Department of Physical and Quantitative Sciences

GRACE COLLEGE & GRACE THEOLOGICAL SEMINARY CATALOG 2026-2027

GRACE COLLEGE

Department of Physical and Quantitative Sciences

Faculty

Full-time Faculty

Joseph W. Frentzel, Ph.D.
Dr. Eugene Inman Endowed Chair of Science
Chair, Department of Physical and Quantitative Sciences
Director, Physical Sciences Program

Amy Feaver, Ph.D.

Abiodun Ikotun, Ph.D.
Director, Computer Science Program

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

Christopher Moore, M.S., F.S.A.

Tyler D. Scott, Ph.D.

Part-time Instructors

Donald DeYoung, Ph.D.
Kenneth Kolembe, M.S.
Sushree Mohan, Ph.D.
Charles Wiebe, M.S.

Purpose

This Department prepares majors for careers in the physical sciences, computing 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 – With Christ at the forefront of our thoughts, students come to understand that there are moral implications to how they conduct themselves both personally and professionally.
2. Competence – Students mature into a confident, yet humble understanding of their discipline enabling them to be competitive in the workplace and in graduate programs.
3. Service – Knowing how much God has gifted us, Grace Science and Math students are motivated to serve others with the expectation of receiving nothing in return.

The Physical and Quantitative Sciences Department offers coursework and programs in the computer, environmental, mathematical, and physical sciences.

Majors

Actuarial Science (B.S. or B.A.)
Chemistry (B.S. or B.A.)
Computer Science (B.S.) - 5 concentrations available
General Science (B.S. or B.A.)
Mathematics (B.S. or B.A.)
Mathematics Education—Secondary (B.S. or B.A.)
Medical Imaging (B.S. – 4 different concentrations available; a Grace College degree in partnership with John Patrick University) *

Minors

Applied Mathematics
Chemistry
General Science
Mathematics
Mathematics and Computing

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.
*Additional information regarding our partnership programs is available below in the general descriptions.

STRENGTHS WITHIN THE PHYSICAL AND QUANTITATIVE SCIENCES DEPARTMENT

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.

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.

MEDICAL IMAGING MAJOR

In partnership with John Patrick University

Bachelor of Science

The major in medical imaging is offered in collaboration with John Patrick University (JPU). This technical degree prepares graduates for certification in magnetic resonance imagery (MRI), nuclear medicine, sonography, or computed tomography (CT) subspecialties. Students complete basic science and math courses along with General Education at Grace College with the remaining specialty coursework offered remotely through JPU. Clinical training occurs at one of the nearly 200 medical facilities partnered with this program.

General Education Requirements (45 credits)
Grace Core (39 credits)
Bachelor of Science courses (6 credits), includes:

MAT 1120 College Algebra
SC 1140 Physical Science Survey

Required Grace College courses (22 credits):
BIO 1200 Medical Terminology – excluding CT
BIO 2010/2020 Anatomy & Physiology I and Lab
BIO 2040/2050 Anatomy & Physiology II and Lab
BIO 2700/2710 Introduction to Microbiology - excluding Sonography
BIO 3710 Pathophysiology
CHM 1010/1020 Introduction to Chemistry and Lab
MAT 3200 Probability and Statistics - CT only
PSY 1100 Introduction to Psychology – CT only

Required JPU Core Medical Imaging courses (33 credits): MRI, Nuclear Medicine and CT only
IMA 3010/RS 300 Orientation to Advanced Modalities
IMA 3060/RS 306 Patient Care in Advanced Modalities
IMA3520/BIOL 352 Imaging and Sectional Anatomy
IMA 3125/RS 312 Radiation Physics
IMA 3950/RS 390 Ethics and Law for Advanced Modalities
IMA 3020/RS 302 Radiation Biology and Protection
IMA 3300/MI 330 Leadership and Communication
IMA 3140/RS 314 Pharmacology
IMA 3160/RS 316 Professionalism and Workplace Experience
IMA 4030/RS 403 Professional Practice
IMA 4350/RS 435 Research Methods and Capstone
IMA 4200/RS 420 Clinical Practice I

Concentrations (select one of the following):

Nuclear Medicine (24 credits):
IMA 4020/NM 400 Orientation to Nuclear Medicine
IMA 4700/NM 406 Diagnostic and Therapeutic Procedures I
IMA 4710/NM 407 Diagnostics and Therapeutic Procedures II
IMA 4780/NM 408 Instrumentation, QC and QA
IMA 4145/NM 414 Radiopharmacy and Pharmacology
IMA 4245/NM 424 Radiation Safety in Nuclear Medicine
IMA 4220/NM 421 Clinical Practice II

Magnetic Resonance Imaging / MRI (24 credits):
IMA 3185/RS 318 Productivity & Assessment in Radiation Sciences
IMA 4045/RS 404 Communication and Information Management
IMA 4010/MR 400 Orientation to MRI
IMA 4065/MR 406 MRI Procedures
IMA 4085/MR 408 MRI Instrumentation, Imaging Physics, and Safety
IMA 4130/MR 413 MRI Anatomy and Pathology Correlation

IMA 4140/MR 414 Pulse Sequences, Image Formation and Contrast
IMA 4160/MR 416 Advanced Techniques in MRI

Sonography (60 credits):

IMA 3010/RS300	Orientation to Advanced Modalities
IMA 3950/RS390	Ethics & Law for Advanced Modalities
IMA 2000/US301	Introduction to Sonography
IMA 2150/US303	Patient Care & Professionalism
IMA 3220/US305	Ultrasound Physics
IMA 3130/US322	Abdomen Ultrasound I
IMA 3150/US324	Superficial & Small Parts Ultrasound I
IMA 4050/US330	Gynecological Ultrasound
IMA 3170/US332	OB Ultrasound I
IMA 4720/US390	Clinical A
IMA 3230/US422	Abdomen Ultrasound II
IMA 3880/US360	Vascular Ultrasound I
IMA 3270/US430	OB Ultrasound II
IMA 4730/US394	Clinical B
IMA 3820/US423	Pediatric Ultrasound
IMA 4250/US434	Advanced OBGYN Imaging
IMA 3250/US424	Superficial & Small Parts II
IMA 4740/US494	Clinical C
IMA 4950/US410	Ultrasound Board Review
IMA 4900/US480	Sonography Capstone
IMA 4260/US426	Advanced Abdomen Imaging
IMA 4750/US495	Clinical D

Computed Tomography / CT (44 credits):
Students must also complete the Nuclear Medicine concentration for this degree path

IMA 4000/CT 400 Orientation to Computed Tomography
IMA 4060/CT 406 CT Procedures
IMA 4080/CT 408 CT Instrumentation and Imaging Physics
IMA 4120/CT 412 CT Anatomy and Pathology Correlation
IMA 4240/CT 414 Planar and Volumetric Post-Processing
IMA 4210/CT 421 Clinical Practice I

NOTE: Courses listed for JPU may be subject to change. Course descriptions for JPU courses may be found here. Partnership programs may include additional fees. For more information, please contact the administrator of the Partnership Program at leitchjd@grace.edu or the Biology Program Director. This is a Grace College degree.

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 serve other majors.

Program Learning Outcomes

1. Students will be able to apply what they've learned to solve problems.
2. Students will demonstrate intellectual tenacity, curiosity, intellectual humility, and honor others as image bearers of God (faith integration).
3. Students will be able competently to use mathematical and logical language (applies to math and math education majors).
4. Students will be able to do the mathematics necessary for their respective majors (applies to math and math education majors).
5. Students will demonstrate success in VEE courses (applies to actuarial science majors)
6. Students will pass the P and FM exams (applies to actuarial science majors).

Liberal Arts Electives

Every student at Grace College pursuing a Bachelor of Science degree in a major not under the math program 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, Introduction to Statistics, 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 to become an actuary or pursue another statistics-based career. A total of 49 credits in mathematics, business, and information systems courses are required.

General Education Requirements (45 credits)

Grace Core (39 credits)
Bachelor of Arts or Bachelor of Science courses (6 credits for either)

Math Requirements (25 credits):

MAT 1230/1240 Calculus I and Lab
MAT 1250 Calculus II
MAT 2250 Calculus III
MAT 2280 Differential Equations
MAT 4120 Interest Theory
MAT 4200 Probability Theory
MAT 4320 Mathematical Statistics
MAT 4020 Senior Seminar in Mathematics
MAT 4930 Mathematics Internship

Business Requirements (21 credits):
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
CSI 1151Introduction to Computer Science

A minor is required for this major.

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

COMPUTER SCIENCE MAJOR

Bachelor of Science and Bachelor of Arts

The requirement for a major in Computer Science includes 61 credits in a variety of computing and math disciplines. Specific Computing Science courses are offered online through a partnership with the Lower Cost Models for Independent Colleges Consortium (LCMC). A total of 5 concentrations are offered for students to pursue a more specific area of interest in Computer Science.

General Education Requirements (45 credits)
Grace Core (39 credits)
Bachelor of Arts or Bachelor of Science courses (6 credits for either)

Computing Core (21 credits):
CSI 1120 First-Year Seminar
CSI 1151 Introduction to Computer Science
CSI 2150 Object-Oriented Programming
CSI 2100 Data Structures
CSI 3880 Database Programming
CSI 4200 Application Development Lab

Math Courses (19 credits):
MAT 1230/1240 Calculus 1 and Lab
MAT 1250 Calculus 2
MAT 2200 Discrete Mathematics
MAT 3130 Linear Algebra
MAT 3200 Probability & Statistics
MAT 4020 Math Science Senior Seminar

Computer Science (15 credits):
CSC 4100/COMPS VI Algorithms
CSC 2130/COMPS VII Web Development
CSC 2710/COMPS VIII Modern Technologies
CSC 2720/COMPS XI Software Development
CSC 3720/COMPS XII Computer Systems
CSI 4730 Computer Science Internship

Available Elective Courses:
ISM 2700 HTML & Web Development
ISM 4110 Client-Side Programming
CSC 4140/COMPS XIII Capstone Project
MAT 4830 Research in Mathematics
Any course with CSI or CSC prefix

Concentrations – select one of the following (12 credits):
Concentration 1: General Computer Science
Choose 4 available electives

Concentration 2: Data Analytics
CSI 2240/DSM I Data Science I
CSI 3240/DSM II Data Science II
MAT 4200 Probability Theory
MAT 4320 Mathematical Statistics

Concentration 3: Application Development
CSC 3250/COMPS IX Application Development I
CSC 3350/COMPS X Application Development II
Choose two available electives

Concentration 4: Cybersecurity:
CSC 1070 Introduction to Cybersecurity
CSC 3200 Network and System Security
CSC 2020 Cybercrime & Governance
CSC 3330 Security Operations

Concentration 5: Applied A.I.
CSC 1200/AAI I Introduction to Generative AI
CSC 2420/AAI II How to Get a Job in AI
CSC 2820/AAI III Predictive Modeling in AI
CSC 3620/AAI IV Prescriptive AI

NOTE: Course descriptions for BUS, ACC, and MGT can be found in the Department of Business course listings. CSC and CSM courses are offered via partnership with LCMC and course descriptions can be found here. Additional fees may apply to partnership programs. For more information, please contact the administrator of Partnership Programs at leitchjd@grace.edu.

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 43-44 credits in mathematics, physics, and related courses are required.

General Education Requirements (45 credits)
Grace Core (39 credits)
Bachelor of Arts or Bachelor of Science courses (6 credits for either)

Math and Science Requirements (35 credits):
CSI 1151 Introduction to Computer Science
MAT 1230/1240 Calculus I and Lab
MAT 1250 Calculus II
MAT 2250 Calculus III
MAT 2100 Introduction to Proofs
MAT 2200 Discrete Mathematics
MAT 2280 Differential Equations
MAT 3130 Linear Algebra
MAT 4020 Senior Seminar in Mathematics
PHY 2240/2250 University Physics I and Lab

Electives (12-13 credits):
Choose one of the following:
MAT 4930 Mathematics Internship
MAT 4830 Research in Mathematics

Choose one of the following:
MAT 4140 Abstract Algebra
MAT 4280 Real Analysis

Choose two from the following:
MAT 3280 College Geometry
MAT 3930 Independent Study in Mathematics
MAT 4200 Probability Theory
MAT 4280 Real Analysis
MAT 4140 Abstract Algebra
MAT 4320 Mathematical Statistics

Choose one of the following:
BUS 3050 Business Spreadsheet Applications
CSI 2150 Object-Oriented Programming
PHY 2260/2270 University Physics II and Lab

A minor is required for this major.

NOTE: Course descriptions for BUS 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. A total of 73 credits in mathematics, information systems, and professional education courses are required.

General Education Requirements (45 credits)
Grace Core (39 credits)
Bachelor of Arts or Bachelor of Science courses (6 credits for either)

Required Courses (37 credits):
CSI 1151 Introduction to Computer Science
MAT 1230/1240 Calculus I and Lab
MAT 1250 Calculus II
MAT 2250 Calculus III
MAT 2100 Introduction to Proofs
MAT 2200 Discrete Mathematics
MAT 3130 Linear Algebra
MAT 3200 Probability and Statistics
MAT 3280 College Geometry
MAT 4020 Senior Seminar in Mathematics
MAT 4140 Abstract Algebra
MAT 4280 Real Analysis

Electives - choose one of the following (3 credits):
MAT 2280 Differential Equations
MAT 3930 Independent Study in Mathematics
MAT 4200 Probability Theory
MAT 4320 Mathematical Statistics
MAT 4830 Research in Mathematics

Professional Education Requirements (36 credits):
SED 1000 Teaching School in America
SED 1120 Foundations in Mathematics II
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 3800 Classroom Assessment & Environment
SED 4650 Methods of Teaching Secondary Mathematics
SED 4700 The Moral Practitioner
SED 4900 Student Teaching and Seminar

No minor is required for this major.

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

APPLIED MATHEMATICS MINOR

The requirement for an applied mathematics minor is 19 credits in mathematics.

Required Courses (16 credits):
MAT 1230/1240 Calculus I and Lab
MAT 1250 Calculus II
MAT 2250 Calculus III
MAT 2280 Differential Equations
MAT 3130 Linear Algebra

Electives – choose one of the following (3 credits):
MAT 2100 Introduction to Proofs
MAT 2200 Discrete Mathematics
MAT 4120 Interest Theory
MAT 4200 Probability Theory
MAT 4320 Mathematical Statistics

MATHEMATICS MINOR

The requirement for a mathematics minor is 19 credits in mathematics.

Required Courses (10 credits):
MAT 1230/1240 Calculus I and Lab
MAT 1250 Calculus II
MAT 2100 Introduction to Proofs

Electives – choose from the following (9 credits):
MAT 2200 Discrete Mathematics
MAT 2250 Calculus III
MAT 2280 Differential Equations
MAT 3130 Linear Algebra
MAT 3280 College Geometry
MAT 4120 Interest Theory
MAT 4140 Abstract Algebra
MAT 4200 Probability Theory
MAT 4280 Real Analysis
MAT 4320 Mathematical Statistics

MATHEMATICS AND COMPUTING MINOR

The requirement for a mathematics and computing minor is 30 credits in mathematics.

Mathematics Courses (13 credits):
MAT 1230/40 Calculus 1 and Lab
MAT 1250 Calculus 2
MAT 2250 Calculus 3
MAT 3130 Linear Algebra

Computing Courses (17 credits)
CSI 1120 First-Year Seminar
CSI 1151 Introduction to Computer Science
CSI 2150 Object Oriented Programming
CSI 2100 Data Structures
CSI 3050 Algorithm Analysis
CSI 3880 Database Programming

PHYSICAL SCIENCES PROGRAM

In just six days, God spoke into existence the physical realm. The physical sciences serve to help students unravel the intricacies of the material universe which He created through the application of mathematical laws and scientific principles. Students leverage theoretical knowledge learned in the classroom for solving laboratory exercises which broadly apply to the interests of a diverse array of majors. . The program seeks to help the student appreciate the

truths of creation as revealed by physical form and processes. Courses are designed for students who desire broad cultural training, for prospective teachers, and for pre-professional students. The physical sciences require that students submit to nationally standardized exams to gauge student learning and graduate school readiness.

Program Learning Outcomes

1. Students can use the principles of physical science to solve quantitative/ conceptual problems.

2. Students can use laboratory tools, techniques and computers to analyze and solve physical science problems.

3. Students can utilize chemical literature (Chemistry only).

4. Students can articulate an integration of Christian Faith and physical science.

5. Students are prepared for desired careers through applied learning.

GENERAL SCIENCE MAJOR

Bachelor of Science and Bachelor of Arts

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

General Education Requirements (45 credits)
Grace Core (39 credits)
Bachelor of Arts or Bachelor of Science courses (6 credits for either)

Science and Math Requirements (31 credits):
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

Choose one of the following:
BIO 4010 Senior Seminar in Biology
MAT 4020 Senior Seminar in Mathematics

Electives – choose from the following (6-7 credits):
SCI 1160 Theories of Origins
EXS 2000 Kinesiology
EXS 3760 Exercise Cardiology
EXS 4180 Exercise Physiology
Any BIO, CHM, ENV, PHY, or SCI at 2000 level or above.

Experiential Learning Requirement – choose from the following (3 credits):
BIO 2910-2930 Biology Internship
BIO 4810-4830 Research in Biological Science
CHM 4710-4730 Internship in Chemistry
CHM 4810-4830 Research in Chemistry
ENV 4810-4830 Field Education
PHY 4810-4830 Research in Physics

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 44 credits in chemistry and designated supporting courses. A biology minor is required.

General Education Requirements (45 credits)
Grace Core (39 credits)
Bachelor of Arts or Bachelor of Science courses (6 credits for either)

Required Chemistry Courses (29 credits):
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

Required Math and Physics Courses (12 credits):
MAT 1230/1240 Calculus I and Lab
PHY 2240/2250 University Physics I and Lab
PHY 2260/2270 University Physics II and Lab

Experiential Learning Requirement - choose one of the following (3 credits):
CHM 4730 Internship in Chemistry
CHM 4830 Research in Chemistry

Math Requirement (3 credits):
MAT 1250 Calculus II

Suggested Elective for Graduate School:
CHM 4700 Advanced Inorganic Chemistry
*Suggested courses are intended to provide additional support for the major in chemistry, but are not included in the required 44-47 credits.

CHEMISTRY MINOR

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

Required Courses (16 credits):
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 credits):
BIO 2310 Biochemistry (required for Biology/Health Science majors)
CHM 3610 Environmental Analytical Chemistry (required for Environmental Science majors)

GENERAL SCIENCE MINOR

The requirement for a minor in general science is 24 credits 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.

COURSE DESCRIPTIONS

Some majors, minors, concentrations, and courses are offered online through a consortium of regionally accredited colleges and universities. Instruction is provided by faculty employed by partner institutions within the consortium, with technology and administrative support provided by Rize Education.

Oversight of courses offered through the consortium are reviewed and approved by Grace College and its accreditor. Students register through Grace College and receive academic credit from Grace College.

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 credits.

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. Prerequisite: one year of high school chemistry; minimum of Algebra II completed in high school. Four credits.

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. Students must enroll concurrently in 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 credits.

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. Students must enroll concurrently in CHM 1710. This course has a fee for consumables used in its labs.

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), SN2/SN1/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 H NMR and 13 C NMR spectroscopy will be investigated along with mass spectrometry. Prerequisite: CHM 1710/1720. Students must enroll concurrently in CHM 2620. Four credits.

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, organic chemical properties, distillation, thin-layer chromatography, synthesis, isolation, purification, and characterization of organic compounds. 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}H and ^{13}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. Prerequisite: CHM 2610/2620. Four credits.

CHM 2720 Organic Chemistry II Lab

This lab course will utilize an eco-conscious microchemistry approach for the synthesis and purification of organic compounds. Microchemistry labware kits enable students to perform reflux and condensation reactions using minimal quantities of organic reagents. Students will analyze purified compounds via thin-layer chromatography (TLC), polarimetry, Fourier-transform

infrared spectroscopy (FT-IR) and ^{1}H-NMR and ^{13}H-NMR spectra. 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 interest will include air-pollution, global warming, fossil fuels, CO_2 emissions, biofuels and renewable energy, water chemistry and eater 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 credits. 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 credits.

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-requisite: CHM 2710/2720. Three credits.

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-requisite: CHM 2710/2720. Students must enroll concurrently in CHM 4620. Four credits.

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-requisite: CHM 2710/2720. Three credits.

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 credits

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 earned. This time commitment is fulfilled through laboratory and out-of-lab requirements. One to three credits. This course has a fee for consumables used in its labs.

COMPUTER SCIENCE

CSI 1120 First-Year Seminar
This course is designed to give the student a broad introduction to computer science topics. Two credits.

CSI 1151 Introduction to Computer Science
This course exposes students to essential computer science topics including algorithms and introductory programming concepts including sequence, decision, and assignment and iteration. Three credits.

CSI 2100 Data Structures
Teaches the fundamentals of data structures, their properties, and operations and enables students to efficiently store, access, and modify data in modern software applications. Prerequisite: CSI 2150. Three credits.

CSI 2150 Object Oriented Programming
Students will use an object-oriented programming language to build programs that solve given problems. Prerequisite: CSI 1151. Three credits.

CSI 3880 Database Programming
Students will learn a database language (SQL) and then integrate it into programs that result in data-driven web applications. Prerequisites: CSI 2150. Three credits.

CSI 4200 Application Development Lab
In this course, students will select, design, and develop a software application that solves a real-world problem. Prerequisite: CSI 2100. Three credits.

CSI XXXX Special Topics in Computer Science
Given the dynamic nature of the Computer Science discipline, this course will allow us to offer instruction in cutting-edge information system topics. This course also allows the School of Science and Engineering to offer experimental courses and instructional opportunities. Permission by the Faculty of Record. Three credits.

CSI 4730 Computer Science Internship
Open to qualified junior and senior computer science majors and minors who are employed by cooperating firms to receive training in the organizational use of computer science. Periodic reports and evaluations are submitted by the firm and the student. Prerequisite: Approval by program director. Three credits.

MATHEMATICS

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 credits.

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 credits.

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. Students must enroll concurrently in MAT 1240. Four credits.

MAT 1240 Calculus I Lab
The laboratory is designed to support MAT 1230 and must be taken concurrently with the course.

MAT 1250 Calculus II
This course is a continuation of the topics covered in Calculus 1. 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. Three credits.

MAT 2000 Introduction to Statistics
This course is an introductory course on statistics intended for students in a wide variety of areas of study. Topics discussed include displaying and describing data, the normal curve, simple linear regression, probability, statistical inference, confidence intervals, and hypothesis tests with applications in the real world, especially analyzing data sets using technology. Three credits.

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. Three credits.

MAT 2200 Discrete Mathematics
MAT 2200 Discrete Mathematics
This course is an introduction to discrete mathematics, including combinatorics, mappings of discrete elements, sequences, and graph theory. Topics covered include set theory, counting methods, functions and inverse relations, types of sequences and recurrence relations, trees, coloring, paths and circuits. Prerequisite: MAT 1250 or permission of the mathematics program director. Three credits.

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 credits.

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 credits.

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 credits.

MAT 3200 Probability and Statistics
This 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 credits.

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 credits.

MAT 3930 Independent Study in Mathematics
An independent study in mathematics is designed for students who have excelled in several post-calculus classes and 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, and permission of the mathematics program director. Three credits.

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; and MAT 2250. Three credits.

MAT 4120 Interest Theory
In this course we learn the concepts of financial mathematics, including simple, compound and continuous interest; how to calculate present and accumulated values of cash flow streams, including annuities, loans and bonds; and how to calculate duration and convexity for immunization purposes. Material covered in this course is included on Exam FM/2 of the SOA/CAS. Prerequisite: MAT 1250 or permission of the mathematics program director. Three credits.

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. Abstract 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 credits.

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. Material covered in this course is included on Exam P/1 of the SOA/CAS. Prerequisites: MAT 2250 and MAT 2100, or permission of the mathematics program director. Three credits.

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 credits.

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 and MAT 3200. Three credits.

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, and permission of mathematics program director. Three credits.

MAT 4930 Mathematics Internship
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 credits are given and are equivalent to approximately 120 hours in the work-place (or 40 work hours per credit). Students are responsible for providing their own transportation during the duration of the internship opportunity. Prerequisites: MAT 1230/1240, MAT 1250, and MAT 2250 or consent of the instructor. Three credits.

PHYSICS

PHY 2140 College Physics I
The first half of a basic course 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. Students must enroll concurrently in PHY 2150. Four credits.

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 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. Students must enroll concurrently with PHY 2170. Four credits.

PHY 2170 College 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 1230/1240. Students must enroll concurrently in PHY 2250. Four credits.

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. Students must enroll concurrently in PHY 2270. Four credits.

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 credits.

GENERAL SCIENCE

SCI 1140 Physical Science Survey
Activities and lectures will cover motion, energy, gravity, light, radiation, earth materials, and space. Three credits.

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 credits.

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 credits.

SCI 2240 Physical Geology
A study of the earth, components of the crust, weathering and erosional processes, and mountain building forces. Three credits.

SCI 2360 Introduction to Astronomy
A survey of our created universe: the solar system, types of stars, constellations, and galactic distribution. Emphasis on night observation, laboratory, and individual projects. Three credits.

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 credits; non-repeatable.