having an overall grade point average (GPA) of less than 2.0 are considered to be on probationary status. Probation students must meet with their Probation Advisor prior to registration.
2. Biom, CpE, and EE students who do not achieve at least a C grade in any EE or CpE course that is a prerequisite for another EE or CpE course are strongly urged to repeat the course before moving forward.
3. CS students are required to achieve a C grade or better in all degree-required courses.

### **B. Prerequisites**

Students must complete all prerequisite courses before taking each course in the curriculum. If it is discovered that a student does not have credit for a listed prerequisite, he/she will be administratively deleted from the course roster during the first week of class. **See APPENDIX 1 for a list of LCSEE courses and their prerequisites.**

### **C. Online Registration**

1. Point your browser to <http://www.mix.wvu.edu/>.
2. Enter your Username and Password and click "OK." If your MIX account is jdoe@mix.wvu.edu, then your Username is jdoe. Your password is your 2-digit day of birth and the last 4 digits of your Student ID Number (unless you changed it). For example, if your date of birth is May 3, 1974 and your Student ID Number is 700-45-6789, then your password is 036789.
3. On the next page, select the "STAR" tab on top, then the "WVU STAR Information System" link.
4. Select the "Student Services & Financial Aid" link, then the "Registration" link
5. Click on "Select Term" link. Use the pull down option to select desired term. Click submit.
6. Select the "Add or Drop Classes" link.
7. Enter your Term PIN issued by your advisor, then enter the CRN for each course. Click submit.
8. Review your schedule by selecting "Concise Student Schedule" or "Student Detail Schedule" links.
9. If you have selected courses that have variable credits or multiple grading modes, you can make appropriate changes by choosing the "Change Class Options" link.
10. If you have selected courses that have restricted enrollment, you must obtain the appropriate approvals and be added manually by your academic advisor.

### **D. Maximum Credit Load**

Students wishing to register for more than 20 credit hours in one semester (or a total of 9 credit hours for both Summer terms) must obtain prior permission from their advisor, Academic Standards Committee member, and Associate Dean for Academic Affairs. The completed [Course Overload Request](#) must be submitted to the College Office of Student Services, Room 141 ESB.

### **E. Freshman Engineering Requirements**

In general, all CEMR programs require common freshman year courses. EE and CpE Students are moved from Freshman Engineering into their chosen major after successful completion of Chem 115, Engl 101, and Engr 101, 102, and 199. The BIOM program requires Biol 115 in the freshman year. CS does not require Engr 102, but CS 110 instead. The CS ECAS track requires Engr 199 instead of Univ 101.

### **F. 500-level Courses for Undergraduate Credit**

To enroll in appropriate 500 level courses for undergraduate credit:

- Students must be classified as either a junior or senior

- Students must meet all prerequisites for the course in which they wish to enroll.
- Students must have a cumulative grade point average of at least 3.00.
- Course undergraduate enrollment cannot exceed 20% of the total class.
- Undergraduate students may not enroll in 600 level courses.

The completed [Application to Enroll in a 500 Level Course for Undergraduate Credit](#) must be approved by the advisor and instructor prior to the time of enrollment and returned to the College Office of Student Services, Room 141 ESB, to obtain approval of the Associate Dean for Academic Affairs. Final approval will be granted after the class roster has been distributed and the percentage of undergraduate enrollment has been verified. In the event that the undergraduate enrollment exceeds 20%, approval will be granted according to the date of submission of the request.

#### G. Declaring a Minor

The following steps should be followed to assure that completion of a formal minor is appropriately recognized and posted to the student's transcript:

- Complete a "Declaration of Intent to Complete a Minor Field" form. This form is available from the student's major advisor or CEMR Student Services.
- The student works with her/his major advisor to incorporate minor requirements into schedule planning. Students are welcome to consult with advisors in the minor department if they wish to do so. Students who wish to complete a minor in Music, Women's Studies, or ROTC must work with advisors for those programs.

**1. Minor in CS:** Any student may complete a minor in CS by achieving a C or better in the following:

- CS 110 and 111 – CpE required
- Pick one from: CS 210, 220, or 230 – CS 230 is CpE required
- CS 310 – 3 hrs CpE Technical Elective
- CS 350 – CpE required
- At least one CS 4xx course – CS 450 CpE required

**2. Minor in Mathematics:** Any student may complete a minor in Math by achieving either a C or better or a cumulative 2.25 GPA in the following:

- Math 155, 156, 251, 261 – Biom, CpE and EE required
- Math 375 – Biom and CpE required, or EE Math/Sci Elective
- Math 3xx/4xx excl. 331/332/493 - 6 hrs EE Technical Electives

**3. Minor in Physics:** Any student may complete a minor in Physics by achieving a cumulative 2.0 GPA in the following:

- Phys 111, 112 – Biom, CpE, CS, and EE required
- Phys 314 - Take as EE Math/Sci Elective
- Phys 321 & 471 - 6 hrs EE Technical Electives

CpE majors may earn a CS minor without taking any extra courses. EE majors may earn either a Math or Physics minor without taking any extra courses.

For complete minor information and a list of all available minors, see the [current WVU Catalog](#), or <http://welcometo.wvu.edu/academics/minors>.

## **XII. HONORS and STUDY ABROAD PROGRAMS**

### **A. Honors Program**

Lane Department students who are enrolled in the University Honors Program need to plan their course schedules carefully to meet the requirements for graduation with Honors (24 Honors credit-hours). Where possible, students are advised to register for the Honors sections of courses on the CEMR Approved GEC course list. In addition, Honors students are advised to register for the Honors sections of their sophomore Mathematics and Physics courses, and for the Honors sections of Econ 201 and Econ 202, which are normally taken in the senior year. In special cases, and in consultation with their Honors Advisor, an Honors student may establish a work program related to an LCSEE course for which limited Honors credit can be earned. Up to 6 hours of honors credit can be achieved for participation in certain WVU Study Abroad or exchange programs. For more details concerning the Honors Program, contact Dr. Roy Nutter at [Roy.Nutter@mail.wvu.edu](mailto:Roy.Nutter@mail.wvu.edu), or visit the Honors Program website at <http://www.honors.wvu.edu/>.

**Honors Advisors:** **BIOM** – Bojan Cukic; **EE** – Larry Hornak; **CpE** – Roy Nutter; **CS** – Cindy Tanner.

### **B. Study Abroad Opportunities**

LCSEE and WVU offer an exciting array of study abroad and student exchange opportunities. For more information concerning Study Abroad and exchange programs, please visit the Office of International Programs website at <http://www.wvu.edu/~intlprog/>, or phone their Stansbury Hall office at 293-6955

### XIII. REQUIRED ACADEMIC ACHIEVEMENT

#### A. Probation Status

Students whose overall grade-point average falls below 2.0 will receive a letter from the Dean of the College of Engineering and Mineral Resources stating that they are on probation. Upon receiving a copy of such a letter, a student's advisor shall deliver the student's records to the Probationary Advisor, who will be the temporary advisor for as long as the student is on probation.

**Probation Advisors:** **BIOM** – Bojan Cukic; **CpE** – Powsiri Klinkhachorn; **CS** – Cindy Tanner;  
**EE** – Muhammad Choudhry

#### B. Suspension and Readmission Policy

The guidelines for acceptable academic standing are listed in the chart below. These guidelines were adopted by the WVU Faculty Senate in the Spring of 2004. If a student's cumulative GPA drops to the points listed below, they become eligible for suspension for up to one calendar year.

Total Hours Attempted*	Minimum Cumulative GPA Allowed*
10-19	0.95
20-24	1.13
25-29	1.33
30-34	1.47
35-39	1.57
40-44	1.64
45-49	1.70
50-54	1.75

Total Hours Attempted*	Minimum Cumulative GPA Allowed*
55-59	1.79
60-64	1.82
65-69	1.85
70-74	1.87
75-79	1.90
80-84	1.91
85 or more	1.93

\*Includes all hours attempted in institutions in the WV system of higher education. Grades of P are excluded and the D/F Repeat Policy is applied.

### XIV. ADMINISTRATIVE POLICIES and PROCEDURES

#### A. D/F Repeat

If you earn a D or F in a course taken at WVU taken no later than the semester or summer session registration when you reach a cumulative total of 60 hours attempted, you are eligible to "D/F Repeat" that course. The course must be repeated at WVU, Potomac State College of WVU, WVU at Parkersburg, or WVU Institute of Technology. You have only one opportunity to improve your original grade. The new grade becomes the grade that counts, even if your performance is worse than when you were originally graded. Students may complete a [Request for D/F Repeat Filing](#) and submit it to the CEMR Office of Student Services, Room 141 ESB.

#### B. Course Substitution Requests

Courses taken at other universities or colleges that are accepted at WVU as open credit may be substituted as WVU courses by completing a [Course Substitution Request](#). After obtaining the approval of the advisor, Academic Standards Committee member, and the Department Chairman, the Course Substitution Request must be submitted to the College Office of Student Services, Room 141 ESB, for the approval of the Associate Dean for Academic Affairs.

#### C. Taking Courses at Other Institutions

A student currently enrolled in WVU who wishes to obtain credit toward a WVU degree by taking courses at another institution must first obtain prior approval. The following provisions must be met in order for approval to be granted:

- The student must confer with the Admissions and Records Office regarding the course and the institution to be attended.
- The student must complete the [Undergraduate Transient Application](#), and then have it approved by the advisor, Dean, and the Director of Admission and Records. This must be done before registering for a course at another institution.
- It is the student's responsibility to have an official transcript sent to WVU after completing the course.
- A course initially taken at WVU must be repeated at WVU, WVUIT, WVUP, or PSCWVU

- A student must have an overall GPA of 2.0 in order to be eligible to have any credit transferred. If the GPA is below 2.0, the student must complete one full-time semester at WVU with a 2.0 average in order to receive credit for work taken elsewhere.

#### D. Transfer within CEMR or University

At any time during the semester, a student may indicate they desire to transfer majors. Students wishing to change their major must complete a [Transfer Request Form](#), obtain their current advisor's signature, and submit the completed form to the CEMR Office of Student Services, Room 141 ESB.

#### E. Withdrawal from Courses and the University

##### 1. Withdrawal from Courses

Students may withdraw from individual courses without affecting their grade-point average until the Friday of the tenth week of class. It is the student's responsibility to verify that dropping classes does not affect their eligibility for financial aid, Promise Scholarship, athletics, international status, or other personal areas such as eligibility for student insurance rates, etc. Students on probation must specific approval from their advisor before dropping a class. If the course dropped is a co-requisite for another course currently being taken, then both courses must be dropped, e.g. a course with an associated lab.

##### 2. Withdrawal from the University

Leaving WVU without following the withdrawal procedure can result in grades of F in all classes and adversely affect the student's future status with the University. Students may withdraw from the University any time before the last day on which classes are scheduled to meet. To do so, they must contact the Division of Student Affairs. Withdrawal procedure will be explained at that time.

Students in good standing who will be away from campus for a year or more may apply for a leave of absence from the Office of Admissions and Records after consulting with their advisor.

### XV. GRADUATION REQUIREMENTS AND PROCEDURES

#### A. Requirements

**If you have questions or concerns about your graduation status, visit your advisor immediately. It is the ultimate responsibility of the student to determine that all major and minor requirements are fulfilled.**

1. A student's overall GPA must be 2.0 or better for graduation.
2. BIOM, EE or CpE students must have attained a GPA of 2.0 or better for all required LCSEE courses, except those in which a grade of W or WU was received. If a class is attempted more than once, only the most recent grade obtained will be used in computing the departmental GPA.
3. CS students must have earned a C or better in all required CS, CpE, and Math courses

#### B. Procedures

During the pre-registration period in the student's penultimate semester, students must review requirements for graduation with their advisor. The advisor and student complete a [Graduation Eligibility Worksheet](#) that itemizes the steps required in the penultimate and final semesters. Students should carefully check each step below:

1. Confirm that required grades have been obtained in all courses of the curriculum except those for which the student intends to register. Check GEC/LSP requirements particularly.
2. File [Course Substitution Requests](#) where appropriate.
3. Students may not graduate with grades of Incomplete. The student must make arrangements with the course instructor or department for a grade change from I to A, B, C, D, F, or P.
4. Check that both overall WVU and Departmental GPAs are acceptable. If there is a deficiency in either case, it must be removed before being eligible for graduation
5. Each graduating senior's transcript is reviewed prior to the first week of class of their final semester to ensure all requirements have been met. Students who have problems that might prevent graduation will be notified via email. **It is the student's responsibility to resolve problems before the close of the registration period.**
6. If pursuing a minor, confirm that all requirements have been met and that a "Declaration of Intent to Complete a Minor Field" has been filed. These are available from advisors or CEMR Student Services.
7. File an "Application for Graduation and Diploma" in the Student Services Office in Room 141 ESB and pay diploma fee.



**APPENDIX I.** Prerequisite listing for BIOM, CpE, CS, and EE courses, and common non-LCSEE courses.

<b>COURSE</b>	<b>PREREQUISITE</b>	<b>CO-REQ</b>	<b>FALL</b>	<b>SPRING</b>
BIOM 426	STAT 215, MATH 261, CS 111		X	
BIOM 480	ENGL 102, Consent, Penultimate Semester		Xx	Xx
BIOM 481	BIOM 480		X	X
CPE 271	MATH 156		X	X
CPE 272		CPE 271	X	X
CPE 310	CPE 271, PHYS 112 (effective spring 2008)		X	X
CPE 311		CPE 310	X	Xx
CPE 312	CPE 310, CPE 311, EE 251, EE 252 (effective spring 2008)	CS 350		X
CPE 313		CPE 312		X
CPE 435	CpE 310, CPE 311, CS 350		X	
CPE 442	MATH 375, CPE 310, CPE 311		X	
CPE 462	EE 327, STAT 215		X	
CPE 480	ENGL 102, Consent, Penultimate Semester		X	X
CPE 481	CPE 480		X	X
CPE 484	CS 350			X
CS 101			X	X
CS 110	Calculus qualified		X	X
CS 111	CS 110		X	X
CS 210	CS 111		X	X
CS 220	CS 110, MATH 155			X
CS 221	CS 111, CS 220, MATH 156		X	
CS 230	CS 111		X	X
CS 310	CS 111			X
CS 350	CS 111		X	X
CS 410	CS 310		X	
CS 420	CS 221		X	
CS 422	CS 221		X	
CS 426	CS 221			X
CS 430	CS 230		X	
CS 440	CS 230			X
CS 450	CS 350		X	X
CS 453	CS 350			X
CS 455	CS 350		X	
CS 465	CS 111, CS 350		X	
CS 470	CS 210		X	
CS 472	CS 230		X	
CS 473	CS 230			X
CS 480	ENGL 102, Penultimate Semester		X	X
CS 481	CS 480		X	X
EE 221	PHYS 111, MATH 156		X	X
EE 222		EE 221	X	X
EE 223	EE 221, EE 222, PHYS 112, MATH 251			X
EE 224		EE 223		X
EE 251	EE 221, EE 222, PHYS 112, CPE 271			X
EE 252		EE 251		X
EE 327	MATH 261, EE 223		X	

<b>COURSE</b>	<b>PREREQUISITE</b>	<b>CO-REQ</b>	<b>FALL</b>	<b>SPRING</b>
EE 328	EE 327	EE 329		X
EE 329	EE 327, STAT 215			X
EE 335	EE 223, EE 224, PHYS 112		X	
EE 336		EE 335	X	
EE 345	MATH 261, PHYS 112		X	
EE 355	EE 223, EE 251		X	
EE 356		EE 355	X	
EE 411	EE 327			X
EE 413	EE 327		X	
EE 425	Phys 112 and Jr. or Sr. standing		X	
EE 431	EE 335, EE 336		X	
EE 435	EE 335, EE 355, EE 356			X
EE 436	EE 335, EE 336			
EE 437	EE 329, EE 345		X	
EE 445	EE 345			
EE 450	EE 345, EE 355			X
EE 455	EE 345		X	
EE 457	EE 345		X	
EE 461	EE 329		X	
EE 463	MATH 251, EE 327			X
EE 465	MATH 251, EE 327			X
EE 480	ENGL 102, Consent, Penultimate Semester		X	X
EE 481	EE 480		X	X
<b>Common Non-LCSEE Courses</b>				
<b>COURSE</b>	<b>PREREQUISITE</b>	<b>CO-REQ</b>	<b>FALL</b>	<b>SPRING</b>
BIOL 115			X	
BIOL 324	BIOL 115 and consent for BIOM majors			X
CHEM 115	Placement or CHEM 110		X	X
IENG 377	None		X	X
MAE 241	PHYS 111 with a C or better		X	X
MAE 320	MATH 155, PHYS 111		X	X
MATH 155	Placement or MATH 126 & 128 or MATH 129 with a C or better		X	X
MATH 156	MATH 153 and 154, or MATH 155 with a C or better		X	X
MATH 251	MATH 156 with a C or better		X	X
MATH 261	MATH 251 with a C or better		X	X
MATH 375	MATH 156 with a C or better		X	X
PHYS 111	MATH 155 with a C or better		X	X
PHYS 112	PHYS 111		X	X
PHYS 321	PHYS 111, 112, and MATH 261			X
STAT 215	MATH 156		X	X
STAT 312	STAT 211, 215, or Equivalent		X	
STAT 313	STAT 312			X
STAT 316	STAT 215		X	

**APPENDIX II:**

**Master List of GEC Courses by objective**

A master list of GEC courses by outcome is located online [http://registrar.wvu.edu/current\\_students/general\\_education\\_curriculum](http://registrar.wvu.edu/current_students/general_education_curriculum) . In addition, students may search for available GEC courses during the scheduling process at <http://www.arc.wvu.edu/courses/> .

The most up-to-date listing is available by visiting either of the links above.

SUBJ	CRS #	3	4	5	6	7	8	9
ADV	201		X			X		
AGEE	101		X					X
AGEE	220		X		X			
ARE	150		X		X			
ARE	187		X					
ARE	220	X	X					
ARE	410							
ARHS	101	X		X				
ARHS	111			X			X	
ARHS	120	X		X				
ARHS	160	X		X				
ARHS	181	X		X				
ART	101	X		X				
ART	105	X		X				
ART	106	X		X				
ART	109	X		X				
ART	110	X		X				
ASP	220		X			X		-
BIOL	105		X					
BIOL	106		X					
BIOL	107		X					
BIOL	122		X		X			
BIOL	352							
BN	215		X				X	
CDFS	110		X		X			
CHE	451							
CHEM	349							
CHIN	101		X					X
CHIN	102		X					X
CHIN	203		X					X
CHIN	204		X					X
CHPR	365		X		X			
CHPR	380		X	-	X	-		
CLAS	101	X					X	
CLAS	102	X					X	
CLAS	203	X					-	
CLAS	204	X					-	
CLAS	231	X					-	
CLAS	232	X		X				
COMM	100		X		X			

SUBJ	CRS #	3	4	5	6	7	8	9
COMM	102		X		X			
COMM	104		X		X			
COMM	105		X		X			
COMM	112		X		X			
COMM	122		X		X			
COMM	212				X	X		
COMM	304				X	X		
COMM	305			X		X		
COMM	306		X		X			
COMM	308		X		X			
COMM	309		X		X			
COMM	314		X					X
COMM	315			X		X		
COMM	316						X	X
COMM	317				X	X		
COMM	410		X		X			
COUN	230		X		X			
CS	101		X					
DANC	101			X				
DISB	282				X			
DISB	380				X			
DS	315							X
ECON	111		X				X	
ECON	201		X				X	
ECON	202		X				X	
ECON	225		X					
ECON	301		X				X	
EDUC	200		X		X			
ENGL	305							
ENGL	131			X				
ENGL	132			X				
ENGL	139			X				X
ENGL	154			X		X		
ENGL	225	X		X				
ENGL	226			X				X
ENGL	232			X				
ENGL	233			X				
ENGL	234			X				
ENGL	235			X				
ENGL	236	X		-				
ENGL	241			X		X		
ENGL	242			X		X		
ENGL	251	X				X		
ENGL	254			X		X		
ENGL	255		X			X		
ENGL	258				X			
ENGL	261	X		X				
ENGL	262	X		X				
ENGL	263	X		X				

SUBJ	CRS #	3	4	5	6	7	8	9
ENGL	272	X		X				
ENGL	273		X	X				
ENGL	285			X				
ENVM	341		X					
ENVP	119		X					
ENVP	155		X					
EXPH	230					X		
F&CS	282				X			
F&CS	385				X			
FDM	210	X					X	
FDN	220		X					X
FDST	200		X					
FIDP	201							
FILM	101	X		X				
FILM	102			X		X		
FLIT	214					X	X	
FLIT	215			X				X
FLIT	220	X						X
FLIT	221			X				X
FLIT	223			X				X
FLIT	261			X			X	
FLIT	262			X			X	
FLIT	266			X				X
FLIT	272			X				X
FLIT	273			X			X	
FLIT	274			X			X	
FLIT	275			X	X			
FLIT	276			X	X			
FLIT	321			X				X
FLIT	371			X	X			
FLIT	372			X			X	
FLIT	373			X			X	
FOR	140		X					
FRCH	100		X				X	
FRCH	101		X				X	
FRCH	102		X				X	
FRCH	200		X				X	
FRCH	203		X				X	
FRCH	204						X	X
FRCH	301	X					X	
FRCH	302		X				X	
FRCH	304			X			X	
FRCH	331			X			X	
FRCH	332			X				X
GEN	101		X					
GEOG	102						X	X
GEOG	106		X					
GEOG	107		X					
GEOG	108		X				X	

SUBJ	CRS #	3	4	5	6	7	8	9
GEOG	110		X					
GEOG	111		X					
GEOG	205		X					
GEOG	207		X				X	
GEOG	209		X					X
GEOG	210		X			X		
GEOG	240		X			X		
GEOG	241		X				X	
GEOG	243		X					X
GEOG	244		X					X
GEOL	101		X					
GEOL	110		X					
GEOL	111		X					
GEOL	203		X					
GER	100		X				X	
GER	101		X				X	
GER	102		X				X	
GER	200		X				X	
GER	203		X				X	
GER	204		X				X	
GER	331			X			X	
GER	332			X			X	
HIST	101	X					X	
HIST	102	X					X	
HIST	104	X						X
HIST	105	X						X
HIST	106	X						X
HIST	108	X	X					
HIST	124	X						X
HIST	152	X				X		
HIST	153	X				X		
HIST	179	X						X
HIST	180	X						X
HIST	201	X					X	
HIST	203	X					X	
HIST	204	X					X	
HIST	205	X					X	
HIST	207	X					X	
HIST	209		X				X	
HIST	217	X					X	
HIST	218		X				X	
HIST	221		X				X	
HIST	241	X						X
HIST	242		X					X
HIST	255	X				X		
HIST	256	X				X		
HIST	257	X				X		
HIST	259	X				X		
HIST	261		X			X		

SUBJ	CRS #	3	4	5	6	7	8	9
HIST	264	X				X		
HIST	271	X					X	
HIST	272	X					X	
HIST	277	X					X	
HIST	281	X	X					
HIST	284	X					X	
HIST	316	X					X	
HNF	126		X			X		
HNF	171		X					
HONS	215				X	X		
HUM	101			X			X	
HUM	102			X			X	
HUM	106			X	X			
HUM	107	X						X
HUM	109	X		X				
IENG	471							
INDS	115			X		X		
ITAL	101		X				X	
ITAL	102		X				X	
ITAL	203		X				X	
ITAL	204		X				X	
JAPN	101		X					X
JAPN	102		X					X
JAPN	203		X					X
JAPN	204		X					X
JRL	101						X	X
JRL	279			X		X		X
LARC	212	X		X				
LING	101		X		X			
MAE	471							
MAE	475							
MATH	218	X						
MDS	120		X		X			
MDS	122		X			-		
MDS	124		X					
MDS	126		X				X	
MDS	212		X		X			
MILS	101		X		X			
MILS	102		X		X			
MILS	201		X		X			
MILS	202		X		X			
MINE	484							
MUSC	168			X		X		
MUSC	170		X	X				
MUSC	173		X	X				
MUSC	175			X		X		
MUSC	179			X				X
MUSC	477			X				X
NAS	200		X					X

SUBJ	CRS #	3	4	5	6	7	8	9
ORIN	175						X	
PET	101	X				X		
PHIL	100		X		X			
PHIL	130		X		X			
PHIL	140	X					X	
PHIL	170		X		X			
PHIL	244	X					X	
PHIL	248	X					X	
PHIL	260		X		X			
PHIL	301		X		X			
PHIL	302		X		-			
PHIL	306		X		X			
PHIL	308		X				X	
PHIL	310		X		X			
PHIL	321		X		X			
PHIL	323		X		X			
PHIL	325		X		X			
PHIL	331		X		X			
PHIL	346	X					X	
PHIL	351	X					X	
PHIL	354				X		X	
PHIL	355		X				X	
PLSC	105		X					
PNGE	332							
POLS	101	X	X					
POLS	102	X	X					
POLS	103						X	X
POLS	210	X	X					
POLS	220	X	X					
POLS	250						-	X
POLS	260		X				X	
POLS	270		X		X			
POLS	335		X			X		
POLS	337		X			X		
POLS	351		X				X	
POLS	355		X					X
POLS	356		X					X
POLS	361		X					X
POLS	364		X				X	
POLS	373	X				X		
PSYC	101		X			X		
PSYC	232					X	X	
PSYC	233		X	X				
PSYC	241		X			X		
PSYC	251		X			X		
PSYC	281		X			X		
PSYC	301							
RELG	102	X						X
RELG	105		X			X		

SUBJ	CRS #	3	4	5	6	7	8	9
RELG	210		X				X	
RELG	219	X					X	
RELG	222	X	X					-
RELG	223	X				X		-
RELG	231	X						X
RELG	232	X						X
RELG	250		X		X			
RELG	303	X						X
RELG	304	X						X
RUSS	101						X	X
RUSS	102						X	X
RUSS	203						X	X
RUSS	204						X	X
SEES	101		X				X	
SEP	271		X			X		
SEP	272		X		X			
SEP	373		X			X		
SM	275	X	X					
SM	375		X					
SM	487							
SOCA	101		X			X		
SOCA	105						X	X
SOCA	107		X			X		
SOCA	232		X			X		
SOCA	235		X			X		
SOCA	256		X					X
SOCA	257			X				X
SOCA	258	X						X
SOWK	105		X			X		
SOWK	147		X			X		
SPA	270		X		X			
SPAN	100						X	X
SPAN	101						X	X
SPAN	102						X	X
SPAN	200						X	X
SPAN	203						X	X
SPAN	204						X	X
SPAN	330	X						X
SPAN	331			X				X
SPAN	332			X				X
SPAN	340	X					X	
SPAN	341			X			X	
SPAN	342			X			X	
SPED	304		X		X			
STAT	111		X					
STAT	211		X					
THET	101	X		X				
THET	102			X				
THET	170			X				X

SUBJ	CRS #	3	4	5	6	7	8	9
USAF	131		X		X			
USAF	132		X		X			
USAF	251	X			X			
USAF	252	X			X			
USAF	371		X		X			
USAF	372		X		X			
WDSC	100	X						
WMAN	100		X		X			
WMAN	150		X					
WMST	150		X			X		
WMST	170		X			X		
WMST	215			X				X
WMST	225			X		X		
WMST	245		X					X
WMST	250				X	X		
WMST	340		X		X			

NOTES: