

# Department of Science and Mathematics

# Department of Science and Mathematics

## ***Faculty***

### Full-time Faculty

Joseph W. Frentzel, Ph.D.; Department Chair,  
Biological Science Program Director

Nathan S. Bosch, Ph.D.; Director, Lilly Center for Lakes & Streams,  
Environmental Science Program Director

Tobias D. Forshtay, M.B.A.; Sustainable Agriculture Program Director

Ryan T. Johnson, Ph.D.; Mathematics Program Director

Richard C. Roberts, Ph.D.; Pre-Health Professions Coordinator

Tyler D. Scott, Ph.D.; Physical Sciences Program Director

Christina L. Walters, M.S.; Exercise Science Program Director

Huajun Andrew Zhou, Ph.D.

### Part-time Instructors

Donald DeYoung, Ph.D.

Sushree Mohan, M.S.

Marcus Moore, M.S.

Megan Neuhart, B.S.

Shelby Swihart, M.S.

Sarah Harman, M.S.

## ***Purpose***

This Department prepares majors for careers in the life/physical sciences and mathematics, equipping them for education, service, and research in technical fields. Both majors and non-majors are encouraged in their understanding, enjoyment, and stewardship of God's creation.

## ***Department Goals:***

1. Character - Students value a positive, respectful attitude toward science and mathematics.
2. Competence - Students respect confident, unpretentious knowledge of their chosen major field.
3. Service - Students appreciate a heart of sharing.

The Science and Mathematics Department offers coursework and programs in the biological, environmental, mathematical, and physical sciences.

The following majors and minors are offered.

## **Majors**

Actuarial Science (B.S. or B.A.)  
Biology (B.S. or B.A.)  
Chemistry (B.S. or B.A.)  
Environmental Biology (B.S. or B.A.)  
Environmental Science (B.S. or B.A.)  
Environmental Studies (B.S. or B.A.)  
Exercise Science (B.S.)  
General Science (B.S. or B.A.)  
Health Science (B.S. or B.A.)  
Life Science Education (B.S.)  
Mathematics (B.S. or B.A.)  
Mathematics Education—Secondary (B.S. or B.A.)  
Math and Computing (B.S. or B.A.)  
Sustainable Agriculture (B.S.)

## **Minors**

Applied Mathematics  
Biology  
Chemistry  
Environmental Science  
General Science  
Mathematics

These programs are designed to be a part of a liberal arts education at Grace College. Information on general education courses, applied learning, and cross cultural education requirements are described in the general Grace College catalog.

## **STRENGTHS WITHIN THE SCIENCE AND MATHEMATICS DEPARTMENT**

### ***Pre-professional preparation***

The Biology and Health Professions program has considerable strength in biology and chemistry to prepare students for post-baccalaureate studies in science and medicine. This program includes pre-medicine, pre-dentistry, pre-pharmacy, pre-physical therapy, pre-physician assistant, pre-veterinary and others areas of medicine.

### ***Environmental Science***

The Environmental Science program at Grace is committed to equipping future professionals in environmental fields with the skills, competence, experience, and stewardship ethic to excel in caring for God's creation. This program has been designed to emphasize hands-on, field-based learning in addition to classroom instruction.

### ***Exercise Science***

The Grace College Exercise Science program develops Christ followers who apply Biblical values as they prepare for careers in Exercise Science and additional Health and Wellness professions through academic classes and applied learning experiences.

### ***Life Science Education***

The life science education major is designed for students who desire to teach science, particularly biology, at the high school level. This program prepares students in the mainstream areas of modern life science in preparation for a career in either public or private schools.

### ***Mathematics Education***

The mathematics education major provides preparation for careers in high school and middle school mathematics teaching. Students will build a deep understanding of mathematics so that they are prepared to teach math effectively regardless of changing standards. The program begins with a series of required courses, after which students take electives depending on personal interest.

### ***Actuarial Science***

The Actuarial Science major is for students seeking a career as an actuary. Actuaries are interdisciplinary problem solvers who use mathematics, computers, finance, accounting, and economics to help companies and organizations assess risk. Students are prepared for the probability exam in the fall of their sophomore or junior year.

## ***BIOLOGY AND HEALTH PROFESSIONS PROGRAM***

Biology is the study of the science of living organisms from the smallest bacterium to the largest of the great whales. The mission of the biology and health professions program at Grace College is to study biology as a science from the perspective of individuals who believe that all life and life processes are a result of God's creation. We believe that the details of biological structure and function from the molecular to the grand anatomical level display the magnificent design of God the Creator. The key phrases of strengthening character, developing competence, and preparing for service from the mission statement of Grace College drive the mission of the biology and health professions program. While the curriculum for the biology and health science majors is designed to give the student a strong background in the traditional areas of biology, there is parallel emphasis on molecular aspects since modern biology involves extensive study of the molecular and cellular level.

There are several degrees offered within the biology and health professions program: the Bachelor of Arts and Bachelor of Science in Biology, the Bachelor of Arts and Bachelor of Science in Health Science, and the Bachelor of Science in Life Science Education. There is also a minor in biology for those students in other majors desiring biology to accompany their chosen major. Biology majors are required to minor in chemistry and to take supporting physics and math courses. The focus of the biology major at Grace is to prepare students for graduate work in many areas of biology including anatomy, biochemistry, botany, genetics, microbiology, physiology and zoology, as well as providing general preparation for a health professions graduate program. This major also prepares students for a general career in an area of biological science, including laboratory work in medicine or chemistry, environmental careers, technical writing, pharmaceutical sales, or food science. Ecology and environmental biology have their own program of preparation at Grace.

The health science major provides a solid foundation in the biological and physical sciences, and is specifically designed for the pre-professional preparation of students preparing credentials for admission into the professional programs of dentistry, medicine, optometry, pharmacy, physician assistant, physical therapy, veterinary medicine, and other health-related fields. Students should meet with the health professions advisor as early as possible in their studies at Grace to increase the probability of effective and accurate course selection and to understand other facets of preparing to be a successful applicant to their chosen graduate health professions program.

## ***MAJORS AND MINORS IN THE BIOLOGY AND HEALTH PROFESSIONS PROGRAM***

## **BIOLOGY MAJOR**

### ***Bachelor of Science and Bachelor of Arts***

The requirement for a major in biology is 65-66 hours in biology and designated biology-related supporting courses, and includes a required minor in chemistry.

Required Science Courses (40 hours):

- BIO 1610/1620 General Biology I and Lab
- BIO 1710/1720 General Biology II and Lab
- BIO 2110/2120 General Ecology and Lab
- BIO 2310 Biochemistry
- BIO 3110 Cellular & Molecular Biology
- BIO 4210 Genetics
- BIO 4010 Senior Seminar
- CHM 1610/1620 General Chemistry I and Lab
- CHM 1710/1720 General Chemistry II and Lab
- CHM 2610/2620 Organic Chemistry I and Lab
- CHM 2710/2720 Organic Chemistry II and Lab

Students will also choose courses from among the following (15-16 hours):

- BIO 2410/2420 Plant Biology and Lab
- BIO 2510/2520 Animal Biology and Lab
- BIO 3210/3220 Advanced Anatomy & Physiology I and Lab
- BIO 3310/3320 Advanced Anatomy & Physiology II and Lab
- BIO 4110/4120 Microbiology and Lab
- PHY 2140/2150 College Physics I and Lab
- PHY 2160/2170 College Physics II and Lab
- MAT 1230/1240 Calculus I and Lab
- MAT 3200 Probability and Statistics

Other Electives (10 hours):

Choose 10 credits from approved BIO/ENV/SCI/EXS courses, at least one of which must include a lab.

## **HEALTH SCIENCE MAJOR**

### ***Bachelor of Science and Bachelor of Arts***

The requirement for a degree in health science varies, with the core major requiring 48-49 credits, and the concentrations adding 8-18 credits. A minor is not required, but many concentrations include a minor in chemistry.

Required Science Courses (33 hours):

- BIO 1610/1620 General Biology I and Lab
- BIO 1710/1720 General Biology II and Lab
- BIO 2100 Health Sciences Seminar
- CHM 1610/1620 General Chemistry I and Lab
- CHM 1710/1720 General Chemistry II and Lab
- BIO 2110/2120 General Ecology and Lab
- BIO 2310 Biochemistry

BIO 3110 Cellular & Molecular Biology  
BIO 4210 Genetics  
BIO 4010 Senior Seminar

Students will also select courses from among the following (15-16 hours):

Choose two courses:

CHM 2610/2620 Organic Chemistry I and Lab  
CHM 2710/2720 Organic Chemistry II and Lab  
PHY 2140/2150 College Physics I and Lab  
PHY 2160/2170 College Physics II and Lab

Choose one course:

BIO 3210/3220 Advanced Anatomy & Physiology I and Lab  
BIO 3310/3320 Advanced Anatomy & Physiology II and Lab  
BIO 4110/4120 Microbiology and Lab

Choose one course:

MAT 1230/1240 Calculus I and Lab  
MAT 3200 Probability and Statistics

In addition, a health science major must also declare a concentration, which defines course choices and lists additional courses required for professional health science schools in that concentration, or are covered on the entrance examination for that field. Available concentrations include pre-medicine, pre-podiatry, pre-optometry, pre-dental, pre-veterinary, pre-chiropractic, pre-physician's assistant, pre-physical therapy, pre-pharmacy, and pre-occupational therapy.

## ***LIFE SCIENCE EDUCATION MAJOR*** ***Bachelor of Science***

The major in life science education is designed for students desiring to teach science, particularly biology, at the secondary level.

The requirement for a major in life science education is a minimum of 35 hours in the sciences including a minimum of 17 hours of designated biology courses and four hours of general ecology. The major also requires a minimum of 36 hours of designated professional education courses. Students desiring this major must register their intent with the School of Education during their first year of study at Grace to ensure they receive the most recent communications from the School of Education in this ever-changing discipline.

Required Science Courses (35 hours):

SCI 1140 Physical Science Survey  
SCI 1160 Theories of Origins  
BIO 1610/1620 General Biology I and Lab  
BIO 1710/1720 General Biology II and Lab  
CHM 1610/1620 General Chemistry I and Lab  
CHM 1710/1720 General Chemistry II and Lab  
ENV 2110/2120 General Ecology and Lab  
BIO 2310 Biochemistry  
BIO 3110 Cellular & Molecular Biology  
BIO 4210 Genetics

Professional Education Requirements (36 hours):

SED 1000 Teaching School in America

SED 2200 The School Age Child  
SED 2210 Responsive and Differentiated Instruction  
SED 2400 Teaching Exceptional Learners  
SED 2500 Teaching in a Pluralistic Society  
SED 2600 Teaching and Learning  
SED 3600 Teaching in the Middle and High School Setting  
SED 4660 Methods of Teaching Secondary Science  
SED 4700 The Moral Practitioner  
SED 4900 Student Teaching and Seminar

A minor is not required for this major.

NOTE: Course descriptions for SED can be found in the School of Education course listings. MAT 1185 Quantitative Reasoning is the required math course for the additional general education portion of the Bachelor of Science degree.

### ***BIOLOGY MINOR***

The requirement for a minor in biology is 20-21 hours in science.

Required Courses (12 hours):

BIO 1610/1620 General Biology I and Lab  
BIO 1710/1720 General Biology II and Lab  
CHM 1610/1620 General Chemistry I and Lab

Biology Electives (8-9 hours):

BIO 2110/2120 General Ecology and Lab  
BIO 2210 Nutrition  
BIO 2310 Biochemistry  
BIO 2410/2420 Plant Biology and Lab  
BIO 2510/2520 Animal Biology and Lab  
BIO 3110 Cellular & Molecular Biology  
BIO 3210/3220 Advanced Anatomy & Physiology I and Lab  
BIO 3310/3320 Advanced Anatomy & Physiology II and Lab  
BIO 4110/4120 Microbiology and Lab  
BIO 4210 Genetics

### ***ENVIRONMENTAL SCIENCE PROGRAM***

The environmental science program at Grace is committed to equipping future professionals in environmental fields with the skills, competence, experience, and stewardship ethic to excel in caring for God's creation. Requirements for the environmental biology, environmental science, and environmental studies majors as well as individual courses have been designed to emphasize hands-on, field-based learning in addition to classroom instruction. The majors have been intentionally constructed to prepare students desiring immediate employment in an environmental career following their undergraduate graduation from Grace as well as those who plan to go on to graduate school to further their formal education.

### ***Majors and Minors in the Environmental Science Program***

#### ***ENVIRONMENTAL BIOLOGY MAJOR***

### ***Bachelor of Science and Bachelor of Arts***

The requirement to complete a major in environmental biology is 49 hours in ecology, biology, and supporting math courses. A minor in chemistry is also required. The environmental biology major will prepare those students focused on a career in teaching or cutting-edge research with the academic platform necessary to succeed in graduate school.

Required Courses (36 hours):

BIO 1610/1620 General Biology I and Lab  
ENV 2110/2120 General Ecology and Lab

ENV 3210/3220 Aquatic Ecology and Lab  
ENV 3410 Environmental Ethics  
ENV 4010 Senior Seminar  
ENV 4210 Genetics  
ENV 4830 Field Education  
MAT 1230/1240 Calculus I and Lab  
PHY 2140/2150 College Physics I and Lab  
PHY 2160/2170 College Physics II and Lab

Electives (13 hours):

ENV 2410/2420 Plant Biology and Lab  
ENV 2510/2520 Animal Biology and Lab  
ENV 4110/4120 Microbiology and Lab  
ENV 4810 Field Education  
ENV 4820 Field Education  
ENV 4830 Field Education  
ENV 3950 Various Au Sable Institute courses  
MAT 3200 Probability and Statistics  
SCI 1160 Theories on Origins

BIO 1710/1720 General Biology II and Lab

A chemistry minor is required (19 hours):

CHM 1610/1620 General Chemistry I and Lab  
CHM 1710/1720 General Chemistry II and Lab  
CHM 2610/2620 Organic Chemistry I and Lab  
CHM 2710/2720 Organic Chemistry II and Lab  
CHM 3610 Environmental Analytical Chemistry

NOTE: MAT 3200 Probability and Statistics is the required math course for the additional general education portion of the Bachelor of Science degree.

### ***ENVIRONMENTAL SCIENCE MAJOR***

#### ***Bachelor of Science and Bachelor of Arts***

The requirement to complete a major in environmental science is 45 hours in a variety of scientific disciplines. A minor is also required. The environmental science major is designed for those students who want a solid science foundation in order to hit the ground running in an environmental career immediately after college.



Required Courses (38 hours):

PSY 1100 Intro to Psychology  
BIO 1610/1620 General Biology I and Lab  
CHM 1610/1620 General Chemistry I and Lab  
CHM 1710/1720 General Chemistry II and Lab  
POS 2010 Intro to Political Thought  
ENV 2110/2120 General Ecology and Lab  
ENV 3210/3220 Aquatic Ecology and Lab  
CHM 3610 Environmental Analytical Chemistry  
ENV 3410 Environmental Ethics  
ENV 4830 Field Education  
ENV 4020 Senior Seminar

Electives are chosen from the following (at least 7 hours):

SCI 1160 Theories of Origins  
SOC 2140 Social Problems

ENV 2410/2420 Plant Biology and Lab  
ENV 2510/2520 Animal Biology and Lab  
POS 3010 State and Local Government

ENV 4110/4120 Microbiology and Lab  
ENV 4210 Genetics  
ENV 4810 Field Education  
ENV 4820 Field Education  
ENV 4830 Field Education  
Various Au Sable Institute courses

A minor is required to accompany this major.

NOTE: MAT 3200 Probability and Statistics is the required math course for the additional general education portion of the Bachelor of Science degree.

## ***ENVIRONMENTAL STUDIES MAJOR***

### ***Bachelor of Science and Bachelor of Arts***

The requirement to complete a major in environmental studies is 43 hours in a variety of scientific disciplines. A minor is also required. This major replaces some specialized science classes with courses that will provide the student with business and organizational tools. For example, the environmental studies major might be for those students wishing to focus on grass-roots advocacy or not-for-profit organizations.

Required Courses (33 hours):

BIO 1010/1020 Biological Science Survey and Lab  
BUS 1010 Foundations of Business  
CHM 1010/1020 Introduction to Chemistry and Lab  
PSY 1100 Intro to Psychology  
POS 2010 Introduction to Political Thought  
ENV 2110/2120 General Ecology and Lab  
ENV 3210/3220 Aquatic Ecology and Lab

ENV 3410 Environmental Ethics  
ENV 4010 Senior Seminar  
ENV 4830 Field Education

Electives are chosen from the following (at least 10 hours):

GEO 1010 World Geography  
SCI 1160 Theories of Origins  
SOC 2140 Social Problems

POS 2200 Intro to American Government  
ENV 2410/2420 Plant Biology and Lab  
ENV 2510/2520 Animal Biology and Lab  
POS 3010 State and Local Government  
POS 3100 International Relations

GEO 3300 Geography of North America  
CHM 3610 Environmental Analytical Chemistry  
ENV 4110/4120 Microbiology and Lab

ENV 4810-4830 Field Education

A minor is required to accompany this major.

NOTE: MAT 3200 Probability and Statistics is the required math course for the additional general education portion of the Bachelor of Science degree.

### ***ENVIRONMENTAL SCIENCE MINOR***

The requirement for a minor in environmental science is 18 hours in science.

Required Courses (14 hours):

BIO 1010/1020 Biological Science Survey and Lab  
**or** BIO 1610/1620 General Biology I and Lab  
ENV 2110/2120 General Ecology and Lab  
ENV 3210/3220 Aquatic Ecology and Lab  
ENV 3410 Environmental Ethics

Electives are chosen from the following (4 hours):

ENV 2410/2420 Plant Biology and Lab  
ENV 2510/2520 Animal Biology and Lab

### ***EXERCISE SCIENCE PROGRAM***

Exercise science is the study of people in motion. This program incorporates a variety of educational disciplines and proficiencies in human biological studies, assessment and management including human anatomy and physiology, kinesiology, biomechanics, fitness assessment and exercise prescription, nutrition, strength and conditioning, exercise cardiology and physiology, and special attention to injury care and prevention. These proficiencies launch students into practical and effective professional careers. The emphasis of this program is on hands-on learning and skills training to prepare students for their desired professional field. Exercise science majors at Grace will prepare

students for graduate work in various fields including physical therapy, occupational therapy, athletic training, exercise physiology, clinical rehab, and biomechanics. In addition, this major prepares students for general careers in such areas as cardiopulmonary rehab, strength and conditioning, personal training, and coaching. There are two concentrations of study within the major. The first concentration of study is health and wellness and is geared toward the fitness and allied health care professional. The second concentration of study is in pre-physical therapy.

## **EXERCISE SCIENCE MAJOR**

### ***Bachelor of Science***

The requirement for the major in exercise science with a concentration in health and wellness is 71 hours. A major in exercise science with a concentration in pre-physical therapy requires 66 hours and designated supporting courses related to behavioral science. No minor is required.

### **HEALTH & WELLNESS CONCENTRATION**

Exercise Science Foundation (27 hours):

- EXS 1000 Introduction to Exercise Science
- EXS 1050 Dynamics of Fitness
- EXS 2000 Kinesiology
- EXS 2250 Care and Prevention of Injuries
- EXS 3000 Strength and Conditioning
- EXS 3600 Fitness Assessment
- EXS 3750 Exercise Cardiology
- EXS 4180 Exercise Physiology
- EXS 4240 Biomechanics

Science Requirements (19 hours):

- BIO 1610/1620 General Biology I and Lab
- BIO 1710/1720 General Biology II and Lab
- BIO 2210 Nutrition
- BIO 2010/2020 Anatomy & Physiology I and Lab
- BIO 2040/2050 Anatomy & Physiology II and Lab

Behavioral Science Electives – Select any 3 courses prefix: BHS, PSY, or SOC (9 hours):

(Suggested courses listed below)

- PSY 3000 Brain and Behavior
- PSY 3300 Sport Psychology
- PSY 3550 Health Psychology
- PSY 3600 Motivation and Emotion
- SOC 3230 Substance Use and Abuse

Business Electives – Select any 3 courses prefix: BUS, SMT, MKT, FIN, ACC (9 hours):

(Suggested Courses listed below)

- BUS 2430 Principles of Management
- BUS 3260 Small Business Entrepreneurship
- MKT 4030 Services Marketing
- SMT 2050 Risk Management
- EXS 2130 Principles of Coaching

Experiential Learning Requirement (7 hours):

EXS 2150 Practicum in Exercise Science  
EXS 4840 Research in Exercise Science  
EXS 4930 Internship in Exercise Science

No minor is required for this major.

***PRE-PHYSICAL THERAPY CONCENTRATION***

Exercise Science Foundation (24 hours):

EXS 1000 Introduction to Exercise Science  
EXS 1050 Dynamics of Fitness  
EXS 2000 Kinesiology  
EXS 2250 Care and Prevention of Injuries  
EXS 3000 Strength and Conditioning  
EXS 3600 Fitness Assessment  
EXS 4180 Exercise Physiology  
EXS 4240 Biomechanics

Science Requirements (35 hours):

BIO 1610/1620 General Biology I and Lab  
BIO 1710/1720 General Biology II and Lab  
BIO 2210 Nutrition  
BIO 3210/3220 Advanced Anatomy & Physiology I and Lab  
BIO 3310/3320 Advanced Anatomy & Physiology II and Lab  
CHM 1610/1620 General Chemistry I and Lab  
CHM 1710/1720 General Chemistry II and Lab  
PHY 2140/2150 College Physics I and Lab  
PHY 2160/2170 College Physics II and Lab

Experiential Learning Requirement (7 hours):

EXS 2150 Practicum in Exercise Science  
EXS 4840 Research in Exercise Science  
EXS 4930 Internship in Exercise Science

Suggested electives\* - choose 2 from the following (6 hours):

PSY 2170 Abnormal Psychology  
PSY 2360 Child and Adolescent Psychology  
PSY 2280 Life Span Development  
PSY 3300 Sport Psychology  
PSY 3550 Health Psychology  
PSY 3600 Motivation and Emotion  
SOC 3230 Substance Use and Abuse  
SMT 2050 Risk Management  
EXS 2130 Principles of Coaching

No minor is required for this major.

\*Suggested electives are intended to enhance the major, but are not part of the 66 credit hour requirements.

NOTE: Course descriptions for BUS and MKT can be found in the Department of Business course listings. SMT course descriptions can be found in the Department of Sport Management course listings. Course descriptions for BHS, PSY and SOC can be found in the Department of Behavioral Science course listings.

## ***MATHEMATICS PROGRAM***

Mathematics is the language we use to understand God's creation, as well as a necessary skill associated with solving real world problems. The mathematics program is built on four areas of strength: education, pure math, actuarial science, and applied math. The math education - secondary major (B.A. and B.S. degree options) prepares students for a career in teaching. The mathematics major can prepare students for graduate school or be used to fortify studies in other disciplines such as business or science. The math and computing major prepares students for technology related jobs. The actuarial science major prepares students for jobs as an actuary or a statistician. The mathematics program offers a variety of liberal arts and support courses to service other majors.

### ***Liberal Arts Electives***

Every student at Grace College pursuing a Bachelor of Science degree is required to take a math class (certain majors have specific requirements). The mathematics program offers a variety of courses to fit the interests of each student: Quantitative Reasoning, College Algebra, Probability and Statistics, Calculus, etc.

## ***MAJORS AND MINORS IN THE MATHEMATICS PROGRAM***

### ***ACTUARIAL SCIENCE MAJOR***

#### ***Bachelor of Science and Bachelor of Arts***

The actuarial science major equips students for statistics based careers. A total of 44 credit hours in mathematics and information systems courses are required.

Math Requirements (23 hours):

- MAT 1230/1240 Calculus I and Lab
- MAT 1250/1260 Calculus II and Lab
- MAT 2250 Calculus III
- MAT 2280 Differential Equations
- MAT 4200 Probability Theory
- MAT 4320 Mathematical Statistics
- MAT 4020 Senior Seminar in Mathematics

Business Requirements (21 hours):

- ACC 2110 Financial Accounting
- ACC 2120 Managerial Accounting
- BUS 2230 Economics
- BUS 3050 Business Spreadsheet Applications
- FIN 3240 Corporate Finance
- FIN 4610 Advanced Financial Mathematics
- ISM 1150 Introduction to Computer Science

A minor is required for this major.

NOTE: Course descriptions for ACC, BUS, FIN, and ISM can be found in the Department of Business course listings.

## **MATHEMATICS MAJOR**

### ***Bachelor of Science and Bachelor of Arts***

The mathematics major equips students for a broad variety of applications. Students will learn how mathematics is the language we use to describe and predict God's creation. The program places a strong focus on practical problem solving with applications in business and the sciences. A total of 45 credit hours in mathematics, physics, and related courses are required.

Degree Requirements (45 hours):

- ISM 1150 Intro to Computer Science
- MAT 1230/1240 Calculus I and Lab
- MAT 1250/1260 Calculus II and Lab
- MAT 2250 Calculus III
- MAT 2100 Introduction to Proofs
- MAT 2200 Discrete Mathematics
- MAT 2280 Differential Equations
- MAT 3130 Linear Algebra
- MAT 3200 Probability and Statistics
- MAT 4020 Senior Seminar in Mathematics
- PHY 2140/2150 College Physics I and Lab
- Choose 1 of the following:
  - MAT 4140 Abstract Algebra
  - MAT 4280 Real Analysis
- Choose 2 of the following:
  - MAT 3280 College Geometry
  - MAT 3930 Independent Study in Mathematics
  - MAT 4200 Probability Theory
  - MAT 4280 Real Analysis **or** 4140 Abstract Algebra
  - MAT 4320 Mathematical Statistics
  - MAT 4830 Research in Mathematics
- Choose 1 of the following:
  - BUS 3050 Business Spreadsheet Applications
  - ISM 2150 Object-Oriented Programming
  - PHY 2160/2170 College Physics II and Lab

A minor is required for this major.

NOTE: Course descriptions for BUS and ISM can be found in the Department of Business course listings.

## **MATH AND COMPUTING MAJOR**

### ***Bachelor of Science and Bachelor of Arts***

The math and computing major equips students for technology, computer programming and information systems. A total of 44 credit hours in mathematics and information systems courses are required.

Math Requirements (23 hours):

- MAT 1230/1240 Calculus I and Lab
- MAT 1250/1260 Calculus II and Lab

MAT 2250 Calculus III  
MAT 2100 Introduction to Proofs  
MAT 2200 Discrete Mathematics  
MAT 3130 Linear Algebra  
MAT 4020 Senior Seminar in Mathematics

Information Systems Requirements (18 hours):

ISM 1150 Intro to Computer Science  
ISM 2100 Object-Oriented Programming  
ISM 2700 HTML and Web Development  
ISM 3400 Database  
ISM 3500 Data Structures  
One of the following  
ISM 4110 Client Side Programming  
ISM 4120 Server Side Programming  
ISM 3470 Business Information Systems

Elective (3 hours):

One additional course from MAT or ISM at the 3000-level or higher

A minor is required for this major.

NOTE: Course descriptions for ISM can be found in the Department of Business course listings.

## ***MATHEMATICS EDUCATION—SECONDARY MAJOR***

### ***Bachelor of Science and Bachelor of Arts***

The mathematics education major provides preparation for careers in high school and middle school mathematics teaching. It is designed to build a deep understanding of mathematics so that students are prepared to effectively teach math regardless of changing standards. The program begins with a series of required courses, after which students take electives depending on personal interests.

Required Courses (32 hours):

ISM 1150 Introduction to Computer Science  
MAT 1230/1240 Calculus I and Lab  
MAT 1250/1260 Calculus II and Lab  
MAT 2250 Calculus III  
MAT 2100 Introduction to Proofs  
MAT 2200 Discrete Mathematics  
MAT 3130 Linear Algebra  
MAT 3280 College Geometry  
MAT 4020 Senior Seminar in Mathematics  
MAT 4140 Abstract Algebra

Electives - choose 2 of the following (6 hours):

MAT 2280 Differential Equations  
MAT 3380 Number Theory  
MAT 3930 Independent Study in Mathematics  
MAT 4200 Probability Theory  
MAT 4280 Real Analysis

MAT 4320 Mathematical Statistics  
MAT 4830 Research in Mathematics

Professional Education Requirements (36 hours):

SED 1000 Teaching School in America  
SED 2200 The School Age Child  
SED 2210 Responsive and Differentiated Instruction  
SED 2400 Teaching Exceptional Learners  
SED 2500 Teaching in a Pluralistic Society  
SED 2600 Teaching and Learning  
SED 3600 Teaching in the Middle and High School Setting  
SED 4650 Methods of Teaching Secondary Mathematics  
SED 4700 The Moral Practitioner  
SED 4900 Student Teaching and Seminar

A minor is not required for this major.

NOTE: Course descriptions for SED can be found in the School of Education course listings. Course descriptions for ISM can be found in the Department of Business course listings.

### **APPLIED MATHEMATICS MINOR**

The requirement for an applied mathematics minor is 20 hours in mathematics.

Required Courses (17 hours):

MAT 1230/1240 Calculus I and Lab  
MAT 1250/1260 Calculus II and Lab  
MAT 2250 Calculus III  
MAT 2280 Differential Equations  
MAT 3130 Linear Algebra

Electives – choose 1 from the following (3 hours):

MAT 2100 Introduction to Proofs  
MAT 2200 Discrete Mathematics  
MAT 4200 Probability Theory  
MAT 4320 Mathematical Statistics

### **MATHEMATICS MINOR**

The requirement for a mathematics minor is 20 hours in mathematics.

Required Courses (11 hours):

MAT 1230/1240 Calculus I and Lab  
MAT 1250/1260 Calculus II and Lab  
MAT 2100 Introduction to Proofs

Electives – choose 3 from the following (9 hours):

MAT 2200 Discrete Mathematics  
MAT 2250 Calculus III  
MAT 2280 Differential Equations



MAT 3130 Linear Algebra  
MAT 3200 Probability and Statistics  
MAT 3280 College Geometry  
MAT 4140 Abstract Algebra  
MAT 4200 Probability Theory  
MAT 4280 Real Analysis  
MAT 4320 Mathematical Statistics

### ***PHYSICAL SCIENCES PROGRAM***

The purpose of the physical sciences program at Grace College is to present the facts and theories of the physical sciences and to provide laboratory experiences which emphasize scientific methods. The department seeks to help the student appreciate the truths of creation as revealed in the physical sciences. The courses are designed for students who desire broad cultural training, for prospective teachers, and for pre-professional students.

### ***GENERAL SCIENCE MAJOR***

#### ***Bachelor of Science and Bachelor of Arts***

The requirement for a major in general science includes 37-38 hours in a variety of science and math disciplines. The general science major broadly surveys the physical and biological sciences. Students have opportunity to explore in-depth areas of special interest.

Science and Math Requirements (31 hours):

MAT 1230/1240 Calculus I and Lab  
BIO 1610/1620 General Biology I and Lab  
BIO 1710/1720 General Biology II and Lab  
CHM 1610/1620 General Chemistry I and Lab  
CHM 1710/1720 General Chemistry II and Lab  
PHY 2140/2150 College Physics I and Lab  
PHY 2160/2170 College Physics II and Lab  
MAT 4020, BIO 4010, or ENV 4030

Electives – choose 2 of the following (6-7 hours):

ENV 2110/2220 General Ecology and Lab  
SCI 1160 Theories of Origins  
SCI 2360 Introduction to Astronomy  
SCI 2230 Physical Geography  
SCI 2240 Physical Geology

A minor is required to accompany this major.

### ***CHEMISTRY MAJOR***

#### ***Bachelor of Science and Bachelor of Arts***

The requirement for a major in chemistry is 42-44 hours in chemistry and designated supporting courses. A biology minor is required.

Required Chemistry Courses (29 hours):

CHM 1610/1620 General Chemistry I and Lab  
CHM 1710/1720 General Chemistry II and Lab

BIO 2310 Biochemistry  
CHM 2610/2620 Organic Chemistry I and Lab  
CHM 2710/2720 Organic Chemistry II and Lab  
CHM 3610 Environmental Analytical Chemistry  
CHM 4610/4620 Physical Chemistry and Lab  
CHM 4700 Advanced Inorganic Chemistry

Required Physics and Math Courses (12 hours):

PHY 2140/2150 College Physics I and Lab  
PHY 2160/2170 College Physics II and Lab  
MAT 1230/1240 Calculus I and Lab

Choose one of the following (1-3 hours):

CHM 4710-4730 Internship in Chemistry  
CHM 4810-4830 Research in Chemistry

Suggested courses:

MAT 1250/1260 Calculus II and Lab  
CHM 2300 Forensic Chemistry  
CHM 4530 Independent Study in Chemistry: Adv Organic Chemistry

### **CHEMISTRY MINOR**

The requirement for a minor in chemistry is 19 credit hours of selected courses in chemistry. All biology and environmental biology majors are required to complete the chemistry minor.

Required Courses (19 hours):

CHM 1610/1620 General Chemistry I and Lab  
CHM 1710/1720 General Chemistry II and Lab  
CHM 2610/2620 Organic Chemistry I and Lab  
CHM 2710/2720 Organic Chemistry II and Lab

Choose one of the following (3 hours):

BIO 2310 Biochemistry (required for Biology/Health Science majors only)  
CHM 3610 Environmental Analytical Chemistry (required for Environmental program majors only)

### **GENERAL SCIENCE MINOR**

The requirement for a minor in general science is 24 credit hours of courses in biological, environmental, and/or physical science. Choose any courses from biological, environmental or physical science (BIO, ENV, CHM, PHY and SCI course prefixes). Note that some courses have prerequisites.

## **MAJOR IN THE SUSTAINABLE AGRICULTURE PROGRAM**

### **SUSTAINABLE AGRICULTURE MAJOR**

#### **Bachelor of Science**

The requirement for a major in sustainable agriculture is 18 hours in agriculture-related coursework, in addition to 7 internship (experiential learning) hours which places students in agricultural establishments or businesses. Additionally, students majoring in sustainable agriculture will need to

complete 22 credits in biology, chemistry and environmental science in order to provide a solid foundation for understanding agricultural practices and its relationship to the environment.

Required Sustainable Agriculture Courses (25 hours):

- AGR 1000 Introduction to Agriculture and Farm Management
- AGR 2000 Agricultural Economics
- AGR 2100 Conservation in Agriculture
- AGR 3000 Financing the Farm Operation
- AGR 3500 Sustaining the Family Business
- AGR 4700 Agricultural Seminar
- AGR 2900, 2910, 2920 Sustainable Agriculture Internship I-III

Students will also need to complete the following science courses (22 hours):

- BIO 1010/1020 Bioscience Survey and Lab
- CHM 1010/1020 Introduction to Chemistry and Lab
- ENV 2110/2120 General Ecology and Lab
- BIO 2410/2420 Plant Biology and Lab
- BIO 2510/2520 Animal Biology and Lab
- ENV 3410 Environmental Ethics

## **COURSE DESCRIPTIONS**

### **BIOLOGY**

#### **BIO 1010 Biological Science Survey**

A broad overview of living organisms, their structure, function, and relationships to their non-living environment, to each other, and to humans. Special attention is given to cellular biology as it applies to both lower and higher forms of life. Students must enroll concurrently in BIO 1020 Biological Science Survey Laboratory. (Credit will not be given for both BIO 1010 & BIO 1610). Four credit hours.

#### **BIO 1020 Biological Science Survey Laboratory**

The laboratory is designed to support BIO 1010 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

#### **BIO 1200 Medical Terminology**

Students will focus on building core medical vocabulary by analyzing their prefix, suffix, root, connecting and combining forms. Through such analysis, students gain an understanding of the human body's structure, function and diseases. Three credit hours.

#### **BIO 1610 General Biology I**

Principles of structure, function, and cellular organisms. Includes an introduction to the scientific method, characteristics of cytoplasm, and basic cytology, energy acquisition and release and heredity. Also includes basic plant structure and function. Students must enroll concurrently in BIO 1620. Four credit hours.

#### **BIO 1620 General Biology I Laboratory**

The laboratory is designed to support BIO 1610 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

#### **BIO 1710 General Biology II**

A continuation of BIO 1610. Includes structure, function and interrelationships of the organ systems of animals with particular attention to the human body. Also includes introductory taxonomy, surveying the major groups of plants and animals. Prerequisite: BIO 1610 or permission of the instructor. Students must enroll concurrently in BIO 1720. Four credit hours.

#### **BIO 1720 General Biology II Laboratory**

The laboratory is designed to support BIO 1710 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

#### **BIO 2010 Anatomy and Physiology I**

This course is designed for students pursuing a career in an allied health field (nursing, health and wellness, etc.) The class includes the study of basic gross and microscopic anatomy and the function of the body on cellular, tissue, and organ system levels. The class will include organization of the body, cytology, basic histology, and the study of several organ systems – integumentary, skeletal, muscular, nervous, and endocrine. Remaining body systems including – circulatory, respiratory, digestive, urinary, and reproductive to be covered in course BIO 2040. (BIO 2020 is to be taken concurrently). Four credit hours.

**BIO 2020 Anatomy and Physiology I Lab**

The laboratory is designed to support BIO 2010 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

**BIO 2040 Anatomy and Physiology II**

This course is designed for students pursuing a career in an allied health field (nursing, health and wellness, etc.) This course includes a basic study of the gross and microscopic structure of several major organ systems – endocrine, circulatory, respiratory, digestive, urinary, and reproductive. The other body systems including – integumentary, skeletal, muscular, nervous, and endocrine to be covered in course BIO 2010. (BIO 2050 is to be taken concurrently). Four credit hours.

**BIO 2050 Anatomy and Physiology II Lab**

The laboratory is designed to support BIO 2040 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

**BIO 2100 Health Sciences Seminar**

An overview of the health professions, as presented by current practicing medical professionals. Includes occupations ranging from nurse to medical doctor to veterinarian to chiropractor, with many others included. Prerequisite: BIO 1610 and BIO 1710 or consent of the instructor. One credit hour.

**BIO 2110 General Ecology**

A study of the interaction of organisms with their physical environment and with each other. Particular focus will be on application of ecological concepts and field work in various local ecosystems. Students must enroll concurrently in BIO 2120. Four credit hours. (Cross-listed; register as ENV 2110.)

**BIO 2120 General Ecology Lab**

This laboratory is designed to support BIO 2110 and must be taken concurrently with the course. (Cross-listed; register as ENV 2120.) This course has a fee for consumables used in its labs.

**BIO 2210 Nutrition**

Functions and interrelationships of food nutrients throughout the life cycle of man. Includes digestion, absorption and metabolism of nutrients, as well as dietary evaluation and modification for physiological needs. Other areas of study include: role of social, psychological and cultural factors in food selection. Prerequisite: BIO 1610 or consent of the biology program director. Three credit hours.

**BIO 2310 Biochemistry**

A study of the basic composition, function and metabolism of carbohydrates, lipids and proteins. Emphasis is placed on the catalytic function and regulation of enzymes, and on the process of cellular respiration. Some consideration given to the role of nucleic acids in cellular metabolism. The course includes hands-on laboratory experiments involving current procedures in biochemistry. This course has a fee for consumables used in its labs. Prerequisite: CHM 1710 and BIO 1610 or consent of instructor. Three credit hours.

**BIO 2410 Plant Biology**

Integrated study of plants as organisms. Deals with plant structure, physiology, development, genetics, ecology, and classification of major plant groups. Prerequisite: BIO 1610 or consent of the instructor. Students must enroll concurrently in BIO 2420. Four credit hours.

**BIO 2420 Plant Biology Laboratory**

The laboratory is designed to support BIO 2410 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

**BIO 2510 Animal Biology**

Integrated study of animals as organisms. Deals with animal structure, physiology, development, genetics, ecology, and classification of major animal groups. Prerequisite: BIO 1610 or consent of the instructor. Students must enroll concurrently in BIO 2520. Four credit hours.

**BIO 2520 Animal Biology Laboratory**

The laboratory is designed to support BIO 2510 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

**BIO 2700 Introduction to Microbiology**

An organ systems approach to the study of disease-related microorganisms intended for the nursing major. The foundations of microbiology are presented through the lens of disease processes as bacterial, viral and parasitic infections relevant to health professionals are explored. Other course topics include: host-parasite interaction; virulence factors; hospital and community acquired infections; mechanisms of gene transfer; disinfection; antimicrobial drugs; and, immunology. Prerequisite: BIO 1010 and 1020; or, BIO 1610 and 1620; or, BIO 2010 and 2020; or, consent of the instructor. Students must enroll concurrently in BIO 2710. Four credit hours.

**BIO 2710 Introduction to Microbiology Laboratory**

The laboratory is designed to support BIO 2700 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

**BIO 2810-2830 Healthcare Experience**

This course requires 40 hours per credit of active participation in providing healthcare as a trained healthcare worker, during which time the student will better understand the roles in medicine and the art of interacting with patients in a healthcare setting. This could include serving as a Certified Nursing Assistant, Patient Care Technician, Pharmacy Technician, Occupational Therapy or Physical Therapy Aide, etc. Several of these require outside licensing and training that is to be pursued by the student independently. As these are paid occupations, securing employment in such positions is the student's responsibility. If this course is taken more than once, the same occupation and position may be used for subsequent enrollments. Prerequisite: BIO 1610 and BIO 1710; or, consent of the instructor. One to three credit hours.

**BIO 2850 Healthcare Observation**

This course requires 40 hours of shadowing a healthcare professional in the area of the student's desired future occupation, during which time the student will become more familiar with the specifics of the career. Shadowing may require that the student be vetted through the volunteer process of a healthcare facility (may include an application, drug screening and/or health testing, which are the student's responsibility to complete). If this course is taken more than once, a different healthcare professional must be shadowed each time (these may be in the same profession). Prerequisite: BIO 1610 and BIO 1710; or, consent of the instructor. One credit hour.

**BIO 2910-2930 Biology Internship**

This course is designed to award college credit to students who participate in a life science internship. Internship opportunities can range from working alongside zookeepers and wildlife managers to participating in bench science at Q/A and research laboratories. Students must commit to a total of 40 hours per credit at the internship site which can also include the time needed for completing the required internship journal assignments. Students are responsible for providing their own transportation during the duration of the internship opportunity and must complete an off-campus safety training course prior to starting the internship. Prerequisite: BIO 1610 & BIO 1710; or, consent of the instructor. One to three credit hours.

***BIO 3110 Cell and Molecular Biology***

A study of the basic principles that guide cellular composition, organization and function. Particular attention will be paid to understanding the molecular mechanism that underlies cell function. Topics studied in the course include, processes of energy extraction, membrane transport, cell surface communication, cell cycle and regulation, cell division, along with the study of specialized cells like gametes, lymphocytes, neurons, muscle cells, and cancer cells. The course includes hands-on laboratory experiments involving current procedures in cell and molecular biology. This course has a fee for consumables used in its labs. Prerequisite: BIO 1610 and BIO 2310 or consent of the instructor. Three credit hours.

***BIO 3210 Advanced Anatomy and Physiology I***

This course is designed for students preparing for graduate studies in biology/medically related programs (medicine, physical therapy, pharmacy, veterinary medicine, etc.). The class includes an in-depth look at organization of the human body, cytology, histology, and the study of several of the major organ systems – integumentary, skeletal, muscular, nervous, and endocrine. A detailed study of the remaining body systems including – circulatory, respiratory, digestive, urinary, and reproductive to be covered in course BIO 3310. (BIO 3220 is to be taken concurrently). Prerequisites: BIO 1710 and 1720 (or consent of the instructor). Four credit hours.

***BIO 3220 Advanced Anatomy and Physiology I Lab***

The laboratory is designed to support BIO 3210 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

***BIO 3310 Advanced Anatomy and Physiology II***

This course is designed for students preparing for graduate studies in biology/medically related programs (medicine, physical therapy, pharmacy, veterinary medicine, etc.). This course includes an in depth study of the gross and microscopic structure of several major organ systems – endocrine, circulatory, respiratory, digestive, urinary, and reproductive. A detailed study of the other body systems including –integumentary, skeletal, muscular, nervous, and endocrine to be covered in course BIO 3210. (BIO 3320 is to be taken concurrently). Prerequisites: BIO 1710 and 1720 or consent of the instructor. Four credit hours.

***BIO 3320 Advanced Anatomy and Physiology II Lab***

The laboratory is designed to support BIO 3310 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

***BIO 4110 Microbiology***

An introductory study of microorganisms dealing with the morphology, physiology and cultivation and identification of microbes and their role in the environment. Other areas studied include: immunology,

genetics, metabolism, food, preservation, and diseases. Prerequisite: BIO 1610 and BIO 1710 or consent of the instructor. Students must enroll concurrently in BIO 4120. Four credit hours.

***BIO 4120 Microbiology Laboratory***

The laboratory is designed to support BIO 4110 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

***BIO 3810-3830 Readings in Biological Science***

This course is designed to allow the student a more in-depth investigation of a topic of special interest in the areas of biological science. Prerequisite: permission of the individual instructor. One to three credit hours; non-repeatable.

***BIO 3910-3940 Independent Study in Biological Science***

Topics or projects to be chosen and investigated in the areas of biological science in consultation with the individual instructor. Prerequisite: permission of the biology program director. One to four credit hours, non-repeatable.

***BIO 4010 Biology Senior Seminar***

This course is designed as a capstone course for science majors and is meant to teach valuable skills and give experience with tools needed for science careers or post-graduate education. Coursework is designed to challenge the student to integrate their current biological knowledge with a Biblical worldview, as well as to consider their future role as a Christ-follower in the workforce. Prerequisites: BIO 1610, BIO 2310, and senior class standing or consent of the instructor. Three credit hours.

***BIO 4210 Genetics***

A study of both in-depth classical genetics and underlying molecular mechanisms; also genetic mechanisms and processes, recombination, genetic interaction, and gene regulation. The process of expression of genetic information through protein synthesis is also considered in depth. The course includes hands-on laboratory experiments involving current procedures in molecular genetics. This course has a fee for consumables used in its labs. Prerequisites: BIO 1610 and BIO 2310 or consent of the instructor. Three credit hours.

***BIO 4810-4830 Research in Biological Science***

A course designed to give the student an opportunity to do individual research on special problems in biology. Prerequisite: BIO 1610, BIO 1710, and BIO 2310, or consent of the biology program director. One to three credit hours. Maximum of six hours permitted.

***CHEMISTRY***

***CHM 1010 Introduction to Chemistry***

This course is designed to give the student a broad introduction to general, organic, and biological chemistry. The lecture emphasizes general chemical concepts while the laboratory concentrates on techniques and data handling. Students must enroll concurrently in CHM 1020. Four credit hours.

***CHM 1020 Introduction to Chemistry Lab***

Designed to support CHM 1010 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

***CHM 1610 General Chemistry I***



This course is designed to investigate all topics normally found within the American Chemistry Society recommended guidelines (i.e., atomic structure, physical measurements, chemical reactions and balancing equations, percent composition, solubility and precipitation, redox chemistry, gas laws, thermochemistry, quantum chemistry, VSEPR theory, molecular orbital theory, unit cells and unit cell calculation, and intermolecular forces) for a first-semester freshmen chemistry course. Students must enroll concurrently in CHM 1620. Four credit hours.

### ***CHM 1620 General Chemistry I Lab***

General Chemistry I Lab investigates many of the concepts discussed in CHM 1610 and re-enforces the student's applied learning. Must be taken concurrently with CHM 1610. This course has a fee for consumables used in its labs.

### ***CHM 1710 General Chemistry II***

This is the second part of a two-semester sequence in General Chemistry. This course studies and problem solves topics in solution chemistry, chemical kinetics, chemical equilibria, thermodynamics, acid-base equilibria, electrochemistry, and an introduction to organic chemistry. Prerequisite: CHM 1610/1620. Students must enroll concurrently in CHM 1720. Four credit hours.

### ***CHM 1720 General Chemistry II Lab***

General Chemistry II Lab focuses on the van't Hoff factor and its effect on boiling point elevation, chemical kinetics of a combustion reaction, chemical equilibria and reaction rates, synthesis of biodiesel, electrochemical cells, oxidation-reduction, and testing functional groups of organic compounds. Must be taken concurrently with CHM 1710. This course has a fee for consumables used in its labs.

### ***CHM 2300 Forensic Chemistry***

This is a descriptive course covering the wide spectrum of current forensic chemistry and its application in criminal investigations. Drugs, drugs as physical evidence, seized drugs and their analysis, and selected drug classes are investigated. Drugs in the body, and the chemistry of combustion and arson, explosives, and firearms are also covered. Quantitative reasoning is utilized in the form of scientific units (e.g., dosage) and in oxygen balance calculations (i.e., explosives). Discussion boards and documented case studies re-enforce the material covered. Prerequisite: None required. Three credit hours.

### ***CHM 2610 Organic Chemistry I***

This is a first part of a two-semester sequence in organic chemistry. Fundamentals of organic chemistry will be studied which include atomic structure, functional groups, acid-base chemistry, chemical nomenclature, alkane conformations (Newman configurations, chair conformations),  $S_N2/S_N1/E2/E1$  reactions and their mechanisms, alkene reactions and mechanisms, radical reactions and their mechanism and general physical and chemical properties of all organic compounds presented herein. Additionally, FT-IR,  $^1\text{H}$  NMR and  $^{13}\text{C}$  NMR spectroscopy will be investigated along with mass spectrometry. Prerequisite: CHM 1710/1720. Students must enroll concurrently in CHM 2620. Four credit hours.

### ***CHM 2620 Organic Chemistry I Lab***

The lab component will cover essential organic chemistry skills that include (but are not limited to) melting point determination, acid-base extraction, aqueous extraction, thin-layer chromatography, FT-IR,  $^1\text{H}$  NMR and  $^{13}\text{C}$  NMR spectroscopic analysis and synthesis, isolation, purification, and characterization of a complex organic heterocycle. Must be taken concurrently with CHM 2610. This course has a fee for consumables used in its labs.

### ***CHM 2710 Organic Chemistry II***

This is the second part of a two-part sequence in Organic Chemistry. Reactions and mechanisms are covered for alcohols, ketones, aldehydes, carboxylic acids, carboxylic acid derivatives, aromatic EAS and NAS reactions, alpha-carbonyl chemistry, and amine chemistry.  $^1\text{H}$  and  $^{13}\text{C}$  NMR and IR spectroscopy and MS are heavily utilized. Special topics will include amino acid and nucleic acid chemistry. Students must enroll concurrently in CHM 2720. Four credit hours.

### ***CHM 2720 Organic Chemistry II Lab***

This lab course will heavily utilize modern synthetic organic chemistry research techniques and practices such as rotary evaporation, Schlenk glassware, vacuum manifold work, TLC and silica purification techniques, and recrystallization. Purified organic compounds will be analyzed by  $^1\text{H}$  and  $^{13}\text{C}$  NMR and IR spectroscopy using instrument within our department as well as out-sourcing to an external research laboratory. Must be taken concurrently with CHM 2710. This course has a fee for consumables used in its labs.

### ***CHM 3610 Environmental Analytical Chemistry***

This course has two parts: analytical chemistry and environmental chemistry. In the analytical portion of this course the student will be expected to master chemical measurements, experimental error, chemical equilibria, titrations, electrochemistry, and redox titrations. Additionally, the student will be introduced to environmental problems, sustainability, and green chemistry. Topics of interests will include air-pollution, global warming, fossil fuels,  $\text{CO}_2$  emissions, biofuels and renewable energy, water chemistry and water pollution, use and misuse of nuclear energy, heavy metals, and pesticides and the problems they cause. Within the context of environmental challenges, analytical chemical techniques and practices are introduced. The class will investigate the environmental disasters experienced by Chernobyl, the Gulf of Mexico, and Three Mile Island. Statistical data analysis as well as analytical techniques and experiments in acid-base titration, buffer solutions, determining an equilibrium constant, potentiometry, electrochemistry, and liquid chromatography are investigated. Pre-requisites: CHM 1710/1720. Three credit hours. This course has a fee for consumables used in its lecture-based labs.

### ***CHM 3400 Selected Topics in Chemistry***

A course designed to give the student an in-depth study of some specific aspects of chemistry not normally covered in other required courses. Course topics will fluctuate with student needs and interests. Prerequisite: dependent on topic; see instructor. Two credit hours.

### ***CHM 4530 Independent Study in Chemistry: Advanced Organic Chemistry***

This course is designed to offer chemistry and other science majors an option to explore an upper-level advanced organic chemistry experience. This independent study requires the student to investigate and master several advanced organic chemistry topics not covered in the typical two-semester sequence of organic chemistry. The student is also to deliver a defense of his/her knowledge at a scheduled meeting with the professor near the end of the course. The student is expected to pass their defense's content knowledge and problem-solving at 70% or higher. Pre-requisites: CHM 2710/2720. Three credit hours.

### ***CHM 4610 Physical Chemistry***

In this course in physical chemistry, the student will be introduced to a variety of concepts and critical thinking/quantitative problem solving in acceleration, force, pressure, work and energy, the Boltzmann distribution, electromagnetic waves, photons, the perfect equation of state, the Maxwell distribution of speeds, the virial and van der Waals equation of state. Following this introduction, the student will

problem solve a variety of physical chemistry topics that include the molecular interpretation of work, heat, and temperature, heat influx during expansions, internal energy, enthalpy, entropy and the first and second laws of thermodynamics, various entropic calculations, chemical equilibria, electrochemistry, and chemical kinetics. Pre-requisites: CHM 2710/2720. Four credit hours.

***CHM 4620 Physical Chemistry Lab***

Designed to support CHM 4610 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

***CHM 4700 Advanced Inorganic Chemistry***

The goal of this course is to expose the student to advanced topics and problems in inorganic chemistry. This course begins with a review and more in-depth look into inorganic basics of bonding (VSEPR theory, Lewis structures, etc). Symmetry and group theory are also investigated as well as utilizing this work to predict IR and Raman bands for spectroscopic analysis. Molecular orbital theory, degenerate orbitals, homonuclear and heteronuclear diatomic molecular orbital diagrams will be studied, reproduced, and mastered to more fully understand the dual properties of electrons in bonding. Finally, organometallic chemistry, the 18-electron rule, and organometallic mechanisms will be explored to predict and understand reactions with transition metal complexes. Pre-requisites: CHM 2710/2720. Three credit hours.

***CHM 4710-4730 Internship in Chemistry***

This course is designed to provide the chemistry major an opportunity to gain experience in a chemistry lab. The successful student's internship will likely be in the form of a chemistry laboratory technician opportunity found within an industry's R & D (Research & Development) department or QC (quality control), however other positions may also be available. The student is expected to learn the skills needed to successfully work within this internship, grow in their responsibilities, keep all company information private, and leave the internship with a letter of recommendation from the company's human resource department. This internship is not limited to industry. For instance, the student could be a water-quality chemist for our local zoo. One to three credit hours.

***CHM 4810-4830 Research in Chemistry***

A course designed to give the student an opportunity to do individual research in an area of special interest in chemistry. A written report or professional presentation of the results at an external meeting at the regional or national level is required. Prerequisite: consent of the faculty research advisor. This course is designed to train the student in relevant research investigation, problem solving, acquisition of scientific data, library research, and dissemination of research results to a broader public. The student is expected to become a member of a scientific society or academy and promote their science at local and/or regional/national venues. The student is expected to commit 40 hours of research work per credit hour earned. This time commitment is fulfilled through laboratory and out-of-lab requirements. One to three credit hours. This course has a fee for consumables used in its labs.

***ENVIRONMENTAL SCIENCE***

***ENV 2110 General Ecology***

A study of the interaction of organisms with their physical environment and with each other. Particular focus will be on application of ecological concepts and field work in various local ecosystems. Students must enroll concurrently in ENV 2120. Four credit hours.

***ENV 2120 General Ecology Lab***

This laboratory is designed to support ENV 2110 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

***ENV 2410 Plant Biology***

Integrated study of plants as organisms. Deals with plant structure, physiology, development, genetics, ecology, and classification of major plant groups. Prerequisite: BIO 1610 or consent of the instructor. Students must enroll concurrently in ENV 2420. Four credit hours. (Cross-listed; register as BIO 2410.)

***ENV 2420 Plant Biology Laboratory***

The laboratory is designed to support ENV 2410 and must be taken concurrently with the course. (Cross-listed; register as BIO 2420.) This course has a fee for consumables used in its labs.

***ENV 2510 Animal Biology***

Integrated study of animals as organisms. Deals with animal structure, physiology, development, genetics, ecology, and classification of major animal groups. Prerequisite: BIO1610 or consent of the instructor. Students must enroll concurrently in ENV 2520. Four hours. (Cross-listed; register as BIO 2510.)

***ENV 2520 Animal Biology Laboratory***

The laboratory is designed to support ENV 2510 and must be taken concurrently with the course. (Cross-listed; register as BIO 2520.) This course has a fee for consumables used in its labs.

***ENV 3210 Aquatic Ecology***

An overview of physical, chemical, and biological components and their interactions in streams and lakes. Prerequisite: ENV 2110. Students must enroll concurrently in ENV 3220. Four credit hours.

***ENV 3220 Aquatic Ecology Lab***

This laboratory is designed to support ENV 3210 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

***ENV 3410 Environmental Ethics***

An exploratory study of secular and Christian views of the natural world and humanity's place in it. Special attention on practical application of a Biblical stewardship ethic. Prerequisite: 55 credit hours. Three credit hours.

***ENV 4010 Senior Seminar***

This course is designed as a capstone course for science majors and is meant to teach valuable skills and give experience with tools needed for science careers or post-graduate education. Prerequisites: BIO 1610 and senior class standing or consent of the instructor. Three credit hours. (Cross-listed; register as BIO 4010.)

***ENV 4210 Genetics***

A study of both in-depth, classical genetics and underlying molecular mechanisms, genetic

mechanisms and processes, recombination, genetic interaction, and gene regulation. The course includes hands-on laboratory experiments involving current procedures in molecular genetics. Prerequisite: BIO 1610 and BIO 2310 or consent of the instructor. Three credit hours. (Cross-listed; register as BIO 4210.) This course has a fee for consumables used in its labs.

***ENV 4810-4860 Field Education***

Research projects or internships to be chosen in the areas of environmental science and outreach in consultation with the instructor. Prerequisite: permission of the environmental science program director. 1-6 credit hours.

***EXERCISE SCIENCE***

***EXS 1000 Introduction to Exercise Science***

Introduction to Exercise Science is an entry level course that is designed to introduce students to the field of exercise science. This course will prepare students with knowledge and information on related health topics including: the history of exercise science, fitness assessment, nutrition, biology, exercise physiology, biomechanics, physical fitness, career opportunities, and beginning diagnostic tools. Three credit hours. This course has a fee for consumables used in its labs.

***EXS 1050 Dynamics of Fitness***

This course will investigate major topics in the study of lifestyle management. Topics included are: wellness, physical fitness, nutrition, disease, prevention, stress management, and consumerism. Three credit hours.

***EXS 2000 Kinesiology***

This course is designed to guide students in the exploration of human anatomy, functional anatomy, fundamental movements and select movements. This will include an in-depth examination of the musculoskeletal framework through structure, function, and application in sport and exercise. Three credit hours.

***EXS 2130 Principles of Coaching***

This course is focused on providing a practical guide to coaching. The fundamentals needed to build a successful sport, personal training or team/group experience begin with basic principles such as practice planning, team building and program development. This class provides instruction to assist the student in possessing the skills to lead and coach individuals in their specific field. Three Credit Hours. Offered every other year.

***EXS 2150 Practicum in Exercise Science***

A practical experience rotation in real-world settings. Students observe exercise science professionals in their prospective fields, and work on interpersonal skills at rotation settings. Pre-requisite: EXS 1000. Two credit hours.

***EXS 2520 Care and Prevention***

Designed to provide information needed to manage the care of athletic injuries—from prevention, identification and assessment of injuries to interaction with players, parents and physicians. Geared toward those beginning careers in fitness or coaching, equipping them for management and implementation of injury and emergency situations. Prerequisites: EXS 2000 or BIO 1710/1720 or BIO 3210/3220. Three credit hours. This course has a fee for consumables used in its labs.

***EXS 3000 Strength and Conditioning***

Principles of strength and conditioning draws students into a creative design and implementation of exercise for various areas of the body. A large majority of students pursuing careers dealing with exercise will encounter prescription weight training and physical conditioning. This course specifically addresses form, function, and programming for the upcoming professional. Prerequisite: EXS 2000. Three credit hours.

***EXS 3600 Fitness Assessment***

This course prepares students to understand the fundamentals of proper fitness assessment and development of prescriptive exercise. The focus of the course is placed on assessment methodology, developing skills with modern test equipment, and incorporating collected data into exercise programs. Prerequisites: BIO 1710/1720. Three credit hours. This course has a fee for consumables used in its labs.

***EXS 3750 Exercise Cardiology***

The design of the course is geared toward an in-depth study of the anatomy of the heart. Students will engage in assessment and testing of the heart in a resting and active state. An examination of abnormalities found in general, athletic, pediatric, women, and special populations. ECG testing and equipment skills proficiency along with data interpretation will be included as well. Prerequisites: BIO 2010/2020, or BIO 3210/3220. Three credit hours. This course has a fee for consumables used in its labs.

***EXS 4180 Exercise Physiology***

This course examines the structural components of the musculoskeletal, nervous, cardiovascular, respiratory, and endocrine systems. In addition, there is a comprehensive review of the body's response to exercise, optimal work capacity during exercise training, and limitations due to environmental factors, age, sex, and physical health. Prerequisites: BIO 2040/2050 or BIO 3310/3320. Three credit hours. This course has a fee for consumables used in its labs.

***EXS 4240 Biomechanics***

This course introduces concepts of mechanics in relation to human movement, specifically in exercise, sport and physical activity. The primary focus is to gain understanding of mechanical and anatomical principles that control the link between human motion and structural mechanics in coordination with functional mechanisms. Prerequisites: BIO 2040/2050 or BIO 3310/3320. Three credit hours.

***EXS 4840 Research in Exercise Science***

A course designed to give the student an opportunity to do individual research on a topic of interest in Exercise Science. Prerequisites: EXS 1000 and EXS 2150. Two credit hours.

***EXS 4930 Internship in Exercise Science***

The internship includes activity in a work environment, allowing the student to experience a hands-on opportunity to apply the skills and principles learned in class to a real-world, professional setting. Three hours of credit is given and is equivalent to approximately 120 hours in the work-place (or 40 work hours per credit hour). Prerequisites: EXS 1000 and EXS 2150. Three credit hours.

## **MATHEMATICS**

### ***MAT 1110 Mathematics for Elementary School Teachers***

This course investigates a variety of topics necessary for future elementary school teachers. Topics covered include numbers, measurement, probability, statistics, geometry, patterns, spatial relationships, and logic. This is not a methods class; it is a mathematics content class. Prerequisites: 12 credit hours; Basic Algebra and SED 1000. Three credit hours.

### ***MAT 1120 College Algebra***

Topics include algebraic operations, manipulation of functions, polynomial equation solutions, inequalities, logarithms, and exponentials. There will be practice with solving systems of equations, graphing, and algebra applications. Three credit hours.

### ***MAT 1185 Quantitative Reasoning***

This course is designed to build math literacy, which is necessary for informed citizenship, reasoning from evidence, and extracting information from data. Topics include proportional reasoning, math modeling, probability, statistics, and math in politics. The course requires complicated reasoning using elementary mathematics. Three credit hours.

### ***MAT 1230 Calculus I***

This course is a traditional introductory calculus course. We will study functions, limits, derivatives, and integrals. Applications of the derivative and the fundamental theorem of calculus will be particular highlights of this class as well as integrals and derivatives of logarithms and exponential functions. Four credit hours.

### ***MAT 1240 Calculus I Lab***

The laboratory is designed to support MAT 1230 and must be taken concurrently with the course. Zero credit hours. This course has a fee for consumables used in its labs.

### ***MAT 1250 Calculus II***

This course is a continuation of the topics covered in Calculus I. We will study integration techniques, as well as integrals and derivatives of a variety of functions: logarithms, exponential functions, inverse trigonometric functions, and hyperbolic trigonometric functions. We will also study applications of integration, improper Riemann integrals, and L'Hopital's rule for taking limits. Investigating infinite sequences and infinite series will be a highlight of this course. Prerequisites: MAT 1230 or permission of the mathematics program director. Four credit hours.

### ***MAT 1260 Calculus II Lab***

The laboratory is designed to support MAT 1250 and must be taken concurrently with the course. Zero credit hours. This course has a fee for consumables used in its labs.

### ***MAT 2100 Introduction to Proofs***

This course is an introductory course on proofs and emphasizes logic, set theory and proof techniques. Theorems will be taken from topics including set theory, number theory and real analysis. Oral presentations of proofs are required. Prerequisites: none. Three credit hours.

### ***MAT 2220 Discrete Mathematics***

This course is an introduction to discrete mathematics, including combinatorics and graph theory. Topics covered include graph coloring, trees and searching, network flows, network algorithms and complexity analysis, recurrence relations, functions and relations, generating functions, matrices, set

theory, and probability. An emphasis will be on proof by induction. Prerequisite: MAT 2100. Three credit hours.

***MAT 2250 Calculus III***

This course is an investigation of limits, derivatives, and integrals of functions of more than one variable. We will study various applications of calculus, further topics of multivariable calculus, and ways in which calculus interplays with the other mathematical disciplines such as linear algebra, probability theory, and complex analysis. Prerequisites: MAT 1250 or permission of the mathematics program director. Three credit hours.

***MAT 2280 Differential Equations***

A study of differential equations using analytical, numerical and graphical techniques. Emphasis is placed on solving first and second order, and systems of differential equations. Various types of differential equations, their solutions and their applications in physical sciences will be studied. Prerequisite: MAT 2250. Three credit hours.

***MAT 3130 Linear Algebra***

This course builds on the geometric interpretation of vectors and linear equations from Calculus 3 to consider a more abstract view of linear algebra using vector spaces and linear transformations. The history of linear algebra is interspersed throughout the course. Emphasis is placed on real life applications, and technology is used when necessary. Prerequisite: MAT 2250. Three credit hours.

***MAT 3200 Probability and Statistics***

This first course in statistics provides a rigorous introduction to applied statistics. Topics include sampling principles, elementary probability, the normal distribution, hypothesis testing, confidence intervals, inference on numerical and categorical variables, chi-squared, ANOVA, and linear regression. Multiple linear regression and logistic regression will be covered if time permits. Three credit hours.

***MAT 3280 College Geometry***

This course is a thorough investigation of the axioms and theorems of Euclidean geometry. Throughout this course we will also cover several topics in non-Euclidean geometry, symbolic logic, and axiomatic systems in general. This course is designed to thoroughly equip a future high school teacher with the content knowledge needed to successfully teach geometry. Prerequisite: MAT 2100 or permission of the mathematics program director. Three credit hours.

***MAT 3930 Independent Study in Mathematics***

An independent study in mathematics is designed for students who have excelled in several post-calculus classes and have a desire to study a topic that is not currently available in the curriculum. A student wishing to take an independent study will establish a topic to study and seek out a faculty member to whom he or she will be responsible. Once a topic and a faculty member are determined, permission for the independent study must be obtained from the mathematics program director. Independent study in mathematics is a non-repeatable class. Prerequisites: MAT 2250; availability of professor; permission of the mathematics program director. Three credit hours.

***MAT 4020 Senior Seminar in Mathematics***

This is a capstone course for mathematics and mathematics education majors. This course will cover several topics that draw together the various mathematical disciplines, and will portray the global perspective of mainstream mathematics. This course may meet in conjunction with other capstone courses within the science division for a portion of the semester. Prerequisites: declared mathematics or mathematics education major; MAT 2250. Three credit hours.



### ***MAT 4140 Abstract Algebra***

Standard algebra is a study of the arithmetic structure of numbers, and of functions of numbers. There are other objects that we study in mathematics besides numbers, and consequently other arithmetic structures; for example, matrices, functions, and permutations. Modern Algebra is the study of general arithmetic structures, and of functions of these general structures. In this course we study the axioms of group theory and develop the body of theorems associated with these axioms. If time permits, we will also investigate the axioms and theorems of ring theory and field theory. Prerequisite: MAT 2100 or permission of the mathematics program director. Three credit hours.

### ***MAT 4200 Probability Theory***

In this course we study the axioms and theorems of probability theory. We study probability distributions of discrete and continuous random variables, and many of their applications. Throughout this course we will use a significant amount of calculus to develop the theory of probability. Prerequisite: MAT 2250 and MAT 2100 or permission of the mathematics program director. Three credit hours.

### ***MAT 4320 Mathematical Statistics***

This course is the study of multivariable statistics on real data sets. Correlation, hypothesis testing and ANOVA are highlights of this class, which require a significant use of calculus. Prerequisites: MAT 2250, MAT 3200.

### ***MAT 4280 Real Analysis***

Introduction to the fundamental concepts of real analysis. A study of the real number system, limits, sequences, series, convergence, functions, continuity, differentiability, and Riemann integration can all be touched on. Prerequisite: MAT 2100 or permission of the mathematics program director. Three credit hours.

### ***MAT 4830 Research in Mathematics***

Research in mathematics is designed for students who have excelled in several post-calculus classes and have a desire to investigate the fine details of a topic in an attempt to advance the theory with new theorems, new proofs, or new applications. A student wishing to undertake such a research project must do so under the strict supervision of a faculty member and with the permission of the mathematics program director. The supervising faculty member must be willing to invest significant time into helping the student find appropriate resources, ask appropriate research questions, and seek out coherent answers to the questions asked. This course is intended to give students precursory experience into what a graduate thesis experience would be like. Research in mathematics is a non-repeatable class. Prerequisites: MAT 2200; availability of professor; permission of mathematics program director. Three credit hours.

## ***PHYSICS***

### ***PHY 2140 College Physics I***

The first half of a basic course for students of the life sciences, covering the topics of kinematics, dynamics, energy, waves and sound. Prerequisite - One of the following: MAT 1120, MAT 1230/40, ACT Math score of at least 26, SAT Math score of at least 610, passing of department placement exam, or permission of the instructor. Four credit hours.

### ***PHY 2150 College Physics I Lab***

Designed to support PHY 2140 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

**PHY 2160 College Physics II**

The second half of a basic course for students of the life sciences, covering the topics of thermodynamics, properties of matter, electricity, magnetism, light optics, atomic and nuclear physics. Emphasis is on an understanding of the physical principles operative in biological systems and on the application of physical methods in biology and medicine. Prerequisite: PHY 2140/2150. Four credit hours.

**PHY 2170 General Physics II Lab**

Designed to support PHY 2160 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

**PHY 2240 University Physics I**

This is the first half of a two-semester course in calculus-based physics suggested for students in the physical sciences and mathematics. Definitions, concepts, and problem solving will be emphasized. Topics include kinematics, dynamics, energy, conservation laws, rotation, harmonic motion, mechanical waves and thermodynamics. Prerequisite: MAT 1230. Four Credit hours.

**PHY 2250 University Physics I Lab**

Designed to support PHY 2240 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

**PHY 2260 University Physics II**

This is the second half of a two-semester course in calculus-based physics suggested for students in the physical sciences and mathematics. Definitions, concepts, and problem solving will be emphasized. Topics include electricity and magnetism, (electric and magnetic fields, forces, energy, potential, charged particle motion, induction, and circuits), sound waves and optics. Prerequisite: PHY 2240/2250. Four credit hours.

**PHY 2270 University Physics II Lab**

Designed to support PHY 2260 and must be taken concurrently with the course. This course has a fee for consumables used in its labs.

**PHY 4810-4830 Research in Physics**

Designed for research on a topic of interest. One to three credit hours.

**GENERAL SCIENCE**

**SCI 1140 Physical Science Survey**

Activities and lectures will cover motion, energy, gravity, light, radiation, earth materials, and space. Three credit hours.

**SCI 1160 Theories on Origins**

A survey of origin theories with emphasis on creation/evolution. Explores fossils, design, thermodynamics, chronology, flood geology, life in space, and current creation research. Three credit hours.

**SCI 2030 Faith, Science, and Reason**

Faith, Science, and Reason is designed to assist the student in demonstrating the scope and magnitude of science and mathematics: why we study these subjects; knowing the limitations of these subjects; where the Christian fits and operates within the scientific paradigm; how a Christian can incorporate their faith and reason within the scientific enterprise; and how to use it as a productive platform when communicating to those of different worldviews. Three credit hours.

***SCI 3910-3930 Independent Study in Physical Science***

Topics or projects to be chosen and investigated in the areas of physical science in consultation with the individual instructor. Prerequisite: permission of the physical science program director. One to three credit hours, non-repeatable.

***SUSTAINABLE AGRICULTURE***

***AGR 1000 Introduction to Agribusiness & Farm Management***

This course is designed to introduce the student to the world of agriculture related business and the fundamentals of farm management. A series of speakers and field trips to a variety of agriculturally related business will provide real time introduction to the field. Three credit hours.

***AGR 2000 Agricultural Economics***

This course will serve as an overview of the economic theory related to the optimization of food and fiber production. This topic deals with far more than just crop yield including the discussion of food policy, agriculture policy and environmental policy. Prerequisite: AGB 1000 or permission by Instructor. Three credit hours.

***AGR 2100 Conservation in Agriculture***

This course illuminates the significant role of conservation in promoting sustainable agriculture. Topics of natural resource exploration, biodiversity, and labor will contribute to establishing a healthy baseline for conservation in agriculture. Three credit hours.

***AGR 2900 Farm Internship I***

This internship will start in Spring Session B at the beginning of planting phase and carry through the initial stages of the agricultural cycle. Special topics to be covered during the internship will be technology related to the preparation and planting of crops or specialized technology related to the particular operation emphasized by the internship site. One credit hour.

***AGR 2910 Farm Internship II***

This internship will start in Spring Session B at the beginning of planting phase and carry through the initial stages of the agricultural cycle. Special topics to be covered during the internship will be technology related to the preparation and planting of crops or specialized technology related to the particular operation emphasized by the internship site. Two credit hours.

***AGR 2920 Farm Internship III***

This internship will start in Spring Session B at the beginning of planting phase and carry through the initial stages of the agricultural cycle. Special topics to be covered during the internship will be technology related to the preparation and planting of crops or specialized technology related to the particular operation emphasized by the internship site. Three credit hours.

***AGR 3000 Financing the Farm Operation***

This course provides an overview of the financial aspects of running an agricultural business. Topics to be covered will include; land and equipment acquisition, leasing arrangements, hedging and working in commodity markets, and working with financial partners. Prerequisites: ACC 2110 and ACC 2120. Three credit hours.

***AGR 3500 Sustaining the Family Business***

This course will cover topics related to the legal side of running a farm including: leasing, contracts, policy issues and succession planning. The course will also touch on working with family and the dynamic that extra dimension brings to the environment. Prerequisite: AGB 1000 or permission by Instructor. Three credit hours.

***AGR 4700 Agricultural Seminar***

This is the capstone course for the program. Students will be tasked with producing a senior project, developing a business plan for a start-up business in the agricultural industry and presenting the plan to a panel of professionals. Prerequisite: Senior status. Four credit hours.