Department of Natural and Applied Sciences

Majors are available in Applied Science and Sustainability, Biology, Biology Education, Chemistry, Chemistry Education, Computer Science, Health Care - Nursing, Mathematics, Applied Mathematics, and Mathematics Education.

Minors are available in Applied Science, Agronomy, Biology, Chemistry, Computer Science, Forensic Science, General Science, Mathematics, Physical Science, and Physics.

Pre-professional tracks are available in Pre-Nursing, Pre-Medicine, Pre-Engineering, Pre-Physician Assistant, Pre-Dentistry, Pre-Veterinary Medicine, Pre-Optometry, Pre-Chiropractic, Pre-Pharmacy, Pre-Physical Therapy, and other programs that can be developed to meet students' needs.

Students planning to teach secondary school may choose a Biology Education, Chemistry Education, or Mathematics Education major and complete the Secondary Education professional requirements in the Department of Education for teacher certification.

All programs in the Department fulfill the requirements for the Bachelor of Science degree. For a Bachelor of Arts degree, a student must include one year of foreign language.

Applied Science and Sustainability

The Applied Science and Sustainability major is designed for students who wish to prepare for graduate school or professional work in areas relating to the environment, compassion, conservation, or field research. Students in this program experience a wide array of classes in the life and physical sciences, as well as numerous field and laboratory opportunities.

Applied Science and Sustainability Program Learning Outcomes.
Graduates of the Applied Science and Sustainability Program will:

1. Acquire foundational level of scientific literacy.
2. Develop a mature Christian worldview that integrates faith and science.
3. Deal wisely and ethically with the technological issues facing society.
4. Develop a positive attitude toward science.
5. Make contributions to the church, their profession, and society.
6. Demonstrate readiness for graduate school and/or the chosen professions.
7. Demonstrate critical thinking and problem-based learning skills to understand, interpret, and evaluate scientific hypotheses.
8. Gain experience with working independently as well as part of a team.
9. Demonstrate proficiency using scientific principles in theory and

practice (field and laboratory when appropriate).

10. Communicate scientific findings in scientifically standard written and oral formats.
11. Develop a realistic understanding of the various challenges and benefits of science vocations through work studies, internships, or summer research opportunities.

The Applied Science and Sustainability major provides students with a marketable 4-year degree as well as for students planning to attend graduate school in areas relating to the environment, conservation, or field research.

There are two tracks for the Applied Science and Sustainability major. While both tracks are scientifically based, the Compassion track is designed for those more interested in the sociological/programmatic aspects of Applied Science and Sustainability and who will probably not pursue graduate studies in environmental science.

The Environmental Science track is designed for those planning to work in the more technical aspects of the field and who are considering pursuit of science post-baccalaureate degrees.

The ***Applied Science and Sustainability major: Compassion track*** consists of 56 credits, as follows: BIOL 131, 200, 201, 202, 298/498, 424, 343, 496; CHEM 110, 377; CPSC 101; MATH 129; GSCI 111, 115; Plus 6 credits from THEO 325, NBUS 323, ICST 111, CRDV 334.

The ***Applied Science and Sustainability major: Environmental Science Track*** consists of 57-59 credits distributed as follows: BIOL 200, 201, 202, 342, 343, 496, and upper-division biology elective (3 cr.); CHEM 111, 112, and 271; CPSC 101; MATH 129 or 231; GSCI 111 or 112; PHYS 211.

The ***Applied Science and Sustainability minor*** consists of 21 credit hours in biology and chemistry and must include BIOL 131, 200, 298/498, 343; and CHEM 377.

Suggested Program Applied Science and Sustainability Major: *Compassion Track*

First Year: BIOL 200, CHEM 110, BIBL 111, GSCI 100, EXER 101, BIOL 201, GSCI 111, BIBL 115, CPSC 101, ENGL 111, MATH 129.
Second Year: BIOL 202, GSCI 115, BIBL 116, Hist. Inq. Option, Reading and Imagination option, CHEM 377, BIOL 131, ENGL 341, and MATH 21, elective.
Third Year: BIOL 342, BIOL 448 (Applied Sustainability), Book study, FIN 138, electives.
Fourth Year: BIOL 343, BIOL 496, Artistic Expression option, Behavioral and Social Sciences option, PSYC 138, Humanities option, ICST 350, THEO 320, electives.

Suggested program Applied Science and Sustainability Major: *Environmental Science Track*

First Year: BIOL 200, CHEM 111, BIBL 111, GSCI 100, BIOL 201, CHEM 112, BIBL 115, CPSC 101, ENGL 111, electives.

Second Year: BIOL 202, CHEM 271, BIBL 116, Historical Inquiry option, Reading and Imagination option, CHEM 377, GSCI 111, ENGL 341, MATH 210.
Third Year: BIOL 342, PHYS 211, Book Study, FIN 138, biology and other electives.
Fourth Year: BIOL 343, BIOL 496, Artistic Expression Option, Behavioral and Social Sciences option, PSYC 138, Humanities option, ICST 350, THEO 320, electives.

Biology

The biology curriculum is designed to meet the needs of students who wish to prepare for professional work in health sciences, prepare for teaching, pursue graduate work, train for semi-professional work in industry or civil service, or obtain a broad education in biology. Students planning for careers in medicine, dentistry, optometry, pharmacology, veterinary medicine, physician assistant, or physical therapy attend a graduate program in one of these disciplines after completing their bachelor's degree at EU.

Biology Program Learning Outcomes
Graduates of the Biology Program will:

1. Develop understanding of function/structure/classification of life
2. Effectively communicate principles of biology through oral means
3. Effectively communicate principles of biology through written means
4. Demonstrate proficiency in laboratory and field techniques
5. Demonstrate ability to know, analyze, and synthesize scientific principles

The ***biology major*** includes 66 credits as follows: MATH 231 or MATH 129, CPSC 101 or higher, CHEM 111, 112, 271 and 375 (CHEM 272 is highly recommended also), PHYS 211 and 212, BIOL 200, 201, 202, 335, 338, 437, and 496. Four credits must be chosen from either BIOL 341, 342 or 343 plus at least 4 additional credits from upper division BIOL courses.

A ***Biology minor*** consists of 20 credits in biology and must include BIOL 200.

Suggested Program for Biology Major

First Year: BIOL 200, 201; CHEM 111, 112; BIBL 111, 115; MATH 231 or 129; CPSC 101, composition proficiency; core curriculum.
Second Year: BIOL 202, 335; CHEM 271, 272; BIBL 116, 3xx; MATH 210; ENGL 341; core curriculum.
Third Year: BIOL 341, 342 or 343; BIOL electives (311, 312); PHYS 211, 212; CHEM 375; BIOL 437; BIOL electives; core curriculum.
Fourth Year: BIOL 338, 496, BIOL electives; core curriculum.

Biology Courses

BIOL 101: Biological Science (3 cr.)
Introduces biological science with an emphasis in the development of critical thinking skills in science, procedure skills, and content competency. Laboratory is required and involves scientific inquiry methods and a research component. Meets Core Curriculum requirements. Biology majors should take BIOL 200. Corequisite: BIOL 101 Laboratory

BIOL 101: Biological Science Laboratory (1 cr.) Accompanies BIOL 101 as laboratory component. Corequisite: BIOL 101 Lecture.

BIOL 123: Nutrition (3 cr.) Explores nutritional requirements of human beings. Topics include the roles of nutrients throughout the life cycle. Meets Core Curriculum requirements.

BIOL 124: Human Biology (3 cr.) Explains the physiology and anatomy of the human body. Topics include a unit on origins and bioethics. Corequisite: BIOL 124 Laboratory.

BIOL 124: Human Biology Lab (1 cr.) Accompanies BIOL 124 as laboratory component. Corequisite: BIOL 124 Lecture.

BIOL 131: World Agricultural Systems (3 cr.) Discusses agro-environmental characteristics of world agriculture. Topics include historical and contemporary features of world food production, interactions between agriculture and human societies (past and present), historical discussions on the world's major food crops and farming methods, current agricultural systems on our planet, climate and soils' roles in agricultural systems, and how agriculture and the rest of the environment interact.

BIOL 200: General Biology (3 cr.) Introduces cell biology, genetics, and concepts important to contemporary society. Develops critical thinking skills in science. First course in four-course sequence for Biology and Applied Science & Sustainability majors. Corequisite: BIOL 200 Laboratory.

BIOL 200 General Biology Laboratory (1 cr.) Accompanies BIOL 200 as laboratory component. Corequisite: BIOL 200 Lecture.

BIOL 201: Zoology (3 cr.) Explores zoology. Topics include adaptations, taxonomy, and physiology. Second course in four-course sequence for Biology and Applied Science & Sustainability majors. Corequisite: BIOL 201 Laboratory.

BIOL 201: Zoology Lab (1 cr.) Accompanies BIOL 201 as laboratory component. Corequisite: BIOL 201 Lecture

BIOL 202: Botany (3 cr.) Examines botany. Topics include fungi and ecology. Third course in a four-course sequence required for Biology and Applied Science & Sustainability majors. Corequisite: BIOL 202 Laboratory.

BIOL 202: Botany Lab (1 cr.) Accompanies BIOL 202 as laboratory component. Corequisite: BIOL 202 Lecture.

BIOL 211: Human Anatomy and Physiology for the Health Sciences (3 cr.) Introduces human anatomy and physiology. Topics include roles of homeostasis and pathology and their interactions. Required: Nursing students. Corequisite: BIOL 211 Laboratory.

BIOL 211: Human Anatomy and Physiology for the Health Science Lab (1 cr.) Accompanies BIOL 211 as laboratory component. Corequisite: BIOL 211 Lecture.

BIOL 212: Human Anatomy and Physiology for the Health Sciences 2 (3 cr.) Continues introduction of human anatomy and physiology. Topics include roles of homeostasis and pathology and their interactions. Corequisite: BIOL 212 Laboratory.

BIOL 212: Human Anatomy and Physiology for the Health Sciences 2 Laboratory (1 cr.) Accompanies BIOL 212 as laboratory component. Corequisite: BIOL 212 Lecture.

BIOL 221: Human Structure and Function (3 cr.) Explores human anatomy and function. Topics include physical performance. This course is a Prerequisite for PHED 441 and SWK 271. Corequisite: BIOL 221 Laboratory.

BIOL 221: Human Structure and Function Laboratory (1 cr.) Accompanies BIOL 221 as laboratory component. Corequisite: BIOL 221 Lecture.

BIOL 235: Microbiology for the Health Sciences (3 cr.) Examines microorganisms and their growth and control. Topics include bacteria of medical importance, aseptic lab procedures, and care in the medical environment. Prerequisite: CHEM 110 Corequisite: BIOL 235 Laboratory.

BIOL 235: Microbiology for the Health Sciences Lab (1 cr.) Accompanies BIOL 235 as laboratory component. Corequisite: BIOL 235 Lecture.

BIOL 293: Special Problems (1 cr.) This course is available as needed. Prerequisite: Permission of the professor.

BIOL 298: Internship (1-3 cr.) Provides opportunity for students to engage in special projects while working in some vocation related to biology under the supervision of both a facility manager (1.e.- Physician) and an academic advisor. Prerequisite: Permission of the professor.

BIOL 311: Human Anatomy and Physiology (3 cr.) Introduces the study of human anatomy and physiology. Topics include homeostasis, pathology, and their interactions. This course is for those interested in health-related careers such as medicine, dentistry, physician assistant, and physical therapy. Corequisite: BIOL 311 Laboratory.

BIOL 311: Human Anatomy and Physiology Laboratory (1 cr.) Accompanies BIOL 311 as laboratory component. Corequisite BIOL 311 Lecture.

BIOL 312: Human Anatomy and Physiology II (3 cr.) Continues introduction of human anatomy and physiology. Topics include an emphasis on the roles of homeostasis and pathology and their interactions. This course is for those interested in health-related careers such as medicine, dentistry, physician assistant, and physical therapy. Corequisite: BIOL 312 Laboratory.

BIOL 312: Human Anatomy and Physiology II Laboratory (1 cr.) Accompanies BIOL 312 as laboratory component. Corequisite BIOL 312 Lecture.

BIOL 320: Plant Propagation (3 cr.) Encourages an interest, understanding, and appreciation of the principles and techniques of plant propagation, and enhances skills in finding and understanding published research about scientific advances in plant propagation.

BIOL 334: Medical Terminology (2 cr.) Introduces comprehensive medical terminology organized by body systems with emphases on anatomy, physiology, pathological conditions, and diagnostic treatments and procedures. Online Course.

BIOL 335: Microbiology (3 cr.) Examines microorganisms and their growth and control. Fourth course in a four-course sequence required for Biology and Applied Science & Sustainability majors. Corequisite: BIOL 335 Laboratory Prerequisite: BIOL 201 and CHEM 112.

BIOL 335: Microbiology Laboratory (1 cr.) Accompanies BIOL 335 as laboratory component. Corequisite: BIOL 335 Lecture.

BIOL 338: Molecular and Classical Genetics (3 cr.) Explores genetics topics covered broadly in general biology. Topics include linking classical transmission genetics, molecular genetics, human genetics, genomics, and bioinformatics. Corequisite: BIOL 338 Laboratory Prerequisite: BIOL 335.

BIOL 338: Molecular and Classical Genetics Laboratory (1 cr.) Accompanies BIOL 338 as laboratory component. Corequisite: BIOL 338 Lecture.

BIOL 341: Marine Biology (3 cr.) Examines field biology procedures and theories with particular emphasis on marine biology. Includes a 2-week field trip during the summer. Corequisite: BIOL 341 Laboratory Prerequisite: One course in biology.

BIOL 341: Marine Biology Laboratory (1 cr.) Accompanies BIOL 341 as laboratory component. Corequisite: BIOL 341 Lecture.

BIOL 342: Ecology (3 cr.) Discusses basic ecological theories and practice. Field trips required. Corequisite: BIOL 342 Laboratory Prerequisite: BIOL 202.

BIOL 342: Ecology Laboratory (1 cr.) Accompanies BIOL 342 as laboratory component. Corequisite: BIOL 342 Lecture.

BIOL 343: Environmental Biology (3 cr.) Discusses the influence of environmental factors. Topics include geology, climate, water, wastes; political factors on plants, animals, and microbes and their interactions; conservation and utilization; population growth; and sustainability of resources and ethics. Corequisite: BIOL 343 Laboratory. Prerequisite: One course in Biology.

BIOL 343: Environmental Biology Laboratory (1 cr.) Accompanies BIOL 343 as laboratory component. Corequisite: BIOL 343 Lecture.

BIOL 345: Biological Statistics Research Applications (4 cr.) Explains intermediate and advanced statistical methods, research design, and research proposals for the biological sciences. Prerequisite: MATH 210.

BIOL 360: Pathophysiology (3 cr.) Examines the physiological response to disease, stress, and the environment, including a review of basic human physiology. Requirements: Nursing students. Prerequisite: BIOL 212 or 312. Online course.

BIOL 375: Biochemistry (3 cr.) Explores chemistry related to life processes in plants and animals. Topics include enzymes and metabolism, carbohydrates, lipids, proteins, and nucleic acid chemistry. Corequisite: BIOL 375 Laboratory. Cross-listed with CHEM 375 Prerequisite: CHEM 271; BIOL 335 Recommended.

BIOL 375: Biochemistry Laboratory (1 cr.) Accompanies BIOL 375 as laboratory component. Corequisite: BIOL 375 Lecture.

BIOL 437: Cell Biology (3 cr.) Examines cellular organization and function with primary emphasis on eukaryotic cell. Requirements: All Biology majors. Prerequisites: BIOL 335 and BIOL/CHEM 375.

BIOL 448: Special Topics (1-4 cr.) This course is available as needed. Topics may include vertebrate physiology, plant physiology, virology, medical botany, bacterial pathogenesis or advanced microbiology. Prerequisite: Permission of the professor.

BIOL 460: Bioethics (3 cr.) Explores the basic ethical principles and applications as they pertain to healthcare environments. Topics include in-depth discussion of ethical principles. Cross-listed as PHIL 460.

BIOL 493: Special Problems (1-3 cr.) This course is available as needed. Intended for research projects. Prerequisites: Permission of the professor. Prerequisite: Junior or Senior standing.

BIOL 496: Senior Seminar (1-2 cr.) Required for all biology majors. Topics include development of scientific research and writing skills, one formal paper and a formal oral presentation. Prerequisite: Senior standing.

BIOL 498: Internship (1-3 cr.) Provides students with an internship experience in a vocation related to biology under the supervision of both a facility manager and an academic advisor. Prerequisites: Permission of Department Chair. This course is available as needed.

Biology Education

The Biology Education program represents a partnership between the Natural and Applied Sciences Department and the Education Department to provide a comprehensive major to prepare biology students for a career in secondary education.

Program Learning Outcomes for Biology Education

In addition to Professional Education Outcomes as set for in Education, graduates of the Biology Education program will:

1. Explain functions, structures, and classification of life.
2. Effectively communicate principles of biology through oral and written means.
3. Demonstrate mastery of plant taxonomy or biology.
4. Demonstrate mastery of microbial biology, taxonomy and ecology.
5. Demonstrate mastery of scientific analysis and writing and the ability to communicate important information.
6. Demonstrate lab technique skills.
7. Demonstrate acute attention to detail, outstanding effort in collecting detail.
8. Demonstrate mastery of plant biology, analysis of plant characteristics, and synthesis of food system.

All ***biology education majors*** must complete a total of 37 credit hours of secondary education courses as listed under Department of Education, Secondary Education. Biology education majors must complete a) the Science Core Requirements and b) the subject certification track.

Science Core Requirements (33-35 cr.): BIOL 200, 201, 202, 342 (or 343 or 341); CHEM 110; GSCI 230, 336; MATH 129 or higher.

Subject Certification Track Requirements (12-13 cr.): 8 credits of BIOL 300/400 elective w/lab; GSCI 111 or 112; GSCI 115 or PHYS 211 or PHYS 231.

Chemistry

The chemistry curriculum provides broad and rigorous training in the five traditional branches of chemistry—analytical, bio, inorganize, organize and physical—to prepare students desiring to work as professional chemists, to teach chemistry or to pursue advanced degrees in chemistry, biochemistry or medicine.

Chemistry Program Learning Outcomes
Graduates of the Chemistry Program will:

1. Apply theoretical principles, models and conventions to the study of chemistry.
2. Design and perform experiments using the scientific method.
3. Analyze experimental data to draw conclusions about the physical world.
4. Effectively communicate chemistry concepts through written means.
5. Effective communicate chemistry concepts through oral means.

A ***Chemistry major*** completes at least 42 credits of chemistry course work as follows: CHEM 111, 112, 271, 331, 375, 431, 435 and 496, plus 12 credits of Chemistry electives with course numbers above 200. Chemistry majors are also required to complete MATH 231 and 232 (8 credits), CPSC 111 (3 credits), and PHYS 231 and 232 (10 credits). Students (especially those preparing for graduate study in chemistry) are also advised to complete MATH 233, 331 and 431.

Students in the **Pre-Medical Chemistry track** must complete CHEM 272 as part of the 12 elective Chemistry credits, as well as BIOL 200, 311, 312, 335 and 338.

A ***Chemistry minor*** consists of at least 21 semester hours of chemistry, which must include CHEM 111, 112, and 11 credits of Chemistry electives with course numbers above 200.

A ***Chemistry concentration*** consists of 28 semester hours of chemistry, which must include CHEM 111,112, 496, and 17 credits of Chemistry electives with course numbers above 200.

Suggested Program for Chemistry Major

First Year: CHEM 111, 112; MATH 231, 232; BIBL 111, 115; ENGL 111; GSCI 100; core curriculum course.
Second Year: CHEM 271, 272, BIBL 116, ENGL 341; MATH 210, 233, PHYS 231, 232.
Third Year: CHEM 331, 332; 375, 435; BIBL 360-370 book study; CPSC 111; ICST 350; MATH upper division elective, core curriculum 2 courses.
Fourth Year: CHEM 431, 434, 296; THEO 230; core curriculum 4 courses; electives 2 courses.

Note: MATH 231 and 232 are deferred until second year if student needs MATH 129.

Chemistry Education

The Chemistry Education program represents a partnership between the Department of Natural and Applied Sciences and the Education Department to provide a comprehensive major to prepare chemistry students for a career in secondary education.

Chemistry Education Program Learning Outcomes
In addition to Professional Education outcomes, Chemistry Education graduates will:

1. Apply theoretical principles, models and conventions in the study of chemistry.
2. Design and perform experiments using the scientific method.
3. Analyze experimental data to draw conclusions about the physical world.
4. Effectively communicate chemistry concepts through written means.
5. Effectively communicate chemistry concepts through oral means.

All ***chemistry education majors*** must complete the required courses as listed under Department of Education, Secondary Education. Chemistry education majors must complete a) the Science Core Requirements and then b) the subject certification courses.

Science core requirements (46 cr.): CHEM 111, 112, 271, 272, 331, 375, 377; GSCI 230; PHYS 211 or 231 or GSCI 115; MATH 129 or 231; CPSC 101; BIOL 342 or 343.

Additional subject certification track requirements (8 cr.): BIOL 200 w/lab; GSCI 111 or 112 w/lab.

Chemistry Courses

CHEM 101: Introduction to Chemistry (3 cr.) Introduces the fundamental concepts of general chemistry with emphasis on developing critical thinking and mathematical skills in science and problem-solving techniques. May be used to meet the Core Curriculum Natural Science option.

CHEM 110: Chemistry for Health Sciences (3 cr.) Introduces fundamental concepts of general chemistry, organic chemistry, and biochemistry, primarily focused for application to nursing. Topics include molecular structure and bonding; chemical equations and associated calculations; solution calculations; states of matter; nuclear chemistry; identification of primary organic functional groups and their reactions; the basic chemistry of carbohydrates, proteins, lipids, amino acids, and DNA; critical thinking skills in science; and problem-solving procedure development. Corequisite: CHEM 110 Laboratory Prerequisite: High school chemistry or permission of the instructor.

CHEM 110: Chemistry for Health Sciences Laboratory (1 cr.)
Accompanies CHEM 110 as laboratory component. Corequisite: CHEM 110.

CHEM 111: General Chemistry I (4 cr.) Discusses the fundamentals of chemistry. Topics include physical and chemical properties and changes in atoms, molecules, and ions; mass relationships in chemical reactions; reactions in aqueous solution, gases and the gas laws; thermochemistry; quantum theory and the electric structure of atoms; periodic relationships; chemical bonding; molecular geometry and hybridization of atomic orbitals; and intermolecular forces in liquids and solids.

Corequisite: CHEM 111 Laboratory
Prerequisite: High school chemistry

CHEM 111: General Chemistry Laboratory (1 cr.) Accompanies CHEM 111 as laboratory component. Corequisite: CHEM 111 Lecture.

CHEM 112: General Chemistry II (4 cr.) Continues discussions from CHEM 111. Topics include properties of solutions; chemical equilibrium; acid-base theories; acid-base equilibria; solubility equilibria; entropy and free energy; electrochemistry; chemical kinetics; transition metal chemistry and coordination compounds; nuclear chemistry; and introduction to organic chemistry. Corequisite: CHEM 112 Laboratory Prerequisite: CHEM 111.

CHEM 112: General Chemistry II Laboratory (1 cr.) Accompanies CHEM 112 as laboratory component. Corequisite: CHEM 112 Lecture.

CHEM 271: Organic Chemistry I (3 cr.) Explores general principles and theories of organic chemistry. Topics include preparation; properties; hybridization; stereochemistry; mechanisms of reactions and uses of aliphatic, halogenated, unsaturated, and alcoholic organic functional groups; critical thinking skills for solving organic chemistry reactions and syntheses; and problem-solving procedure development. Corequisite: CHEM 271 Laboratory Prerequisite: CHEM 112.

CHEM 271: Organic Chemistry I Laboratory (1 cr.) Accompanies CHEM 271 as laboratory component. Corequisite: CHEM 271 Lecture.

CHEM 272: Organic Chemistry II (3 cr.) Continues discussions from CHEM 271. Topics include basic spectroscopic techniques applicable to organic molecules and conjugated systems, reaction mechanisms and uses of aromatic (substituted aromatic), oxygen- containing (ethers, phenols, carbonyls, and heterocyclic), nitrogen containing (amines, amides, and heterocyclic), carboxylic acids and derivative functional groups; multistep synthesis along with carbonyl and ester condensation reactions. Corequisite: CHEM 272 Laboratory Prerequisite: CHEM 271.

CHEM 272: Organic Chemistry II Laboratory (1 cr.) Accompanies CHEM 272 as laboratory component. Corequisite: CHEM 272 Lecture.

CHEM 293/492: Special Problems (1-3 cr.) This course is available as needed. Prerequisite: Chemistry major and permission of the professor.

CHEM 331: Quantitative Analysis (3 cr.) Improves techniques in analytical chemistry. Topics include analytical laboratory equipment; measurement uncertainly and error; statistical analysis of data; quality assurance and calibration; and titrimetric and gravimetric analysis. Corequisite: CHEM 331 Laboratory Prerequisite: CHEM 112.

CHEM 331: Quantitative Analysis Laboratory (1 cr.) Accompanies CHEM 331 as laboratory component. Corequisite: CHEM 331 Lecture.

CHEM 332: Instrumental Analysis (3 cr.) Introduces theory and practice of instrumental methods for chemical analysis and separation. Topics include high performance liquid gas chromatography; atomic spectroscopy; UV-vis spectroscopy; Fourier transform infrared spectroscopy;

mass spectrometry; and nuclear magnetic resonance spectroscopy. Prerequisite: CHEM 331.

CHEM 332: Instrumental Analysis Laboratory (1 cr.) Accompanies CHEM 332 as laboratory component. Corequisite: CHEM 332 Lecture.

CHEM 375: Biochemistry (3 cr.) Explores chemistry related to life processes in plants and animals. Topics include enzymes and metabolism, carbohydrates, lipids, proteins, and nucleic acid chemistry. Corequisite: CHEM 375 Laboratory. Cross-listed with BIOL 375 Prerequisite: CHEM 271; BIOL 335 Recommended.

CHEM 375: Biochemistry Laboratory (1 cr.) Accompanies CHEM 375 as laboratory component. Corequisite: CHEM 375 Lecture.

CHEM 377: Environmental Chemistry (3 cr.) Explores a broad range of topics related to the chemistry of the air, soil, and water. Topics include environmental pollution, global warming, alternative energy sources, and the treatment of hazardous wastes. Corequisite: CHEM 377 Laboratory. Prerequisite: CHEM 375 and MATH 231 or higher.

CHEM 377: Environmental Chemistry Laboratory (1 cr.) Accompanies CHEM 377 as laboratory component. Corequisite: CHEM 377 Lecture.

CHEM 378: Organic Chemical Analysis and Methods (1 cr.) Discusses the analysis of unknown organic compounds and mixtures and methods for detection. Topics include identification, separation, and structural determination of organic molecules and functional groups using classical chemical and spectroscopic instrumental methods. Corequisite: CHEM 378 Laboratory. Prerequisite: CHEM 271.

CHEM 378: Organic Chemical Analysis and Methods (1 cr.) Accompanies CHEM 378 as laboratory component. Corequisite: CHEM 378 Lecture.

CHEM 431: Physical Chemistry I (3 cr.) Introduces a calculus-based approach to the study of chemistry. Topics include states of matter, laws and applications of thermodynamics. Corequisite: CHEM 431 Laboratory. Prerequisites: MATH 231, 232, CHEM 111, PHYS 212 or 232.

CHEM 431: Physical Chemistry I Laboratory (1 cr.) Accompanies CHEM 431 as laboratory component. Corequisite: CHEM 431 Lecture.

CHEM 432: Physical Chemistry II (3 cr.) Continues discussions from CHEM 431. Topics include the development of modern atomic and molecular theory; introductory quantum mechanics; particle in a box; the hydrogen atom; multi-electron atoms, statistical thermodynamics; and an introduction to atomic and molecular spectroscopy. Corequisite: CHEM 432 Laboratory. Prerequisites: MATH 233, CHEM 111, PHYS 232, or permission of the professor.

CHEM 432: Physical Chemistry II Laboratory (1 cr.) Accompanies CHEM 432 as laboratory component. Corequisite: CHEM 432 Lecture.

CHEM 435: Inorganic Chemistry (3 cr.) Discusses fundamental topics in inorganic chemistry. Topics include the periodic relationships; molecular orbital theory; molecular symmetry; the chemistry of

solids; acids and bases; oxidation and reduction; coordination compounds; and an introduction to physical techniques in inorganic chemistry. Prerequisites: Three of the following four courses: CHEM 112, 272.

CHEM 445: Advanced Organic Chemistry (3 cr.) Explains the development and application of chemical theories to organic compounds with an emphasis on reaction mechanisms. Prerequisite: CHEM 272.

CHEM 496: Seminar (1 cr.) Required for all chemistry majors. Topics include modern developments in the field of chemistry. Prerequisite: Chemistry major.

CHEM 498: Chemistry Internship (1 cr.) Provides students with an internship experience in a vocation related to chemistry under the supervision of both a facility manager and an academic advisor. Prerequisites: Permission of Department Chair. This course is available as needed.

Computer Science

Computer Science studies the representation, storage, and transformation of data into useful information using electronic computing machines. It affects practically all aspects of contemporary life. The main objects of study are digital computers and the phenomena surrounding them. Work in the discipline is focused on the structure and operation of computer systems, the principles that underlie their design and programming, effective methods for their use in different classes of information processing tasks, and theoretical characterizations of their properties and limitations. Computer Science is an extremely fast-growing and rewarding discipline. The Computer Science program at EU provides the fundamentals of the field in preparing students for immediate entry into the computer industry or for continued study at the graduate level.

Computer Science Program Learning Outcomes. Graduates of the Computer Science Program will:

1. Demonstrate the ability to, given a problem statement, develop an optimal algorithm (based upon analysis of algorithm complexity) to solve that problem and implement the algorithm in a high-order language (HOL) adhering to proper software engineering techniques. Algorithm implementation will reflect the proper selection and use of appropriate data structures.
2. Demonstrate an understanding of the underlying concepts and characteristics of real and conceptual (e.g., Turing) machines as well as the hardware comprising a computer system. This knowledge will include the hardware components and storage techniques of a general Von Neumann machine as well as knowledge concerning the basic concepts of distributed and/or parallel processing. A knowledge of peripheral hardware characteristics/processing will also be acquired.
3. Demonstrate an understanding of software comprising a computer system. This knowledge includes the basic concepts/problems/algorithms inherent in the various system software components (e.g., operating system) and how system software interacts with the hardware to perform the desired functionality.
4. Demonstrate the ability to effectively communicate technical information

both orally and in writing. Students will also be able to use those communication skills to effectively contribute to a team task.

A ***Computer Science major*** is required to take 36 credits in computer science: CPSC 111, 211, 215, 225, 231, 311, 415, 441, 493, 497, a second high order programming language, and one upper division (300 or 400 level) CPSC elective. The major also requires BUED 275 and MATH 212. Students (especially those who plan to do post-graduate study) are also strongly advised to take MATH 231, 232, and 331.

Computer science tracks are available in Cybersecurity and Data Science. The afore-mentioned list of required courses vary slightly in each track.

A ***Computer Science minor*** consists of 18 credits and must include CPSC 111 and 211. The remaining 12 credits may be chosen from any CPSC electives.

Suggested program for Computer Science Major

First Year: CPSC 111, 211; MATH 212; University seminar; BIBL 111, 115; COMM 205; FIN 138; PSYC 138 or substitute; historical inquiry elective; humanities elective.
Second Year: CPSC 215, 225, 231; second higher order programming language; MATH 210; BIBL 116; reading & imagination elective; natural science; minor requirements.
Third Year: CPSC 311, 415, 441; BIBL book study; artistic expression elective; BUED 275; minor requirements; MATH 231, 232.
Fourth Year: CPSC 300/400 elective; CPSC 493, 497; THEO 320; ICST 350; natural science; minor requirements or electives; MATH 331.

Computer Science Courses

CPSC 101: Introduction to Personal Computers (3 cr.) Survey of personal computers and applications. Introduces general computer concepts and terminology with emphasis on using the personal computer as a tool for knowledge workers; Popular software applications examined include word processing, data management, electronic spreadsheets, and computer graphics.

CPSC 111: Introduction to Computer Science (3 cr.) Introduction to the field of computer science, including computer architecture and ethics. Emphasizes the logical operations of a digital computer, problem-solving techniques, development of algorithms, design techniques and structured programming concepts. Topics are taught using the high order language- C++. Proper program design, coding disciplines, documentation, debugging, and testing techniques are also discussed. Cross-listed with CIS 111.

CPSC 142: Java Programming I (3 cr.) Introduction to object-oriented programming using Java. Emphasis is placed on event-driven programming by creating and manipulating objects, classes and creating GUI applications. This is a Prerequisite to CPSC 242 (Java Programming 2). Cross-listed with CIS 142.

CPSC 211: Data Structures (3 cr.) Continuation of CPSC 111with additional and more complex data structures defined at the abstract, application, and implementation levels. Topics include basic concepts of data representation, linear lists,

strings, arrays, linked lists, stacks, queues and tree structures. Also included is the study of algorithms developed in support of these data structures and for searching and sorting. Object-oriented programming is done using the C++ language. Prerequisite: A minimum grade of C in CPSC 111. Cross-listed with CIS 211.

CPSC 215: Assembly Language Programming (3 cr.) Introduction to the internal operation of a computer's machine language. Topics include computer architecture, data representation, storage definition, assembler concepts, and instruction formats in an assembler language. Prerequisite: CPSC 211

CPSC 225: Computer Hardware Organization (3 cr.) Introduction to the organization and structure of the major hardware components in a computer system. Topics include the mechanics of information transfer and control, the fundamentals of logic design, the mechanics and structure of I/O devices, the processor, and main memory. Conceptual machines (deterministic and nondeterministic finite state machines, turning machines, etc. are also examined). Prerequisite: CPSC 211 and MATH 212. Cross-listed with CIS 225.

CPSC 231: Introduction to File Processing (3 cr.) Introduction to the concepts and techniques of structuring data on auxiliary storage devices. Common file organizations such as sequential relative and indexed are examined. Topics include external sort-merges, hashing, indexing, and various search tree manipulations. The physical characteristics of auxiliary storage devices are also examined. Prerequisite: CPSC 211.

CPSC 242: Java Programming II (3cr.) A continuation of CPSC 142 (Java Programming I) exploring advanced topics and data structures with a semester project included. Prerequisite: CPSC 142. Cross-listed with CIS 242.

CPSC 248/448: Special Topics (3 cr.) Topics include specialized areas of computer science not otherwise offered. The student's transcript will show the specific topic covered. A maximum of 9 credits of special topics is allowed.

CPSC 250: Introduction to Cybersecurity (3 cr.) Introduction to, and solid foundation for, computer and network security. Coverage includes basic security principles and standards as well as countermeasures and approaches to meeting computer security requirements. Topics include threat types and characteristics, prevention (user authentication and access control), encryption, and legal and ethical aspects. Various exercises are performed to enhance the student's experience. This course satisfies the recommendations of the ACM/IEEE Computer Science Curricula (specifically, the Information Assurance (IAS) Knowledge Area). Prerequisite: CPSC 111 or programming equivalent. Cross-listed with CIS 250.

CPSC 290/490: Independent Study and Research (1-3 cr.) Independent study in computer science under the direction of a faculty member. Topics are selected from recent developments in computer science. Prerequisite: Permission of the professor.

CPSC 311: Systems Analysis and Design (3 cr.) Explores the techniques of problem definition, determination of system requirements, and design of computer

applications. Topics include development life cycle, cost determination, data requirements, and systems documentation. Various case studies are examined. Prerequisite: Junior or senior standing. Cross-listed with CIS 311.

CPSC 325: Data Communications (3 cr.) Explores data communications, including directly connected devices, local and wide area networks, communication protocols and standards, and network security. Prerequisite: Junior or senior standing. Cross-listed with CIS 325.

CPSC 415: Operating Systems (3 cr.) Overview of operating system concepts, characteristics, and design considerations. Topics include concurrent processes, coordination of asynchronous events, file systems, resource sharing, memory management, scheduling, and deadlock problems. Prerequisite: CPSC 211 and 225

CPSC 435: Artificial Intelligence (3 cr.) Introduction to the field of artificial intelligence (AI), a field of computer science concerned with the computational understanding of intelligent behavior along with the machines/computer programs that exhibit such behavior. Topics include the characteristics of typical AI problems and solutions, knowledge representation, defining a problem as a state space search, and heuristic search techniques. Prerequisites: CPSC 211 and MATH 212.

CPSC 441: Database Management Systems (3 cr.) Database concepts, database design, data models, query language facilities, and data protection considerations and methodologies. Emphasis is on the relational data model, but other database models are examined (e.g., object-oriented). Cross-listed with CIS 441.

CPSC 493: Senior Project (3 cr.) The independent development and implementation of a special project chosen by the student (subject to Instructor approval). Designed to have the student incorporate skills developed through prior courses. Prerequisite: Computer Science major with a minimum of 21 credits in computer science completed.

CPSC 497: Internship (3 cr.) Supervised field experience in Computer Science contributing to the student's professional development. Prior approval must be obtained before internship arrangements are completed. Prerequisites: Computer Science major and consent of a Computer Science faculty member.

Health Care – Nursing

Evangel's Nursing Program is a cooperative effort with Cox College. Participants earn two bachelor's degrees: a B.S. in Health Care from Evangel and a B.S.N. from Cox. This is an all-inclusive, fully accredited, 4-year program. As EU students, they live on campus and participate in Evangel student life. Students complete nursing Prerequisite courses and nearly all Core Curriculum requirements during the first three semesters. During the last five semesters, students take courses in nursing theory and clinical work at Cox, using the clinical facilities of the Cox Health Systems network. When they complete the program, students are eligible to take the NCLEX exam which qualifies them for licensure as Registered Nurses.

Health Care Nursing Program Learning Outcomes. Graduates of the Health Care Nursing program will:

1. Develop understanding of function/structure/classification of human beings and their pathogens
2. Effectively communicate principles of biology through oral means
3. Effectively communicate principles of biology through written means
4. Demonstrate proficiency in laboratory techniques
5. Demonstrate ability to know, analyze, and synthesize scientific principles

Entry into the Cox College nursing program is competitive. Applicants need to meet academic standards in their Prerequisite courses (no grades lower than C and minimum GPA of 3.00) and meet the Math Proficiency requirements (see the *Cox College of Nursing and Health Sciences Catalog* under Math Proficiency).

The Bachelor's degree with a ***major in Health Care*** requires the completion of all nursing course work (approximately 66 credits) as determined by Cox College or another accredited college of nursing for completion of the B.S.N. degree. It also requires the following 19 credits from the Evangel Department of Natural and Applied Sciences: BIOL 211 (4), BIOL 212 (4), BIOL 235 (4), BIOL 360 (3), and CHEM 110 (4). In addition, the EU Core Curriculum requirements must be met. This constitutes a comprehensive major.

A ***Health Care minor*** includes 22 credits as listed (or similar but more rigorous coursework in the same area of study). These courses include BIOL 123 (3), BIOL 211 (4), BIOL 212 (4), BIOL 235 (4), BIOL 360 (3), and CHEM 110 (4).

Suggested Program for Health Care Major

First Year: BIBL 111, 115; BIOL 211, 212, 235; CHEM 110; ENGL 111; GSCI 100; NRSI 205; GOVT 170; PSYC 112; PHIL 115; MATH 124 if needed.
Second Year: PSYC 237; ENGL 205; SOCI 111; BIOL 360; MATH 210; BIBL 116; FIN 138; core curriculum courses; NRSI courses (13 credits).
Third Year: NRSI (27 credits); BIBL 3xx; THEO 320.
Fourth Year: NRSI (26 credits); ICST 350.

Associates Degree in Pre-Nursing

A 2-year Associate of Arts degree in pre-nursing is available for students wishing to complete a nursing degree at another school. See the Associate of Arts Program section of this catalog for a description of the A.A. degree. Also, see the Health Care portion of the Department of Natural and Applied Sciences section of this catalog for a further description of the 4-year B.S.N. nursing program.

The pre-nursing A.A. program provides an opportunity to complete the usual nursing General Education requirements in the distinctive environment of a private Christian university. This program offers enough flexibility for a student to meet the specific requirements of most nursing schools.

Suggested Program for Associate of Arts in Pre-Nursing

First Year: BIOL 123, 211, 212, 235; CHEM 110; PSYC 112; BIBL 111, 115, 116; ENGL 111, MATH 210; ENGL 205; GSCI 100.
Second Year: CPSC 101; GOVT 170; BIOL 360; PHIL 115; PSYC 237; SOCI 111; NRSI 205; COMM 246.

Forensic Science Minor

The 20-credit hour Forensic Science minor is designed to introduce the student to various aspects of criminal cases, using methods from the natural and behavioral sciences to accumulate evidence used in criminal investigations. Forensic science requires coursework in the natural and behavioral sciences: biology, chemistry, criminal justice, and psychology.

Required courses for the ***Forensic Science Minor***: BIOL 101, 124, 211, OR 311/ CHEM 110; CJST 241, 422; PSYC 112, 434; Electives (3-4) from: BIOL 335, CHEM 110, CJST 241, CJST 422; PSYC 434.

Mathematics and Applied Mathematics

The mathematics curriculum offers a variety of mathematics topics to meet the needs of students desiring to teach mathematics, prepare for graduate study in mathematics, or work as a professional mathematician in a field such as actuarial science or data science.

Mathematics Program Learning Outcomes. Graduates of the Mathematics Program will:

1. Demonstrate critical thinking and problem-solving skills to understand, interpret, and solve problems in a variety of mathematical fields.
2. Model real life phenomena and apply mathematical techniques to find solutions.
3. Maintain a core of mathematical and technical knowledge, including software and algorithmic processes necessary in quantitative analysis and mathematical modeling.
4. Demonstrate a solid understanding of rigorous mathematical proof; write clear well-organized and logical mathematical arguments.

The Applied mathematics curriculum provides the application of mathematics to a joint area of interest that prepares a student for a career or graduate study in applied mathematics or the associated discipline. Applied Mathematics degrees are offered in conjunction with Biology, Chemistry, or Physics. The core of the Applied Mathematics program combines a concentration in applied mathematics with a concentration in the associated discipline. See the appropriate sections of the catalog to determine the concentration requirements of the associated discipline.

Applied Mathematics Program Learning Outcomes. Graduates of the Applied Mathematics Program will:

1. Demonstrate critical thinking and problem-based learning skills to understand, interpret, and solve problems.
2. Model mechanical, thermodynamic, and electromagnetic processes and use mathematical methods to solve problems and predict outcomes.
3. Maintain a core of mathematical and technical knowledge, including software and algorithmic processes necessary in quantitative analysis and mathematical modeling.

A ***Mathematics major*** requires 33 credits of mathematics including MATH 231, 232, 233, and 496, and 14 additional upper-division (300 or 400 level) credits in mathematics. CPSC 111 and PHYS 231 or

CHEM 111 are also required. A Mathematics concentration consists of 24 credit hours and must include MATH 232. Besides the basic Mathematics major, there are two mathematics tracks: Actuarial Science and Data Science.

A ***Mathematics minor*** consists of 18 semester credits and must include MATH 232.

Only 200-level courses or higher count toward the major, concentration, and minor.

Mathematics Education majors take MATH 210, 212, 231, 232, 233, 331, 334, 336, 343, 490, 496; and two courses selected from MATH 310, 431, 432, and 442; CPSC 111; PHYS 231 or CHEM 111; and one course in biology.

Students interested in the middle school concentration in Mathematics should refer to the appropriate portions of the Department of Education section of the catalog.

Suggested Program for Mathematics Major

First Year: MATH 231, 232, 210 or 212; CPSC 111; ENGL 111; Biblical studies (6); Electives (8).
Second Year: MATH 233, 210 or 212; CHEM 111 or PHYS 231; Biblical Studies (6); Electives (10).
Third Year: MATH 300/400 (6); Biblical studies (3); Electives (22).
Fourth Year: 300/400 MATH (6); MATH 496; Biblical studies; Electives (21).

Mathematics and Applied Mathematics Courses

MATH 120: Mathematics for Elementary Teachers (2 cr.) Introduces the study of space, planes, and lines with their corresponding figures as sets of points, the beginning of deductive theory, concepts of measurement and of coordinate geometry, and basic statistical concepts. This course does not meet mathematics proficiency for non-teaching majors. Requirements: Elementary Education majors.

MATH 121: Mathematics for Elementary Teachers 2 (3 cr.) Explores the structure of the real number system with an emphasis on the basic concepts and algorithms of addition, subtraction, multiplication, and division. Topics include problem solving, elementary set theory, and number theory. This course does not meet the mathematics proficiency for non-teaching majors. Requirements: Elementary Education majors.

MATH 124: Intermediate Algebra (3 cr.) Explores topics such as properties of real numbers, linear equations and inequalities, polynomials, functional relationships, exponential and logarithmic functions such as sequences and series. Does not count towards the core curriculum mathematics requirement. Prerequisite: One year of high school algebra or equivalent.

MATH 129: Precalculus Algebra (3 cr.) Examines the development of the real number system; algebraic operations; inequalities; linear, quadratic, and polynomial functions and their zeroes; inverse functions; exponential and logarithmic functions; complex numbers; and trigonometry. This course satisfies the mathematics proficiency core curriculum requirement. Prerequisite: Two years of high school algebra or equivalent

MATH 210: Elementary Statistics (3 cr.) Examines descriptive statistics including univariate, bivariate, and multivariate data; binomial and normal probability distributions; and confidence intervals, parametric and non-parametric hypothesis tests. This course also uses a statistical software package such as SPSS. This course satisfies the mathematics proficiency core curriculum requirement.

MATH 212: Discrete Mathematics (3 cr.) Discusses mathematical concepts common to computer science and related fields. Topics include logic, set theory, matrices, linear programming, counting, probability, relations, graph theory, and Boolean algebra.

MATH 231: Calculus I (4 cr.) Discusses the concepts of calculus, including coordinate systems, curve analysis, derivatives and differentials, time-related changes, maxima and minima, integration and related topics. This course satisfies the mathematics proficiency core curriculum requirement.

MATH 232: Calculus II (4 cr.) Continues discussions from MATH 231. Topics include trigonometric, exponential, and inverse functions, techniques of integration, intermediate forms, polar coordinates and infinite series. Prerequisite: Math 231.

MATH 233: Calculus III (4 cr.) Continues discussions from MATH 232. Topics include rectilinear and curvilinear motion, parametric equations, polar coordinates, improper integrals, partial differentiation, and multiple integrals. Prerequisite: Math 232.

MATH 310: Probability and Statistical Inference (3 cr.) Topics covered include descriptive statistics, probability modeling, random variables, sampling distributions, central limit theorem, estimation, and hypothesis testing. Prerequisites: MATH 210 and 232.

MATH 331: Linear Algebra (3 cr.) Discusses vectors, vector spaces, determinants, matrices, systems of linear equations, linear transformations, and related topics. Prerequisite: MATH 232.

MATH 334: Foundations of Geometry (1-3 cr.) Explores geometry from the modern axiomatic viewpoint. Topics include elementary logic with attention to methods of proof and axiomatic systems, Euclidean and Non-Elucidean geometry, and essential content of the course is developed from selected sets of postulates. Prerequisite: MATH 232.

MATH 336: Instructional Methods in Mathematics (1 cr.) Introduces the fundamentals of teaching mathematics in middle school and high school. Requirement: Mathematics education major/Middle School Math Concentration.

MATH 343: Abstract Algebra (3 cr.) Examines the theory of groups, rings, integral domains, fields, and related topics. Prerequisite: MATH 232.

MATH 431: Ordinary Differential Equations (3 cr.) Explores equations of the first, second, and higher order; linear equations with constant coefficients and systems of equations; the Laplace Transform, power series, and other standard methods of solution; introduction to difference and partial differential equations; and applications to physics and engineering. Prerequisite: MATH 233.

MATH 432: Numerical Analysis (3 cr.) Explores polynomial approximations, finite differences, numerical differentiation and integration, methods of least squares, and numerical solutions of differential equations. Prerequisites: CPSC 111, MATH 233, or permission of the professor.

MATH 442: Advanced Calculus (3 cr.) Explores selected topics in advanced calculus. Prerequisite: MATH 233.

MATH 448: Special Topics (3 cr.) This course is available as needed. Topics may include analysis, algebra, geometry, topology, logic, and statistics. Transcript will show specific topic covered. Maximum credit allowed under special topics is 9 credits. Prerequisite: Permission of the professor.

MATH 490: Readings in Mathematics (1-2 cr.) These courses are available as needed. Prerequisite: Permission of the professor

MATH 493: Special Problems (1-3 cr.) This course is available as needed. Prerequisite: Permission of the professor

MATH 496: Mathematics Seminar (1 cr.) Required for all senior mathematics majors. Includes class and individual study of advanced topics in mathematics, both pure and applied.

Nursing (See Health Care)

General Science Courses

GSCI 100: University Seminar (1 cr.) Acclimatizes new Evangel students to the University. Encourages the intellectual and practical orientation to the challenges and opportunities of University life and learning. Students learn about the mission of the University and EU20 themes while learning to build relationships within the department, and by attending campus- wide events.

GSCI 111: Geology (3 cr.) Introduces the physical science behind the processes and materials involved in the creation of the earth's crust and its soil. Topics include minerals, rock types, weathering, erosion, soil characterization, perturbation, mapping, horizonation, and soil classification. May be used to meet the Core Curriculum options. Corequisite: GSCI 111 Laboratory.

GSCI 111: Geology Laboratory (1 cr.) Accompanies GSCI 111 as the laboratory component. Corequisite: GSCI 111 Lecture.

GSCI 112: Meteorology (3 cr.) Introduces the physical processes governing weather events and the resulting pattern of climates developed over the earth's surface. Topics include atmospheric composition, temperature, pressure, humidity, wind, radiation processes, clouds, condensation and precipitation, the hydrologic cycle, atmospheric stability, circulation systems, air masses and fronts, hurricanes, thunderstorms, flash floods, hail, lightning, tornadoes, El Nino, global warming, climate classification, climate change, and seasons of the year. May be used to meet the Core Curriculum options. Corequisite: GSCI 112 Laboratory.

GSCI 112: Meteorology Laboratory (1 cr.) Accompanies GSCI 112 as laboratory component. Corequisite: GSCI 112 Lecture.

GSCI 115: Physical Science (3 cr.) Explores the study of motion and energy. Topics include basic ideas of electricity, phenomena of light and radiation,

elementary thermodynamics, and the structure of matter in terms of atoms and molecules and their nature. May be used to meet the Core Curriculum options.

GSCI 115: Physical Science Laboratory (1 cr.) Accompanies GSCI 115 as the laboratory component. Corequisite: GSCI 115 Lecture.

GSCI 230: History and Philosophy of Science (3 cr.) Explores the history and philosophy of science and their effects on the actual practice of science today. Topics include an explanation of the logic and operation of science. Required by the State of Missouri for secondary science teacher certification. May be used to meet the Core Curriculum options. Cross-listed as PHIL 230.

GSCI 293: Special Topics (1 cr.) This course is available as needed. Prerequisite: Permission of the professor.

GSCI 298: Internship (1 cr.) Provides students with an internship experience in a vocation related to general science under the supervision of both a facility manager and an academic advisor. Prerequisites: Permission of Department Chair. This course is available as needed.

GSCI 313: Astronomy (3 cr.) Introduces our modern view of the universe, its contents and development to non-science majors in a non-mathematical perspective. Topics include stars, galaxies, quasars, black holes, light, optics, and the electromagnetic spectrum.

GSCI 336: Instructional Methods in Science (1 cr.) Discusses methods of teaching science in secondary schools. Prerequisites: Science major and admission to the Teacher Education Program.

GSCI 353: Methods of Teaching Middle School Science (3 cr.) Discusses materials and methods of teaching the science area of specialty in middle school.

GSCI 431: Science for Elementary Teachers (2 cr.) Introduces the prospective teacher to the basic concepts of physical and biological sciences. Topics include collection and organization of science materials for the elementary classroom.

GSCI 432: Practicum in Science for Elementary Teachers (2 cr.) Provides 3 hours per week of practicum experience in the public schools. Corequisite: EDUC 341.

Physical Science Minor

The Department of Natural and Applied Science offers Physical Science courses that fulfill the General Education requirements of students majoring in areas other than science or mathematics. A Physical Science minor of 20 credits may be earned by taking CHEM 111, 112, and PHYS 211, 212, or 231, 232.

Physical Science Program Learning Outcomes. Graduates of the Physical Science Program will:

1. Acquire foundational level of scientific literacy.
2. Develop a mature Christian worldview that integrates faith and science.
3. Deal wisely and ethically with the technological issues facing society.
4. Develop a positive attitude toward science.
5. Make contributions to the church, their profession, and society.

6. Demonstrate readiness for graduate school and/or the chosen professions.
7. Demonstrate critical thinking and problem-based learning skills to understand, interpret, and evaluate scientific hypotheses.
8. Gain experience with working independently as well as part of a team.
9. Demonstrate proficiency using scientific principles in theory and practice (field and laboratory when appropriate).
10. Communicate scientific findings in scientifically standard written and oral formats.
11. Develop a realistic understanding of the various challenges and benefits of science vocations through work studies, internships, or summer research opportunities.

A ***Physical Science minor*** of 20 credits may be earned by taking CHEM 111-112 and PHYS 211-212 or 231-232.

A ***Physics concentration*** of 24 credits and Physics minor of 18 credits are offered. Both programs must include PHYS 231-232. Additional credits may be selected from PHYS 245 (Circuit Analysis), PHYS 342 (Thermodynamics), PHYS 351 (Statics), PHYS 352 (Dynamics), PHYS 411 (Modern Physics), PHYS 412 (Electromagnetism), PHYS 448 (Special Topics), and PHYS 493 (Special Problems). These courses form the basis of an Engineering or Physics degree which can be completed at another institution.

Physics Courses

PHYS 211: General Physics I (4 cr.) Explores college-level physics. Topics include the fundamental principles of mechanics, thermal properties of matter, electromagnetism, optics, and modern physics based on a knowledge of college-level algebra and trigonometry. Designed for majors who do not need calculus-based physics. Corequisite: PHYS 211 Laboratory. Prerequisites: HS or college trigonometry course.

PHYS 211: General Physics Laboratory (1 cr.) Accompanies PHYS 211 as laboratory component. Corequisite: PHYS 211 Lecture.

PHYS 212: General Physics II (4 cr.) Continues discussions from PHYS 211. Topics include the fundamental principles of mechanics, thermal properties of matter, electromagnetism, optics, and modern physics based on a knowledge of college-level algebra and trigonometry. Corequisite: PHYS 212 Laboratory. Prerequisites: HS or college trigonometry course.

PHYS 212: General Physics II Laboratory (1 cr.) Accompanies PHYS 212 as laboratory component. Corequisite: PHYS 212 Lecture.

PHYS 231: Engineering Physics I (4 cr.) Introduces fundamental theories and principles in classical physics of mechanics, thermodynamics, electromagnetism, and optics with an introduction in modern physics based on the knowledge of calculus and vector manipulations. This course is designed for physics and pre-engineering students and majors requesting calculus-based physics. Corequisite: PHYS 231 Laboratory. Prerequisites: MATH 231 and 232. May be taken concurrently with MATH 231 or 232.

PHYS 231: Engineering Physics Laboratory I (1 cr.) Accompanies PHYS

231 as laboratory component. Corequisite: PHYS 231 Lecture

PHYS 232: Engineering Physics II (4 cr.) Continues discussions from PHYS 231. Introduces fundamental theories and principles in classical physics of mechanics, thermodynamics, electromagnetism, and optics with an introduction in modern physics based on the knowledge of calculus and vector manipulations. This course is designed for physics and pre-engineering students and majors requesting calculus-based physics. Corequisite: PHYS 232 Laboratory. Prerequisites: MATH 231 and 232. May be taken concurrently with MATH 231 or 232.

PHYS 232: Engineering Physics II Laboratory (1 cr.) Accompanies PHYS 232 as laboratory component. Corequisite: PHYS 232 Lecture.

PHYS 245: Circuit Analysis (3 cr.) Explains AC and DC circuit components; energy and power; series, parallel, and series-parallel circuits; source conversions, Thevenin, and Norton equivalency; mesh and nodal analysis; RLC circuits and frequency response. Prerequisites: MATH 232 and PHYS 232. May be taken concurrently with MATH 232 and PHYS 232.

PHYS 248/448: Special Topics (1-3 cr.) These courses are available as needed. Topics may include specialized areas of engineering or physics according to student needs and instructor's specialization. Prerequisite: Permission of the professor.

PHYS 293/493: Special Problems (1-3 cr.) These courses are available as needed. Includes independent study or elective work in physics or pre-engineering under the direction of a physics or pre-engineering faculty member. Prerequisite: Permission of the professor.

PHYS 296/496: Physics Seminar (1 cr.) These classes are available as needed.

PHYS 342: Thermodynamics (3 cr.) Introduces fundamentals that lead to advanced work in physics, theoretical chemistry, or engineering. Topics include heat theory, states of matter, and laws of thermodynamics. Prerequisites: MATH 231 and PHYS 232.

PHYS 351: Statics (3 cr.) Introduces fundamentals of statics, vector analysis of forces and moment in two- and three-dimensions, free body diagrams, static equilibrium, moments of inertia, centroids, shearing forces, bending moments, and dynamics. Prerequisites: MATH 233 and PHYS 231.

PHYS 352: Dynamics (3 cr.) Introduces the study of dynamic systems. Topics include motion of a particle; motion of a rigid body; relative motion; kinetics of translation and plane motion; work energy methods; impulse/momentum methods; mechanical vibrations. Prerequisite: MATH 233, PHYS 231 and 351.

PHYS 411: Modern Physics (3 cr.) Discusses physics of atomic particles, including the classical theory and the development of the major modern viewpoints. Prerequisites: MATH 232 and PHYS 232.

PHYS 412: Electromagnetism (3 cr.) Explores calculus and vector approach to electricity and magnetism. Topics include electrostatics, electrical circuits, magnetism, electromagnetic theory, and electromagnetic

waves through the Maxwell equation. Prerequisites: MATH 232 and PHYS 232.

Pre-Engineering Associate of Arts

Evangel University offers an Associate of Arts degree in Pre-engineering as well as a Dual Degree program with any accredited engineering school. The Associate of Arts degree is described elsewhere in this catalog, but the suggested program is given below. After completing the A.A. degree, the student may then transfer to a school of engineering. A student should be qualified to enter the third year of studies in most engineering programs upon completion of the program below:

Suggested Program for Associate of Arts in Pre-Engineering

First Year: BIBL 115, 116; CHEM 111, 112; CPSC 111; MATH 210, 231, 232; GSCI 100.
Second Year: BIBL 116; MATH 233, 431; PHYS 231, 232; ENGL 111; SOCI 111; art, music or theatre (2); GOVT 170.

Dual-Degree Program in Engineering

Evangel University offers a dual degree program whereby a student completes at least 82 credits at Evangel and then graduates from an ABET (Accreditation Board for Engineering and Technology) accredited engineering school. Upon graduation from the engineering school, the student is awarded two diplomas: a Bachelor of Science in either Mathematics or Chemistry from Evangel and an Engineering degree from the second institution. In this program, students can enjoy the benefits and enrichment of both a liberal arts and a professional engineering education, which make them uniquely prepared for a variety of challenging and rewarding career options. Engineering possibilities are limited only by one's choice of the cooperating institution. This program is flexible and can be adjusted to meet the transfer requirements of most engineering schools.

Suggested Program for Dual Degree in Engineering

First Year: BIBL 111, 115; MATH 210, 231, 232.
Second Year: Pre-English Elective; MATH 233, 431; PHYS 231, 232, elective; BIBL 116; Gen Ed (9)
Fifth Semester: HUMN elective; SSCI elective; PHYS elective; BIBL elective.

Pre-Med, Pre-Physician Assistant, Pre-Physical Therapy, Pre- Dental, Pre-Occupational Therapy, Pre-Chiropractic

Evangel University has excellent academic programs for students who wish to pursue careers in medicine, dentistry, veterinary science, or other health-related fields. A 4-year liberal arts degree usually is required for admission to medical or other professional schools. Evangel's General Education courses, along with a major in Biology, Biological Chemistry or Chemistry, meet the requirements for nearly all medical and other professional schools and allow for many career options. Although pre-medical/pre-professional students are free to select almost any major, Biology or Chemistry are highly recommended and

most chosen. Strong competition exists for admission to medical/professional schools, so it is important for a student to obtain proper advising and be well acquainted with the Prerequisites and the application process. Students should attain a minimum 3.0 GPA by the end of the 2nd year (4th semester) to continue as a pre-professional student.

Pre-Pharmacy

The Pre-pharmacy student usually majors in Biological or Chemistry. After completing the undergraduate degree, he or she applies to a school that offers the Doctor of Pharmacy degree (Pharm. D.). Although some variation exists among Doctor of Pharmacy programs, the following list of undergraduate college
Prerequisites represents the requirements of most schools:

English Composition (6), United States Government or History (3), Behavioral Sciences (3), Calculus (4), Biology/Zoology (8), Microbiology (4), Cell Biology (3), General Chemistry (10), Organic Chemistry (10), Quantitative Analysis or Physical Chemistry (4), Biochemistry (4), General Physics (10), Anatomy and Physiology (8).

Many Colleges of Pharmacy also recommend an economics and a computer science course. Because different pharmacy programs have varying admissions requirements, students should work with advisors to determine the requirements of the schools in which they are interested.