Kinesiology, Science & Mathematics
DIVISION

Ronald D. Meyers, M.S.
Division Chair

Understanding human life and its complex internal and external environments as a revealed gift from the creative hand of God is a vital task for the Christian. Even in its fallen condition, the God-sustained creation is worthy of intense study to attempt to unfold His marvelous fundamental principles and intricate interrelationships woven throughout the cosmos. The mathematical and computer sciences explore symbolic representation and logical implications. The physical sciences explore matter and its interactions. The biological sciences explore life and its intricacies. The kinesiological sciences explore human movement and its effects. All of these areas are explored from the overarching theme of stewardship of the marvelous creation entrusted to us. The core requirements in these areas are designed to initiate that stewardship process. Majors and minors are equipped to understand, interact, and glorify God in these areas as that stewardship is enacted.

The division offers majors in Biology, Computer Science, Environmental Biology, Exercise Science, Integrated Science for Teacher Education, Mathematics, Physical Education, and Pre-professional (Pre-Dental, Pre-Medical, Pre-Veterinary). Minors may be taken in Biology, Chemistry, Coaching, Computer Science, General Science, Integrated Science, Mathematics, and Physical Education. Students may also take coursework at AuSable Trails Institute of Environmental Studies (see page 61).

Degrees:

Bachelor of Arts (B.A.)
Bachelor of Science (B.S.)

Majors:

Biology
Biology - Health Sciences Emphasis
Biology (Secondary Ed.)
Computer Science
Environmental Biology
Exercise Science
Integrated Comprehensive Science
(Secondary)
Integrated Science Major
(Elem. & Secondary)
Mathematics
Mathematics (Secondary Ed.)
Physical Education
Pre-professional:
Pre-Dental
Pre-Medical
Pre-Veterinary

Minors:

Biology
Biology (Secondary Ed.)
Coaching
Chemistry
Computer Science
General Science
Integrated Science (Elementary)
Mathematics
(Elementary & Secondary Ed.)
Physical Education
Physics - Secondary Teaching
(in consortium with Calvin College)

Programs:

AuSable Institute

Faculty

Meyers, Ronald D., Associate Professor of Science (1979) (Chair); B.A. (1971), Cedarville College; M.S. (1979), Ohio State University

Atwood, Peter R., Professor of Mathematics (1975); B.S. (1966), Trinity College; M.A. (1968), Princeton University; Ph.D. (2001), Western Michigan University

Crompton, Nigel E.A., Professor of Biology (2002); B.Sc. (1980), Victoria University of Manchester, England; M.Sc. (1982), Victoria University of Manchester, England; PhD. (1987), Justus-Liedig University of Giessen, Germany; D.Sc. (1998), University of Zurich, Switzerland

Fryling, James A., Professor of Chemistry (1997); B.S. (1981) United States Air Force Academy; M.S. (1986), Ph.D. (1990) University of Arizona

Gates, Raymond R., Associate Professor of Biology (1978); B.A. (1973), Spring Arbor University; M.S. (1976), Central Michigan University

Keller, Charles N., Associate Professor of Science (2004); B.A. and B.S. (1976), University of Kansas; Ph.D. (1992), University of Kansas

Keys, Robert S., Assistant Professor of Science (2002); B.A. (1984), Cornerstone University; M.Ed. (1995), Gannon University; Ph.D. (2004), Western Michigan University

Klingensmith, Dionne M., Associate Professor of Kinesiology (2000); B.A. (1991), Adrian College; M.S. (1993), University of Arkansas; Ph.D. (2000), University of Arkansas

Marra, Marty, Assistant Professor of Kinesiology (2005); B.A. (1986), Cornerstone University; B.S., (1987), Calvin College; M.A. (1995), Western Michigan University

Sanford, Julie A., Assistant Professor of Science (2002); B.A. (1985), Cornerstone University; M.En.S. (1988), Miami University

Sprague, Thomas B., Professor of Mathematics (1996); B.S. (1980), Central Michigan University; M.A. (1982), Dallas Theological Seminary; M.A. (1985), Michigan State University; Ph.D. (1990), Western Michigan University

Twietmeyer, T. Alan, Professor of Kinesiology (2002); B.S. (1968), Bemidji State University; M.A. (1974), University of Iowa; PhD. (1976), University of Iowa

Zainea, Kimberly A., Assistant Professor of Kinesiology (1990); B.A. (1988), Cedarville College; M.A. (1990), University of Dayton; Ed.D. (cand.), University of West Virginia

Criteria for Graduation as a Division Major is listed in the Academic Information section under Graduation Requirements.

Degree information for the Bachelor of Arts and Bachelor of Science degrees along with major and minor listings by division can be found in the catalog section entitled Degree Information (see page 74.)

Majors & Minors

BIOLOGY MAJOR (Bachelor of Arts)

General Education Core requirements for the Bachelor of Arts degree are listed in the Degree Information section. Includes SCI-101 Foundations of Scientific Inquiry for Science Majors (see page 74.)

Required Courses		**Credit Hours**
BIO-151	Foundations of Biological Science	4
BIO-225	Botany	4
BIO-233	Zoology	4
BIO-351	Genetics	4
ECO-341	Ecology	4
SCI-380	Internship	3
BIO-400	Biological Perspectives	2
BIO-451	Molecular Cell Biology	4
Electives in Biology (must be upper-level)		4
	Total	33

Required Cognates*

CHM-111	Principles of General Chemistry	4
CHM-112	Principles of Organic and Biochemistry	4
Electives in Mathematics		6
	(Not MAT-096, 107, 110, 211 or 212)	

BIOLOGY MINOR

Required Courses		Credit Hours
BIO-151	Foundations of Biological Sciences	4
BIO-225	Botany	4
BIO-233	Zoology	4
Electives in Biology (must be upper-level)		8
	Total	20

Required Cognate*

CHM-111	Principles of General Chemistry	4

*A cognate is a course that supports the success of completing a major program.

Biology Major for Secondary Teachers Four Year Program Illustration

Freshman year

REL-100	Christian Foundations I	3
ENG-113	Freshman Rhetoric	4
MAT-121	College Algebra	3
or		
MAT-131	Calculus I	4
SCI-101	Found Scientific Inquiry	1
IDS-100	Foundations of Inquiry	2
COM-111	Speech Communication	3
KIN-100	Foundations of Wellness	2
PSY-232	Developmental Psychology	3
BIO-151	Foundations of Bio. Science	4
HIS-113	World Civilization	3
REL-101	Christian Foundations II	3
PHL-211	Introduction to Philosophy	3
Total Freshman Hours (approx.)		34

Sophomore year

EDU-230	Prin. & Phil. of Ed.	3
EDU-231	School Observation Pract.	1
ENG-223	Intro to Literature	3
CHM-111	General Chemistry	4
BIO-225	Botany or	
BIO-241	Anatomy & Physiology I	4
MAT-151	Statistics	3
BIO-233	Zoology	4
CHM-112	Organic & Biochemistry	4
BIO-242	Anatomy & Physiology II	4
(if BIO-241 not taken) or Minor Course		
Total Sophomore Hours (approx.)		33
Foreign Language Requirement		0-8

Junior year

EDU-363	Div. Populations	3
EDU-344	Content Area Literacy	3
EDU-381	Educational Psychology	3
EDU-382	Teacher Assistant Practicum	1
EDU-352	Christian Theology	3
BIO-351	Genetics	4
Minor Course		4
or BIO-225 Botany (if not taken previously)		
XXX	Minor Methods course	3
One of the following:		3
FAR-211	Intro to Fine Arts	
HIS-114	World. Civ. II	
HIS-115	American Studies	
KIN-XXX	Lifetime activity	1
SCI-361	Origins	3
BIO-451	Molecular Cell Biology	4
Total Junior Hours (Approx)		36

Senior year

EDU-262	Computers & Tech. in Edu.	3
SCI-465	Secondary Science Methods	3
ECO-341	Ecology	4
BIO-400	Biological Perspectives	2
EDU-430	Directed Teaching Seminar	3
EDU-484	Secondary Dir. Teaching	12
Minor course and/or elective		3
Total Senior Hours (approx.)		30

BIOLOGY MAJOR FOR SECONDARY TEACHERS (Bachelor of Arts)
General Education Core requirements for the Bachelor of Arts degree are listed in the Degree Information section. Includes SCI-101 Foundations of Scientific Inquiry for Science Majors (see page 74.)

Required Courses		Credit Hours
BIO-151	Foundations of Biological Science	4
BIO-225	Botany	4
One of the following:		4
	BIO-241 Anatomy and Physiology I	
	BIO-242 Anatomy and Physiology II	
BIO-233	Zoology	4
BIO-351	Genetics	4
ECO-341	Ecology	4
SCI-361	Origins	3
BIO-400	Biological Perspectives	2
BIO-451	Molecular Cell Biology	4
	Total	33

Required Cognates*

CHM-111	Principles of General Chemistry	4
CHM-112	Principles of Organic and Biochemistry	4
MAT-151	Statistics	3
SCI-465	Secondary Science Methods	3

*A cognate is a course that supports the success of completing a major program.

BIOLOGY MINOR FOR SECONDARY TEACHERS

Required Courses		Credit Hours
BIO-151	Foundations of Biological Sciences	4
BIO-225	Botany	4
One of the following:		4
	BIO-241 Anatomy and Physiology I	
	BIO-242 Anatomy and Physiology II	
BIO-233	Zoology	4
BIO-341	Ecology	4
	Total	20

Required Cognate*

CHM-111	Principles of General Chemistry	4
SCI-465	Secondary Science Methods	3

*A cognate is a course that supports the success of completing a major program.

BIOLOGY MAJOR (Bachelor of Science)
General Education Core requirements for the Bachelor of Science degree are listed in the Degree Information section. Includes SCI-101 Foundations of Scientific Inquiry for Science Majors (see page 75.)

Program Specific Core Additions:

PHI-211	Introduction to Philosophy	4
One of the following		3
	PSY-111 General Psychology	
	SOC-111 Introduction to Sociology	

Major Requirements

Required Courses		Credit Hours
BIO-151	Foundations of Biological Science	4
BIO-225	Botany	4
BIO-233	Zoology	4
ECO-341	Ecology	4
BIO-351	Genetics	4
BIO-352	Microbiology	4
SCI-361	Origins	3
SCI-380	Internship	3
BIO-400	Biological Perspectives	2
BIO-451	Molecular Cell Biology	4
SCI-495	Senior Research Project & Seminar	2
Electives	BIO, ECO	at least 4
	Total	42

Required Cognates* (Satisfies minor requirement.)

Required Courses		Credit Hours
CHM-121	General Chemistry I	4
CHM-122	General Chemistry II	4
CHM-231	Organic Chemistry I	4
CHM-232	Organic Chemistry II	4
CHM-472	Biochemistry	4
PHY-211	General Physics I	4
PHY-212	General Physics II	4
MAT-151	Statistics	3
One of the following:		3(4)
	MAT-122 Trigonometry	
	MAT-131 Calculus I	
	Total	34(35)

*A cognate is a course that supports the success of completing the major program.

BIOLOGY MAJOR - HEALTH SCIENCES EMPHASIS (Bachelor of Science)
General Education Core requirements for the Bachelor of Science degree are listed in the Degree Information section. Includes SCI-101 Foundations of Scientific Inquiry for Science Majors (see page 75.)

Program Specific Core Additions:

PHI-111	Introduction to Philosophy	4
One of the following		3
PSY-111	General Psychology	
SOC-111	Introduction to Sociology	

Major

Required Courses		**Credit Hours**
BIO-151	Foundations of Biological Science	4
BIO-241	Anatomy and Physiology I	4
BIO-242	Anatomy and Physiology II	4
BIO-233	Zoology	4
BIO-351	Genetics	4
BIO-352	Microbiology	4
SCI-361	Origins	3
SCI-380	Internship	3
BIO-400	Biological Perspectives	2
BIO-451	Molecular Cell Biology	4
SCI-495	Senior Research Project & Seminar	2
Electives	BIO chosen from:	at least 4
BIO-341	Anatomical Kinesiology	
BIO-342	Exercise Physiology	
BIO-343	Biomechanics	
BIO-347	Introduction to Nutrition	
SCI-362	Biomedical Ethics	
SCI-423	Neuroscience	
SCI-480	Advanced Topics	
	Total	42

Required Cognate* (satisfies minor requirement)

Required Courses		**Credit Hours**
CHM-121	General Chemistry I	4
CHM-122	General Chemistry II	4
CHM-230	Organic Chemistry Lab I	2
CHM-231	Organic Chemistry I	3
CHM-232	Organic Chemistry II	3
CHM-233	Organic Chemistry Lab II	2
CHM-472	Biochemistry	4
PHY-211	General Physics I	4
PHY-212	General Physics II	4
MAT-151/ BUS-211	Statistics	3
One of the following:		3(4)
MAT-122	Trigonometry	
MAT-131	Calculus I	
	Total	36(37)

*A cognate is a course that supports the success of completing the major program.

CHEMISTRY MINOR

Required Courses		Credit Hours
CHM-121	General Chemistry I	4
CHM-122	General Chemistry II	4
CHM-411	Perspectives in Chemistry	2
One of the following:		4
CHM-112	Principles of Organic & Biochemistry	
CHM-472	Biochemistry	
Chemistry Electives: (200 level or above)		8
	Total	22

COACHING MINOR

Students enrolled in the Coaching minor must complete their lab science core requirement with BIO-241.

Required Courses		Credit Hours
KIN-231	Principles of Coaching	3
KIN-341	Anatomical Kinesiology	3
KIN-342	Exercise Physiology	4
KIN-362	First Aid and Injury Prevention	3
BIO-242	Anatomy and Physiology II	4
Complete four credits from the following courses:		4
KIN-332	Coaching of Basketball	
KIN-333	Coaching of Track and Field	
KIN-334	Coaching of Soccer	
KIN-335	Coaching of Softball	
KIN-336	Coaching Football	
KIN-337	Coaching of Volleyball	
	Total	21

COMPUTER SCIENCE MAJOR (Bachelor of Arts)

General Education Core requirements for the Bachelor of Arts degree are listed in the Degree Information section (see page 74.)

Required Courses		Credit Hours
CSC-121	Introduction to Programming	4
CSC-151	Hardware and Software Concepts	3
CSC-224	C++ Programming	3
CSC-231	Data Structures and Algorithms	3
CSC-323	C Programming in Unix	3
CSC-325	Database Program Development	3
CSC-332	Systems Analysis	3
CSC-352	Data Communications	3
CSC-380	Internship	3
CSC-451	Theory of Operating Systems (Capstone)	3

Two of the following:. 6

CSC-221 Visual Basic
CSC-222 Introduction to Web Development
CSC-280 Topics in Computing
CSC-421 Programming Languages
CSC-480 Advanced Topics

Total 37

Required Cognate*

(to be completed no later than the Fall semester of the Sophomore year)

Required Courses		**Credit Hours**
One of the following:		3(4)
MAT-121	College Algebra (3)	
MAT-131	Calculus I (4)	

*A cognate is a course that supports the success of completing the major program.

COMPUTER SCIENCE MINOR

Required Courses		**Credit Hours**
CSC-121	Introduction to Programming.	4
CSC-151	Hardware and Software Concepts	3
CSC-231	Data Structures and Algorithms.	3
Four electives from:.		12
CSC-221	Visual BASIC	
CSC-222	Introduction to Web Development	
CSC-280	Topics in Computing	
CSC-224	C++ Programming	
CSC-323	C Programming in Unix	
CSC-325	Database Program Development	
CSC-332	Systems Analysis	
CSC-352	Data Communications	
CSC-431	Applied Software Project	
CSC-451	Theory of Operating Systems	
CSC-470	Advanced Readings	
CSC-480	Advanced Topics	
CSC-490	Independent Study	

Total 22

ENVIRONMENTAL BIOLOGY MAJOR (Bachelor of Science)
General Education Core requirements for the Bachelor of Science degree are listed in the Degree Information section. Includes SCI-101 Foundations of Scientific Inquiry for Science Majors (see page 75.)

Program Specific Core Additions:

Required Courses		Credit Hours
PHI-211	Introduction to Philosophy	3
One of the following:		3
PSY-111	General Psychology	
SOC-111	Introduction to Sociology	

Major:

Required Courses		Credit Hours
BIO-111	Introduction to Biological Sciences	4
BIO-151	Foundations of Biological Sciences	4
BIO-225	Botany	4
BIO-233	Zoology	4
ECO-241	Environmental Science	4
ECO-341	Ecology	4
SCI-380	Internship (Environmental Biology related)	3
BIO 300-400	Electives at Cornerstone University	4
ECO 300-400	Electives at AuSable Institute	8
BIO-400	Biological Perspectives	2
One of the following:		4
BIO-431	Vertebrate Zoology	
ECO-311	AuSable/Field Biology	
ECO-321	AuSable/Animal Zoology	
ECO-322	AuSable/Aquatic Biology	
ECO-342	Field Biology	
ECO-346	AuSable/Winter Stream Ecology	
ECO-442	Advanced Field Studies	
One of the following:		4
BIO-351	Genetics	
BIO-352	Microbiology	
	Total	49

General Science Minor II (required)

Required Courses		Credit Hours
CHM-112	Prin. Of Organic/Biochemistry	4
CHM-121	General Chemistry I	4
CHM-122	General Chemistry II	4
ECO-332	AuSable/Environmental Chem.	4
SCI-262	Geology (or GEOL 216 at AuSable)	4
	Total	20

Required Cognate*

Required Courses		Credit Hours
MAT-151	Statistics	3

One of the following:. 3/4

MAT-121	College Algebra (3)
MAT-131	Calculus I (4)

Total 71/72

*A cognate is a course that supports the success of completing the major program.

AuSable Certificate is strongly recommended from one of the following areas: ·Stewardship Ecologists ·Land Resources Analyst ·Environmental Analyst ·Water Resources Analyst·Naturalist

EXERCISE SCIENCE MAJOR (Bachelor of Science)
General Education Core requirements for the Bachelor of Science degree are listed in the Degree Information section (see page 75.)

Program Specific Core:

Required Courses		**Credit Hours**
Philosophy Course		3
Social Science Course		3
One physical science course from the following:		4
SCI-111	Physical Science	
CHM-111	Principles of General Chemistry	
PHY-211	General Physics I (preferred)	
One of the following:		3
MAT-110	College Math	
MAT-121	College Algebra	
MAT-122	Trigonometry	
MAT-131	Calculus I (4)	
BIO-241	Anatomy and Physiology I	4
BIO-242	Anatomy and Physiology II	4
KIN-341	Anatomical Kinesiology (Prerequisite: BIO-241)	3

Total 24

Major:

Required Courses		**Credit Hours**
MAT-151	Statistics	3
KIN-211	History and Principles of Physical Ed.	3
KIN-251	Motor Development and Learning	3
KIN-342	Exercise Physiology (Prerequisite: BIO-241 & 242) (Recommended: CHM-111)	4
KIN-343	Biomechanics (Prerequisite: BIO-241 & 242, KIN-341) (Recommended: PHY-211 General Physics I)	4
KIN-347	Introduction to Nutrition (Prerequisite: BIO-242)	3
KIN-362	First Aid and Injury Prevention	3
KIN-380	Internship	6
KIN-400	Capstone**	2

Total 31

**Skill and Performance competencies are included in this course and must be initiated as soon as major is declared. Please see the instructor for KIN-461.

GENERAL SCIENCE MINOR

Required Courses	Credit Hours
Two physical science courses (CHM, PHY, SCI designations)	8
Two biological science courses (BIO, ECO designations)	8
One other physical or biological science course	4
Total	20

INTEGRATED SCIENCE MAJOR FOR ELEMENTARY TEACHERS

Required Courses		Credit Hours
Life Sciences:		
BIO-151	Foundations of Biology	4
BIO-233	Zoology	4
BIO-242	Anatomy & Physiology II	4
Physical Sciences:		
CHM-111	Prin. of General Chemistry	4
PHY-211	General Physics I	4
SCI-111	Physical Science	4
Earth/Space Science:		
ECO-241	Environmental Science	4
SCI-261	Astronomy	4
SCI-262	Geology	4
SCI-263	Atmosphere & Weather	2
SCI-400	Integrated Science Capstone	2
	Total	40

INTEGRATED SCIENCE MINOR FOR ELEMENTARY TEACHERS

Required Courses		Credit Hours
Life Sciences:		
BIO-151	Foundations of Biology	4
ECO-241	Environmental Science	4
Physical Sciences:		
CHM-111	Prin. of General Chemistry	4
SCI-111	Physical Science	4
Earth/Space Science:		
SCI-261	Astronomy	4
SCI-262	Geology	4
SCI-263	Atmosphere & Weather	2
SCI-400	Integrated Science Capstone	2
	Total	28

INTEGRATED SCIENCE MAJOR FOR SECONDARY TEACHERS

Required Courses		Credit Hours
Life Sciences:		
BIO-151	Foundations of Biology	4
BIO-233	Zoology	4
BIO-351	Genetics	4
Physical Sciences:		
CHM-111	Prin. of General Chemistry	4
CHM-112	Prin. of Organic & Biochemistry	4
PHY-211	General Physics I	4
Earth/Space Science:		
SCI-261	Astronomy	4
SCI-262	Geology	4
SCI-263	Atmosphere & Weather	2
Comprehensive:		
ECO-241	Environmental Science	4
SCI-361	Origins	3
SCI-400	Integrated Science Capstone	2
	Total	43

INTEGRATED SCIENCE GROUP MINOR

Not available under the new standards for Secondary Endorsement

INTEGRATED COMPREHENSIVE SCIENCE FOR SECONDARY TEACHERS

(Does not require minor)

Required Courses		Credit Hours
Life Sciences:		
BIO-151	Foundations of Biology	4
BIO-225	Botany	4
BIO-233	Zoology	4
BIO-351	Genetics	4
Physical Sciences:		
CHM-111	Principles of General Chemistry	4
CHM-112	Principles of Organic & Biochemistry	4
PHY-211	General Physics I	4
PHY-212	General Physics II	4
Earth/Space Science:		
ECO-241	Environmental Science	4
SCI-261	Astronomy	4
SCI-262	Geology	4
SCI-263	Atmosphere & Weather	2
Comprehensive:		
SCI-361	Origins	3
SCI-400	Integrated Science Capstone	2
	Total	51

MATHEMATICS MAJOR (Bachelor of Arts)

General Education Core requirements for the Bachelor of Arts degree are listed in the Degree Information section (see page 74.)

Required Courses		Credit Hours
MAT-131	Calculus I	4
MAT-132	Calculus II	4
MAT-233	Differential Equations	3
MAT-234	Multivariate Calculus	3
MAT-241	Applied Linear Algebra	3
MAT-245	Mathematical Proofs	3
MAT-252	Computer Statistics	3
MAT-333	Real Analysis	3
MAT-341	Modern Algebra	3
MAT-380	Internship	3
MAT-400	History of the Mathematical Sciences	3
	Total	35

Required Cognate*

Required Course		Credit Hours
CSC-121	Introduction to Programming	4

*A cognate is a course that supports the success of completing the major program.

MATHEMATICS MAJOR FOR SECONDARY TEACHERS (Bachelor of Arts)

General Education Core requirements for the Bachelor of Arts degree are listed in the Degree Information section (see page 74.)

Required Courses		Credit Hours
MAT-131	Calculus I	4
MAT-132	Calculus II	4
MAT-233	Differential Equations	3
MAT-234	Multivariate Calculus	3
MAT-241	Applied Linear Algebra	3
MAT-245	Mathematical Proofs	3
MAT-252	Computer Statistics	3
MAT-333	Real Analysis	3
MAT-341	Modern Algebra	3
MAT-372	Modern Geometry	3
MAT-400	History of the Mathematical Sciences	3
	Total	35

Required Cognate*

Required Courses		Credit Hours
CSC-121	Introduction to Programming	4

*A cognate is a course that supports the success of completing the major program.

MATHEMATICS MAJOR (Bachelor of Science)
General Education Core requirements for the Bachelor of Science degree are listed in the Degree Information section (see page 75.)

Program Specific Core Additions: (additional minor not required)

Required Courses		Credit Hours
CSC-121	Introduction to Programming	4
CSC-151	Hardware and Software Concepts	4
MAT-131	Calculus I	4
MAT-132	Calculus II	4
PHY-111	Physics for Scientists and Engineers I	5
PHY-112	Physics for Scientists and Engineers II	5
PHI-211	Philosophy	3
One of the following:		3
	PSY-111 Psychology	
	SOC-111 Sociology	
	Total	32

Major

Required Courses		Credit Hours
CSC-231	Data Structures	3
MAT-233	Differential Equations	3
MAT-234	Multivariate Calculus	3
MAT-241	Applied Linear Algebra	3
MAT-243	Discrete Mathematics	3
MAT-245	Mathematical Proofs	3
MAT-252	Computer Statistics	3
MAT-333	Real Analysis	3
MAT-341	Modern Algebra	3
MAT-400	History of the Mathematical Sciences	3
MAT-380	Internship	3
MAT-480	Advanced Topics	3
	Total	36

MATHEMATICS MINOR

Required Courses		Credit Hours
MAT-131	Calculus I	4
MAT-132	Calculus II	4
MAT-234	Multivariate Calculus	3
MAT-241	Applied Linear Algebra	3
Three from the following: (See course listings for prerequisites)		9
MAT-233	Differential Equations	
MAT-245	Mathematical Proofs	
MAT-252	Computer Statistics	
MAT-333	Real Analysis	
MAT-341	Modern Algebra	
MAT-400	History of the Mathematical Sciences	
	Total	23

Required Cognate*

Required Courses		Credit Hours
CSC-121	Introduction to Programming	4

*A cognate is a course that supports the success of completing the major program.

MATHEMATICS MINOR FOR ELEMENTARY TEACHERS

Required Courses		Credit Hours
MAT-122	Trigonometry	3
MAT-131	Calculus I	4
One of the following:		3
MAT-151	Statistics	
MAT-252	Computer Statistics	
MAT-211	Math for the Elementary Teacher	3
MAT-212	Geometry for the Elementary Teacher	3
MAT-132	Calculus II	4
One computer course from the following		3
CSC-121	Introduction to Programming	
CSC-151	Hardware and Software Concepts	
CSC-221	Visual BASIC	
	Total	23

MATHEMATICS MINOR FOR SECONDARY TEACHERS

Required Courses		Credit Hours
MAT-131	Calculus I	4
MAT-132	Calculus II	4
MAT-234	Multivariate Calculus	3
MAT-241	Applied Linear Algebra	3
MAT-252	Computer Statistics	3
Two electives from the following:		6
MAT-233	Differential Equations	
MAT-245	Mathematical Proofs	
MAT-333	Real Analysis	
MAT-341	Modern Algebra	

MAT-372	Modern Geometry	
MAT-400	History of the Mathematical Sciences	
	Total	23

Required Cognate*

Required Course		Credit Hours
CSC-121	Introduction to Programming	4

*A cognate is a course that supports the success of completing the major program.

PHYSICAL EDUCATION MAJOR FOR K-12 CERTIFICATION (Bachelor of Arts)
General Education Core requirements for the Bachelor of Arts degree are listed in the Degree Information section (see page 74.)

Education students majoring in Physical Education must complete their lab science core requirement with BIO-241, must complete MAT-110, 121, 122 or 131 and must meet the core activity program course requirements in Physical Education. Such students should follow the professional education program required for secondary education and will have an elementary and secondary student teaching experience.

Required Courses		Credit Hours
BIO-242	Anatomy and Physiology II	4
KIN-211	History and Principles of Physical Education	3
KIN-243	Strategies for Teaching Physical Education K-12	3
KIN-251	Motor Development and Learning	3
KIN-342	Exercise Physiology (Prerequisite: BIO-241 and 242)	4
KIN-344	Adapted Physical Education K-12	2
KIN-357	Physical Education in Preschools & Elem. Schools	3
KIN-359	Physical Education in Secondary Schools	2
KIN-362	First Aid, Injury Prevention and Treatment	3
KIN-401	Professional Capstone Seminar: Ethics in Teaching Phys. Ed.	1
KIN-441	Organization and Administration	3
KIN-442	Measurement and Evaluation	3
KIN-461	Skill and Performance Competencies*	1
	Total	35

*Students must sign up with the instructor for KIN-461 at the time they decide to major in Physical Education.

PHYSICAL EDUCATION MINOR
General Education Core requirements for the Bachelor of Arts degree are listed in the Degree Information section (see page 74.)

Students minoring in Physical Education must complete their lab science core requirements with BIO-241.

Required Courses		Credit Hours
BIO-242	Anatomy and Physiology II	4
KIN-211	History and Principles of Physical Education	3
KIN-251	Motor Development and Learning	3

KIN-341	Anatomical Kinesiology (Prerequisite: BIO-241)	3
KIN-362	First Aid, Injury Prevention and Treatment	3
KIN-461	Skill and Performance Competencies*	1
Electives from the following:		3
	KIN-231 Principles of Coaching	
	KIN-243 Strategies for Teaching Phy. Ed. K-12	
	KIN-331 - 337 Coaching Courses (2 credits each)**	
	KIN-342 Exercise Physiology (4)	
	KIN-343 Biomechanics (4)	
	KIN-441 Organization and Administration	
	KIN-442 Measurement and Evaluation	
	Total	20

*Students must sign up with the instructor for KIN-461 at the time they decide to minor in Physical Education.
**Prerequisite: KIN-231 Principles of Coaching or permission of the instructor.

PHYSICAL EDUCATION MINOR FOR ELEM. AND SEC. TEACHERS

Students enrolled in the Physical Education minor must complete their lab science core requirement with BIO-241, Anatomy and Physiology I, and must meet the core activity program course requirements in Physical Education. Elementary education students in the triple minor program must also complete BIO-111, Introduction to Biological Sciences.

Required Courses		**Credit Hours**
BIO-242	Anatomy and Physiology II	4
KIN-211	History and Principles of Physical Education	3
KIN-243	Strategies for Teaching Phy. Ed. Activities K-12	3
One of the following:		3
	KIN-357 Phy. Ed. in Preschools/Elem. Schools	
	KIN-359 Phy. Ed. in Secondary Schools (2)	
KIN-251	Motor Development and Learning	3
KIN-344	Adapted Physical Ed. K-12	2
KIN-362	First Aid, Injury Prevention, and Treatment	3
KIN-401	Professional Capstone Seminar: Ethics in Teaching .Phys. Ed.	1
KIN-461	Skill and Performance Competencies*	1
	Total	23

*Students must sign up with the instructor for KIN-461 at the time they decide to minor in Physical Education.

PHYSICS MINOR FOR SECONDARY TEACHERS

Students wishing to pursue this consortium minor should meet with the certification officer from the Teacher Education Department during or before their sophomore year. Students will be evaluated by a Calvin advisor who will develop an appropriate program. Consortium minors are subject to final approval by Calvin College.

Required Courses (final approval by Calvin advisor)		**Credit Hours**
PHY-111	Physics for Science & Engineering I	5
PHY-112	Physics for Science & Engineering I	5

PHYS-134	Matter, Space & Energy	4
PHYS-246	Waves, Optics & Optical Technology	4
PHYS-306	Laboratory Investigations in Physics	4
	Total	22

PRE-PROFESSIONAL MAJOR (Pre-Medical, Pre-Dental, Pre-Veterinary) (Bachelor of Arts)
General Education Core requirements for the Bachelor of Arts degree are listed in the Degree Information section. Includes SCI-101 Foundations of Scientific Inquiry for Science Majors (see page 74.) Students electing a Pre-Professional major are not required to complete a minor. Students wishing to pursue this major must meet with the appropriate professional advisor to ensure that all graduate school requirements are met.

Required Courses		**Credit Hours**
BIO-151	Foundations of Biological Science	4
BIO-233	Zoology	4
BIO-241	Anatomy and Physiology I	4
BIO-242	Anatomy and Physiology II	4
BIO-351	Genetics	4
BIO-352	Microbiology	4
BIO-400	Biological Perspectives	2
BIO-451	Molecular Cell Biology	4
SCI-380	Internship	3
SCI Electives from the following:		4
BIO-431	Vertebrate Zoology	
SCI-361	Origins	
SCI-362	Biomedical Ethics	
SCI-423	Neuroscience	
SCI-480	Advanced Topics Seminar	

Required Cognates*

Required Courses		**Credit Hours**
MAT-131	Calculus I	4
MAT-132	Calculus II	4
CHM-121	General Chemistry I	4
CHM-122	General Chemistry II	4
CHM-230	Organic Chemistry Lab I	2
CHM-231	Organic Chemistry I	3
CHM-232	Organic Chemistry II	3
CHM-233	Organic Chemistry Lab II	2
PHY-211	General Physics I	4
PHY-212	General Physics II	4
	Total	71

*A cognate is a course that supports the success of completing the major program.

Course Descriptions

Dept./Level	Course Name	Credits/Frequency (See page 82 for codes)

BIOLOGY

BIO-111 Introduction to Biological Sciences 4/1

An introductory course in Biology in which plants and animals are used to illustrate basic biological principles. The course will examine the relationships among living organism, including man, and his environment. It is designed to increase student awareness and appreciation of organisms in nature as well as the natural history of selected plants and animals. The laboratory includes the identification of common organisms living in West Michigan during field trips. This course is for non-science majors and minors and satisfies the core requirement for Lab Science.

BIO-151 Foundations of Biological Science 4/1

This course is designed to provide a natural science foundation for all science majors and minors. Foundational concepts in cell biology/chemistry, genetics (classical and molecular) and microbiology will be stressed in both lecture and lab. This course satisfies the core requirement for Lab Science.

BIO-225 Botany 4/2

Studies basic plant science, including the structure, reproduction, and ecological relationships among plants. Lecture and lab. This course satisfies the core requirement for Lab Science. Prerequisite: An advanced high school biology course or BIO-111 or BIO-151.

BIO-233 Zoology 4/2

Introduction to the basic principles of zoology, including development, distinguishing characteristics and interactions of the major animal kinds, with special emphasis on the invertebrates. Lecture and lab. This course satisfies the core requirement for Lab Science. Prerequisites: BIO-111 or BIO-151 or advanced high school biology course.

BIO-241 Anatomy and Physiology I 4/2

A systems approach to the structure and function of the human body with special emphasis on disease process as it relates to dysfunction along with practical applications for a life-style of healthful living. Includes integumentary, skeletal, muscular, nervous, and endocrine systems. Laboratory experiences will use microscopic and lab animal investigation. Stresses the homeostatic function and intricacy of the body and its analogies to the Body of Christ, the Church. Lecture and lab. This course satisfies the core requirement for Lab Science.

BIO-242 Anatomy and Physiology II 4/2

A systems approach to the structure and function of the human body with special emphasis on disease process as it relates to dysfunction, along with practical applications for a life-style of healthful living. Includes cardiovascular, digestive, respiratory, lymphatic, urinary, and reproductive systems. Laboratory experiences will use microscopic and lab animal investigation. Stresses the homeostatic function and intricacy of the body and its analogies to the Body of Christ, the Church. Lecture and lab. This course satisfies the core requirement for Lab Science.

BIO-331 Ornithology 4/5
Study of bird anatomy, behavior, life cycles, migration, distribution, and economic relations. Field work is concerned with identification by sight and song and observing the habitat requirements of each species. Lecture and lab. Prerequisite: BIO-233

BIO-341 Anatomical Kinesiology (KIN-341) 3/2
This course is designed as a functionally specific approach to the musculoskeletal system. Emphasis will be placed on the qualitative analysis and description of human movement. Prerequisite: BIO-241

BIO-342 Exercise Physiology (KIN-342) 4/2
A study of the physiological responses of the healthy human body to exercise. This course includes topics such as energy systems, nutrition, conditioning, exercise testing, and exercise prescriptions. Prerequisites: BIO-241 and BIO-242.

BIO-343 Biomechanics (KIN-343) 4/2
The study of the internal and external forces that act upon a human body during movement and the effects produced by these forces. Special emphasis will be given to sport-related movements. Prerequisite: BIO-241 and BIO-242.

BIO-347 Introduction to Nutrition (KIN-347) 3/2
This course is designed to study foods and their effects upon health, development, and performance of the human. Students will develop an understanding of healthful and performance nutrition as it relates to optimal health and physical performance. Also, students will study energy pathways in the body and the six basic nutrients related to performance. Additionally, the students will investigate body composition and weight control. Prerequisite: BIO-242.

BIO-351 Genetics 4/2
A study of classical Mendelian genetics, as well as the current molecular basis of gene expression. Lab investigations include inherited traits studies with a variety of organisms from bacteria to humans. Prerequisites: CHM-112, BIO-233, MAT-151.

BIO-352 Microbiology 4/4
A survey study of the structure and function of micro-organisms, with an emphasis on bacteria. Lab included basic techniques in the isolation, identification and culture of micro-organisms. Lecture and lab. Prerequisite: BIO-151 or BIO-233.

BIO-400 Biological Perspectives 2/6
This course is a senior capstone course for Biology and Pre-Professional Majors, and investigates the ethical and theological issues confronting one choosing a biology-related career. Emphasis will be placed upon constructing a personal, Christian philosophical framework. Students will address these concepts as they investigate and evaluate relevant biological issues. Prerequisite: Upper-class Biology or Pre-Professional Major.

BIO-431 Vertebrate Zoology 4/4
Introduction to the characteristics of the seven classes of vertebrate animals, their structure and life history. Lecture and lab. Prerequisite: BIO-233

BIO-451 Molecular Cell Biology 4/4
Examines the structure, function, differentiation and reproduction of cells at all levels of organization with special emphasis on current research in biological problems. Lab experience includes modern techniques in molecular analysis. Lecture and lab. Prerequisite: BIO-351

CHEMISTRY

CHM-111 Principles of General Chemistry 4/2
Investigation of the composition and properties of substances and the changes they can undergo. Special emphasis on laws of chemical combination, theories of atomic structure, periodic trends, kinetic theory, and chemical and physical equilibria as well as activities to communicate the centrality of chemistry to historical development, modern civilization, and life itself. Explores proper biblical stewardship in chemical manufacturing, disposal, and use. Lecture and lab. This course satisfies the core requirement for Lab Science. Prerequisite: MAT-121 College Algebra or equivalent.

CHM-112 Principles of Organic and Biochemistry 4/2
Study of the structure, properties, reactions, and interactions of the compounds of carbon and the molecules of life. Special emphasis upon the relationship of macromolecular structure and function to their components. Explores and utilizes chemical theory in the understanding of simple and complex molecular behavior. Laboratory exercises concentrate on synthesis, identification and investigation of both natural and man-made products. Lecture and lab. Prerequisite: CHM-111 or equivalent

CHM-121 General Chemistry I 4/2
Investigation of the composition and properties of substances and the changes they can undergo. Special emphasis on laws of chemical combination, theories of atomic structure, periodic trends, and chemical and physical equilibria as well as activities to communicate the centrality of chemistry to historical development, modern civilization, and life itself. Explores proper biblical stewardship in chemical manufacturing, disposal, and use. Lecture and lab. This course satisfies the core requirement for Lab Science. Prerequisite: MAT-121 College Algebra or its equivalent.

CHM-122 General Chemistry II 4/2
A continuation of CHM-121 with emphasis on reaction types and rates, electrochemistry, equilibria, group properties, nuclear chemistry, and qualitative analysis. Addresses environmental concerns and safe handling and disposal of chemicals. Chemical demonstrations as well as laboratory experiments are used throughout the course. Lecture and lab. This course satisfied the core requirement Lab Science. Prerequisite: CHM-121.

CHM-230 Organic Chemistry Lab I 2/2
Laboratory investigations will include micro as well as macro techniques for synthesis and analysis. Note: To be taken concurrently with CHM-231.

CHM-231 Organic Chemistry I 3/2
A study of carbon compounds including nomenclature, physical and chemical behavior, synthesis, reactions and mechanisms. Prerequisite: CHM-122 or equivalent.

CHM-232 Organic Chemistry II 3/2
A continuation of CHM-231 with special emphasis on the biological significance of the functional groups studied in that course. Natural products and polymers will also be covered. Prerequisite: CHM-231.

CHM-233 Organic Chemistry Lab II 2/2
Laboratory investigations will include micro as well as macro techniques for synthesis and analysis. Note: To be taken concurrently with CHM-232.

CHM-411 Perspectives in Chemistry 2/4
Investigation in the history, philosophy, curricular structure, methodology, key ideas and concepts of chemistry. Emphasis will be given to the central role in technology and society as well as stewardship issues of production, utilization, and disposal. Prerequisites: Minimum of three chemistry courses and at least junior standing.

CHM-472 Biochemistry 4/4
Investigation of biologically important molecules including proteins, lipids, carbohydrates, and nucleic acids. Metabolic and biochemical problems will be explored. Lecture and lab. Prerequisite: CHM-232.

COMPUTER INFORMATION SYSTEMS

CSC-112 Introduction to Spreadsheets 1/1
An understanding of spreadsheets and their use in financial applications.

CSC-113 Intermediate Spreadsheets 1/1
This course is a continuation of the study of Microsoft Excel. The objective is to enable the students to use many of the important and complex features of Excel. Topics such as the following will be covered: conditional and logical functions, pivot tables, data consolidation, worksheet outlining, goal seeking problem solver and scenario manager. Prerequisite: CSC-112 Introduction to Spreadsheets or permission of instructor.

CSC-121 Introduction to Programming 4/2
This is the first course in programming. Topics include the design, coding, testing, and documentation of programs written in a modern high-level language. Fundamental issues of object-oriented programming, efficiency, and complexity are introduced in the context of programming and problem solving.

CSC-151 Hardware and Software Concepts 3/2
A breadth-first introduction to Computer Science and Information Systems, emphasizing hardware, operating systems, and programming. Desktop computer hardware is described theoretically, with application to computer assembly, troubleshooting, and repair. Operating systems functions and components are studied, with application to system installation and maintenance. Network technologies are surveyed, and fundamental concepts of programming are introduced through HTML and scripting.

CSC-211 Desktop Publishing 3/2
An introduction to desktop publishing software applied to the designing and producing of a variety of professional-quality documents (such as newsletters, brochures, forms, and presentations) that combine text and graphics features. Major topics will include

composition, formatting, planning and layout, and selection and manipulation of graphics and type styles/sizes.

CSC-221 Visual Basic 3/2
An introduction to programming using Visual Basic. This course introduces programming concepts specifically applied to the object-oriented environment of Windows. Prerequisite: Experience with Windows based applications.

CSC-222 Introduction to Web Development 3/4
This course will focus on the basics of web side structure, including HTML, and Cascading Style Sheets. It will also introduce database integration.

CSC-224 C++ Programming 3/4
An introduction to the C++ programming language. Students will gain programming skill through writing several programs in the C++ language. The course assumes previous programming experience preferably in an objected-oriented language. Prerequisite: CSC-121 or substantial knowledge of some high-level programming language.

CSC-231 Data Structures and Algorithms 3/6
A study of data structures such as stacks, lists, queues, trees, and graphs. Analysis of algorithms and complexity. Programming techniques and implementation of data structures and algorithms. Prerequisite: CSC-121 or permission.

CSC-280 Topics in Computing 1-3/6

CSC-323 C Programming in Unix 3/4
This course introduces the Unix operating system from a programmer's perspective, and provides a comprehensive survey of the C programming language. Topics include: C syntax, implementation of common data structures and algorithms in C, Unix library routines, Unix file operations, and Unix utilities and editors. Prerequisite: CSC-121 and either CSC-224, 231 or permission of the instructor.

CSC-325 Database Program Development 3/4
A study of the relational database model and the SQL programming language as applied to Business Information Systems. Prerequisite: CSC-332 and any programming course.

CSC-332 Systems Analysis 3/2
A study of the process of analyzing and designing Business Information Systems. The system design life cycle is applied using CASE tools. Prerequisite: Previous programming or accounting courses.

CSC-352 Data Communications 3/4
A study of technical topics related to data communications and networks. This course will cover transmission media, analog and digital signals, data transmission, multiplexing, local area and wide area network protocols, and network topologies. There will also be come coverage of network operating systems and computer telephony integration. Prerequisite: CSC-151.

CSC-380 Internship 1-6/1
Practical work experience in a situation where decisions are made concerning equipment or programming or workflow operations. Prerequisite: Permission of instructor.

CSC-431 Applied Software Project 3/6
Application of computer programming and system development concepts, principles, and practices to a comprehensive system development project. Prerequisite: CSC-325

CSC-451 Theory of Operating Systems 3/6
An historical survey of the development of operating systems, followed by a discussion of fundamental concepts and terminology, together with practical applications to real systems. Topics are selected from basic concepts such as processes and inter-process communication, allocation of shared resources and memory, scheduling, deadlock, file systems, protection and security, with applications to system design and administration. Christian worldview and ethical implications will be analyzed and applied in the contexts of quality of service, security, and intellectual property rights. This course serves as the capstone course for the computer science program. Prerequisite: CSC-231.

CSC-470 Directed Readings 1-3/6
Typically, a student selection of readings in Computer related topics. Consultation with Business/Computer faculty and a complete application form is required.
Prerequisites: See General Requirements.

CSC-480 Advanced Topics 1-3/6
Topics of current interest are offered to introduce new course material and to enhance the Business/Computer majors. Prerequisites: To be determined when scheduled.

CSC-490 Independent Study 1-3/6
The study of Computer related topics chosen by the student in consultation with Business/Computer faculty. A complete application form is required. Prerequisites: See General Requirements.

ECOLOGY

ECO-241 Environmental Science 4/2
Studies how ecological principles, philosophy, economics, sociology and politics interact with identifying and solving environmental issues. Topics include: air quality, water quantity and quality, population dynamics, energy sources, types of waste, sustainability, environmental policy and legislation, and pertinent government agencies. Lecture and lab. Prerequisite: BIO-111 or BIO-151

ECO-341 Ecology 4/4
The study of the interrelationships of living organisms, plant or animal, and their environments. These are studied with a view of discovering the principles that govern relationships. A special emphasis on the different ecosystems of Michigan bogs, marshes, streams, and sand dunes, and man's impact on them, will be studied. Lecture and lab.
Prerequisites: BIO-225, 233, and MAT-151

ECO-342 Field Biology 4/6
First two weeks: Instruction and experience in the use of the tools of the field biologist, trips to different types of ecosystems: forest, field, stream, pond, lake, marsh, and bog. Final week: Travel experience covering points of interest in the Upper Peninsula and Lower Peninsula of Michigan, or the student may elect to work on a field problem in the Grand Rapids area. Prerequisites: BIO-225 and BIO-233

ECO-442 Advanced Field Studies variable credit/6
A field-oriented course in the study of the relationships of the fauna and flora of special segment of the biosphere such as Yellowstone National Park, Grand Canyon National Park, or the Florida peninsula. Students spend most of the time on location experiencing the ecology of the area.

Lab attendance is required in all courses with a lab. The Cornerstone Learning Center in MH-107 provides tutorial and technology support for students and instructors.

KINESIOLOGY

KIN-100 Foundations of Wellness 2/1
Instruction in personal wellness as a responsibility of biblical stewardship. This course focuses on whole person wellness in the context of biblical principles. Emotional, intellectual, vocational, physical, social, and spiritual wellness are addressed.

KIN-111 Badminton 1/1
The study and practice of basic techniques in the game of badminton. This course includes topics such as ready position, grip, strokes, serve, rules of the game, and strategy. Opportunities are given to test skills against other class members through tournament play.

KIN-113 Golf 1/2
An introduction for the beginner to golf encompassing basic techniques of the stance, grip, swing, rules of the game and etiquette. This course is designed to offer opportunity to test and improve skills on a regulation eighteen-hole golf course. It is desired that this activity leads to the appreciation of golf and becomes a lifelong enjoyment for the Christian steward.

KIN-115 Tennis 1/6
Instruction in basic techniques of the sport including the history and rules. This course focuses on the forehand, backhand, serve and volley. Strategy for singles and doubles is included along with opportunity for game play.

KIN-116 Racquetball 1/1
An introduction for the beginner to racquetball encompassing rules, basic skills, terminology, strategy and safety. This course is designed to offer game play with class members and is desired that this activity leads to the appreciation of racquetball and becomes a lifelong enjoyment for the Christian steward.

KIN-117 Tumbling 1/6
Instruction to basic tumbling skills. Partner and group stunts and activities, will also be covered.

KIN-119 Downhill Skiing 1/2
Instruction in techniques for all levels of skiers. Cannonsburg staff will divide the students into various groups (beginners to advanced) and teach techniques and etiquette appropriate for each group.

KIN-121 Outdoor Skills 1/6
Instruction in the basic skills and equipment needed for participation in outdoor activities. This course includes opportunity to utilize the cooperation method of problem-solving. Activities selected from the following list will depend on the season the course is offered: hiking, backpacking, map and compass, and rockclimbing.

KIN-122 Introduction to Arnis 1/2
Arnis, a.k.a. Escrima or Arnis de Mano, is a Filipino cultural stick-fighting, dance-like warrior art. It is very rhythmatic and aerobic, produces great hand-eye coordination and makes for a very exciting and fascinating demonstration. Objectives include developing abilities with one and two sticks, weaving technique, disarming and rhythmic partner drills. Christian Martial Arts philosophy included.

KIN-123 Beginning Fencing 1/2
This course is designed to give the student a fundamental background in the skills, technique, rules, and etiquette of foil and epee fencing. Special attention will focus on conditioning, strategy, competitive bouting and safety. Upon completion of this course, students will be equipped with the basic skills necessary to enjoy a lifetime of both competitive and recreational fencing.

KIN-124 Pickleball 1/2
The study and practice of basic techniques in the game of Pickleball (the newest and fastest racquet sport). The course includes topics such as ready position, grip, strokes, serve, rules of game, and strategy. Opportunities are given to test skills against other class members through tournament play.

KIN-125 Rockclimbing 1/2
Instruction in basic techniques of bouldering and rockclimbing. This course offers the opportunity to receive instruction and practice at Inside Moves Rockclimbing Gym. Integration and application to the Christian life will be a vital component of the course.

KIN-126 Intermediate Racquetball 1/6
This class will focus on increasing the accuracy and skill level of the student in all of the aspects of racquetball play, including forehand and backhand strokes, ceiling shots, passing shots, pinch shots, offensive and defensive serves, court positioning strategies, conditioning drills, racquet control drills, hitting drills, shot drills, serve and return drills, and proper warm-up drills. Students will be tested on shot accuracy, court awareness, knowledge of rules of play, and course etiquette. Prerequisite: KIN-116 or permission of instructor.

KIN-127 Introduction to Martial Arts 1/1
This activity course is designed to introduce the student to the basic principles of the martial arts from a Christian perspective. Utilizing the Shinsei Kempo style, which is

eclectic in its technique and training methods, scientific in its concepts and principles, and biblical in its philosophy, symbolism, and terminology, the student will concentrate on self-defense and practical application of discipline of body, mind, and spirit.

KIN-128 Intermediate Martial Arts (Martial Arts with a Mission) 1/2
A continuation of KIN-127 Introduction to Martial Arts for students who want to increase their skill level, including preparation for tournament participation as an outreach. Participation in a Cornerstone Karate Team for outreach demonstrations will be encouraged.

KIN-132 Coed Soccer 1/2
The study and practice of rules, basic fundamentals, strategy, team play, and game etiquette. Opportunities will be given to the student to test skills against other players through tournament play.

KIN-133 Volleyball 1/1
The study and practice of the basic techniques in the game of volleyball. The course includes topics such as ready position, serve, set, forearm pass, rules of the game, and strategy. Opportunities are given to test skills against other class members through tournament play.

KIN-134 Ice Skating/Hockey Skills 1/6
Instruction in basic ice-skating, and hockey skills will be presented in this course. Basic skills and terminology will be presented. This course is designed to familiarize students with this selected winter activity. A lab fee will be charged to cover ice time at a local ice arena.

KIN-143 Jogging 1/2
To provide students with a thorough understanding of aerobic activity and its application to physical conditioning. The content of this course also includes general Biomechanics of jogging, flexibility, nutrition, a proper Christian viewpoint of jogging as a lifetime fitness activity.

KIN-146 Physical Conditioning 1/6
The study and practice of basic physical fitness techniques. The American College of Sports Medicine guidelines to physical fitness are taught. Aside from various conditioning opportunities, the student will learn principles regarding nutrition and stress management.

KIN-147 Physical and Health Education for Classroom Teachers 2/1
This course is designed to provide classroom teachers with a basic understanding of the purpose of physical education programs at the elementary level. The elementary education major will be equipped with basic theory, methods and management techniques for providing quality movement experiences for all students with emphasis placed on the needs of individual learners. A variety of teaching methods, organizational techniques and strategies for integrating physical education across the curriculum will be explored in this course. Various health related topics and their relationship to elementary students will be discussed. Prerequisite: KIN-100 or permission of instructor.

KIN-148 Weight Training 1/1
An introduction for the beginner to basic techniques and instruction in weight training for both muscular strength and endurance. This course is designed for the development of a personalized weight training program and is desired that this activity leads to lifelong enjoyment for the Christian steward.

Varsity Sports 1
A maximum of two credits will be awarded for participation in two different varsity sports. Students must register for credit at the beginning of the semester their sport is in season. These credits will count as elective credit only, and do not apply toward core physical education requirements or the Physical Education major or minor.
Sports included are:

KIN-162	Softball	KIN-165	Soccer
KIN-163	Basketball	KIN-166	Tennis
KIN-164	Volleyball	KIN-171	Golf
KIN-167	Track	KIN-168	Cross Country

PROFESSIONAL PROGRAM COURSES
KIN-211 History and Principles of Sport & Physical Education 3/1
A study of physical education, sport, and fitness in the context of their historical development and how they have been an integral part of culture. The psychological, sociological, and philosophical factors that have affected these topics. This course includes learning techniques such as class debates, readings, and presentation.

KIN-215 Introduction to Sports Management 3/2
An overview of the diverse field of Sport Management. This course includes an in depth examination of various careers, training and necessary courses of study. Additionally, management skills along with related speaking and writing competencies are emphasized.

KIN-231 Principles of Coaching 3/2
The study of the nature and responsibilities of the profession of coaching. Topics include philosophy of coaching, the coach and his/her personality, the athlete and his/her personality, communication, team cohesion, motivation, discipline, teaching techniques, and scouting.

KIN-243 Strategies for Teaching Physical Activities K-12 3/2
The study and practice of the process of teaching physical education activities appropriate for students K-12. This course is designed to help teachers develop the instructional skills necessary to teach physical education effectively. The physical education major will be equipped to select, develop and implement units of instruction. Lesson planning and actual teaching experience (with K-12 students) will provide the practical experience needed for professional growth.

KIN-251 Motor Development and Learning 3/2
A study of childhood growth and development patterns as it relates to motor learning and motor skill acquisition. This course in designed to enhance the understanding of growth and motor behavior/development of children from conception through adulthood. Principles of motor development and learning are explored along with an opportunity to apply them in a lab setting.

KIN-324 Sports in Literature 3/4
A survey of literature related to sports, from fine arts to popular culture. Beginning with classical literature and moving to contemporary. This course will analyze how sports are represented in various eras, and consider the place of sports as symbol, myth, and allegory in various societies. Prerequisite: ENG-113, ENG-223.

KIN-332 Coaching of Basketball 2/4
To provide students with basic concepts, fundamentals, techniques and theories of coaching basketball. This course will also cover topics such as scouting, conditioning, practice organization, and motivation. Prerequisite: KIN-231 or permission of instructor.

KIN-333 Coaching of Cross Country and Track 2/4
This course will provide students with basic concept, fundamentals, techniques and theories of coaching cross-country and track and field. Conditioning, meet organization, and team management will also be covered. Prerequisite: KIN-231 or permission of instructor.

KIN-334 Coaching of Soccer 2/4
To provide students with fundamental skills, tactics, conditioning methods, and team management. This course will also cover topics such as scouting, recruiting, and motivation. Prerequisite: KIN-231 or permission of instructor.

KIN-335 Coaching of Softball 2/4
The study of theories of offensive and defensive systems of play integrated with the teaching techniques of the fundamentals of softball. The student will also cover topics such as conditioning, recruiting, scouting, and team management. Prerequisite: KIN-231 or permission of instructor.

KIN-336 Coaching of Football 2/4
To provide students with basic strategies, fundamentals, techniques and theories of coaching football. This course will also cover topics such as scouting, conditioning, organization and extending a coaching philosophy to a particular sport.
Prerequisite: KIN-231 or permission of instructor.

KIN-337 Coaching of Volleyball 2/4
The study of the theories of offensive and defensive systems of play integrated with the teaching techniques of the fundamentals of volleyball. Conditioning, skill progression, management, organization and scouting are included. Prerequisite: KIN-231 or permission of instructor.

KIN-341 Anatomical Kinesiology (BIO-341) 3/2
This course is designed as a functionally specific approach to the musculoskeletal system. Emphasis will be placed on the qualitative analysis and description of human movement. Prerequisite: BIO-241

KIN-342 Exercise Physiology (BIO-342) 4/2
A study of the physiological responses of the healthy human body to exercise. This course includes topics such as energy systems, nutrition, conditioning, exercise testing, and exercise prescriptions. Prerequisites: BIO-241 and 242. Recommend: CHM-111

KIN-343 Biomechanics (BIO-343) 4/2
The study of the internal and external forces that act upon a human body during movement and the effects produced by these forces. Special emphasis will be given to sport-related movements. Prerequisite: BIO-241, 242 & KIN-341. Recommend: PHY-211

KIN-344 Adapted Physical Education 2/2
This course is an orientation to the theoretical and practical aspects of teaching physical education for K-12 students with physical and mental disabilities. The focus is on the history and scope of adapted physical education, key techniques required for effective and safe instruction, general needs of special populations, legal issues, development of Individualized Education Programs and accommodation of activities, equipment and instructional materials for special populations. These topics will be studied within the context of our Christian worldview, with special attentions given to issues of equity and individual worth. Prerequisite: KIN-243 or permission of instructor.

KIN-347 Introduction to Nutrition (BIO-347) 3/2
This course is designed to study foods and their effects upon health, development, and performance of the human. Students will develop an understanding of healthful and performance nutrition as it relates to optimal health and physical performance. Also, students will study energy pathways in the body and the six basic nutrients related to performance. Additionally, the students will investigate body composition and weight control. Prerequisite: BIO-242

KIN-357 Physical Education in Preschools and Elem. Schools 3/2
This course is designed to provide methods of instruction for teaching preschool and elementary physical education programs. The course will include basic movement education emphasizing Laban's concept of movement analysis, fundamental motor skills, manipulative skills, educational and traditional gymnastic skills, fundamental rhythms, physical fitness activities, and introduction to sports related skills. Development of teaching sequences will be utilized. Clinical experiences will be involved in teaching children and peers. Prerequisite: KIN-243 and KIN-251

KIN-359 Physical Education in Secondary Schools 2/2
This course is designed to provide methods of instruction for teaching team and individual sport activities in the middle and secondary school environments. Development of teaching sequences will be utilized. Clinical experiences will be involved in teaching students and peers. Prerequisite: KIN-243 and KIN-251

KIN-362 First Aid, Injury Prevention, and Treatment 3/2
Basic principles of injury prevention and care, first aid principles of prevention, injury evaluation and current rehabilitation methods are taught. The student will have active participation in caring for various injuries. Prerequisite: BIO-241 and 242 or permission of instructor.

KIN-363 Sport and Exercise Psychology (PSY-362) 3/2
This course is designed to acquaint students in psychology and kinesiology with basic interventions to enhance athletic performance and promote the physical and mental health of athletic and general populations alike. This course also examines the social psychology and psychobiology of sport and exercise.

KIN-380 Internship 1-6
An opportunity to gain practical experience in settings appropriate for exercise science and coaching. Prerequisite: Junior status and approval of divisional chair.

KIN-400 Professional Capstone Seminar 2/2
The seminar will examine from a Christian worldview perspective the ethical and professional issues associated with the major. As a capstone course, the seminar will devote time to Christian worldview reflection in regard to a senior's prior academic preparation and future vocational opportunities. The seminar will include significant evaluation instruments including a portfolio, philosophy thesis, skill and performance competencies (KIN-461) and completion of the senior assessment exam for Kinesiology. Students must sign up with the professor at the time they decide to major in exercise science so they can begin work towards meeting competencies in the areas required. Registration to receive credit will be delayed until the seminar year. Prerequisite: Senior status or approval of divisional chair.

KIN-401 Professional Capstone Seminar: Ethics in Teaching Physical Education 1/2
The seminar will examine, from a Christian worldview perspective, the ethical and professional issues associated with physical education. As a capstone course, the seminar will devote time to Christian worldview reflection in regard to a senior's prior academic preparation and future vocational opportunities. The seminar will include significant evaluation instruments including a portfolio, philosophy paper, and completion of the senior assessment exam for the major. Prerequisite: Senior status or approval of division chair.

KIN-422 Safety and the Law 3/6
A comprehensive study of the five relevant areas of sport and the law: facilities immunity, physical education, athletic associations, workman's compensation, and Title IX.

KIN-441 Organization and Administration 3/2
The study of organization, administration, planning, implementation, interscholastic activities, and sports/fitness clinics. The students will gain a closer look at the administrative roles at these various settings. Topics will include budget creation and control, program development, leadership techniques, and program evaluation.

KIN-442 Measurement and Evaluation 3/4
A study of methods for evaluating cognitive, affective, and psychomotor domains of learning in physical education. The course provides opportunity for practical experience in test construction and administration as well as evaluation of the results. Topics such as statistics, fitness testing, grading procedures, and affective checklists will be covered. Prerequisite: Core mathematics requirement.

KIN-461 Skill and Performance Competencies 1/1
A series of experiences to help students understand the many roles of the physical educator. The specific experiences will be planned jointly by the student and the professor. The goal of this course is to improve the student's personal and professional expertise through participation, observation and leadership opportunities. Students must sign up with the professor at the time they decide to major or minor in kinesiology education so they can begin work toward meeting competencies in the areas required. Registration to receive credit should be delayed until the senior year.

KIN-470 Readings in Physical Education 3/1
Guided readings and periodic reports in areas of student's interest and need.
Prerequisite: Approval of the division chair.

KIN-490 Independent Study 3/1
With faculty supervision, the student will research and write on a specific topic or area. Outside involvement in topic is normally required. Prerequisite: Approval of the division chair.

MATHEMATICS

MAT-096 Pre-Algebra 3/1
An individualized review of applied arithmetic. Patterns leading to operations with fractions, decimals, percents and proportions. Graphing, drawing, probability and spreadsheet tools are used in technology activities to learn problem-solving strategies, numerical geometry, pre-algebra, and basic statistics concepts. Prerequisite: Credits earned for this course do not count toward graduation. Computer software and/or a graphing calculator (TI-83 Plus recommended) is a required tool for this course. Lab required.

MAT-107 Algebra 3/1
A study of number properties, variation, graphs and equations involving linear, quadratic and exponential functions. This course introduces the use of calculators and/or spreadsheets for the study of functions and data. It does not count toward a major or minor in mathematics. MAT-107 is designed to review the necessary foundations in algebra for MAT-110. Prerequisite: MAT-096 or placement examination. Lab fee.

MAT-110 College Mathematics 3/1
College Mathematics introduces students to several applications of algebra, combinatorics, probability and statistics important for the professions, cultural literacy and the liberal arts. Applications include the mathematics of finance, a brief review of algebra, and an introduction to data analysis, probability and statistics. Computational skills with calculators and spreadsheets are developed. This course satisfies the core requirement in mathematics. Prerequisites: Competency in algebra (MAT-107) and applied arithmetic (MAT-096). Lab fee.

MAT-121 College Algebra 3/2
College Algebra introduces the study of polynomial, rational, exponential, and logarithmic functions, in addition to the quadratic formula, geometric series, binomial series, systems of equations and probability. A graphing calculator is required (TI-83/84 or TI-89/92/200 recommended). This course satisfies the core requirement in mathematics. Prerequisites: Acceptable score on placement examination.

MAT-122 Trigonometry 3/2
Properties, graphs and applications of the sine, cosine and tangent functions and their reciprocals and inverse functions. Connections with the geometric series, binomial series, quadratic formula and logarithms. A graphing calculator is required (TI-83/84 or TI-89/92/200 recommended). This course satisfies the core requirement in mathematics. Prerequisite: MAT-121 or acceptable score on placement examination.

MAT-131 Calculus I 4/2
The study of rates of change for polynomial, exponential, logarithmic, and trigonometric functions, tangent lines, graphs, maximum values, and areas. Applications of calculus will be modeled with graphing calculators. Computer software and/or graphing calcula-

tor (TI-89/92/200 recommended) is a required tool for this course. This course satisfies the core requirement in mathematics (p. 226). Prerequisite: MAT-122 or its equivalent.

MAT-132 Calculus II 4/2
Applications of differentiation and integration from MAT 131 will include techniques of integrating functions and series approximations to these functions. Computer software and/or a graphing calculator (TI-89/92/200 recommended) is a required tool for this course. This course satisfies the core requirement in Mathematics (p. 226).
Prerequisite: MAT-131.

MAT-151/BUS-211 Statistics (SSC-241) 3/2
Descriptive statistics including measures of central tendency and standard deviation, statistical inference with emphasis upon testing of hypotheses and measures of association, and application of these techniques to decision-making and planning. Computer software and/or graphing calculator is required (TI-83/84 preferred). This course satisfies the core requirement in Mathematics (p. 226). Prerequisite: Core requirement in math.

MAT-211 Math for the Elementary Teacher 3+lab/2
The course integrates elementary and middle school mathematics education content, methods, and technology. Emphasis is on concepts, relationships, problem solving, reasoning, communicating, and connecting ideas in elementary school mathematics. Prospective teachers implement a mathematics curriculum that models NCTM curriculum teaching and evaluation standards and principles. They plan, implement, and evaluate units and lessons in applied arithmetic, pre-geometry, and pre-algebra. Concepts are taught through applications with manipulatives, multimedia technologies, calculators and computers. Students are strongly encouraged to do lab activities via the Learning Center. Lab activities may include diagnosing and tutoring peers and elementary children and micro-teaching with exemplary K-8 grade curriculum materials/software. Prerequisites: MAT-110 or its equivalent, and EDU-230.

MAT 212 Geometry for the Elementary Teacher 3+lab/2
A continuation of MAT 211. Prospective elementary teachers plan, implement, and evaluate units and lessons on basic geometry concepts in two and three dimensions, measurement, transformational geometry, probability, statistics, and algebra. Concepts are taught through applications with manipulatives, multimedia technologies, calculators and computers. Authentic assessment introduced. Students are strongly encouraged to do lab activities via the Learning Center. Prerequisite: MAT-211

MAT-233 Differential Equations 3/4
The study of equations involving derivatives by methods of algebra, series, or computer approximations. Graphing calculators and computers will graph solutions, phase planes, and chaotic systems. Prerequisite: MAT-132.

MAT-234 Multivariate Calculus 3/4
Derivatives and integrals of functions of several variables such as z=f(x,y), Jacobian determinants, volumes, and surface areas. Three-dimensional graphs and chaotic systems will be investigated on graphing calculators and computers. Computer software and/ or graphing calculator (TI-89/92/200 preferred) is a required tool for this course. Prerequisite: MAT-132.

MAT-241 Applied Linear Algebra 3/2
The algebra of matrices, determinants, vectors, inverting matrices, diagonalizing matrices, eigenvalues and their applications. Computer software and/or graphing calculator (TI-89/92/200) will be used for calculations and applications to dynamic systems. Prerequisite: MAT-132.

MAT-243 Discrete Mathematics 3/6
A study of fundamental principles of discrete mathematics, with applications to computing. Topics such as sets, functions, relations, counting methods, graph theory, matrix theory, and number theory. An introduction to operation counts and algorithmic complexity. Computer software and/or graphing calculator (TI-89/92/200 preferred) is a required tool. Prerequisite: MAT-123 or permission of the instructor.

MAT-245 Mathematical Proofs 3/2
A course in reading and constructing mathematical proofs. How to start proofs (direct proofs, proofs by cases, proofs by contrapostive, proofs by contradiction); proofs about sets, functions, numbers, inequalities, and equivalence relations; proofs by mathematical induction; understanding the theorems of calculus and linear algebra; and preparing to do proofs in Modern Algebra and Real Analysis. Prerequisite: MAT-234 or MAT-241.

MAT-252 Computer Statistics 3/4
Probability simulations and statistical procedures on graphing calculators and computer statistics programs: random sampling, normal and binomial probability distributions, descriptive statistics and graphs, linear regression and/or ANOVA. Graphing calculator required. Computer software and/or graphing calculator (TI-89/92/200 preferred) is a required tool. Prerequisite: MAT-132.

MAT-333 Real Analysis 3/4
Construction of the Real Number Field, its properties, proofs and consequences; Infinite sequences and series; continuous and differentiable functions and otherwise; Riemann integrals. Computer software and/or graphing calculator (TI-89/92/200 preferred) is a required tool. Prerequisite: MAT-234 and MAT-245.

MAT-341 Modern Algebra 3/4
Groups, rings, and fields and their substructures with examples from transformation groups, matrix rings, and number fields. Computer software and/or graphing calculator (TI-89/92/200 preferred) is a required tool. Prerequisite: MAT-241 and MAT-245.

MAT-372 Modern Geometry 3+lab/2
Models and proofs in Euclidean and non-Euclidean geometry from an advanced standpoint. The language and logic of geometry for representing and solving visual problems; points, lines, angles, circles, perimeter, area, 3-D figures, transformations, congruence, and similarity. Emphasis on communicating mathematical arguments with dynamic geometry tools. Internet manipulative and computer explorations appropriate for e-learning in the secondary classroom. Advanced project topics from motion, transformational, topological, protective, conic, axiomatic, differential, discrete, synthetic, hyperbolic, coordinate, finite, fractal, elliptic and spherical geometries. Computer software and/or a TI-92/200 graphing calculator required. Prerequisites: MAT-234 and MAT-241 and MAT-245, or permission.

MAT-380 Internship in Mathematical Sciences 1 - 6/6
An individualized assignment arranged with an agency, business or other organization to provide guided practical experience in a mathematical sciences related career/ministry activity. Prerequisite: Junior standing, consent of instructor, and approval by division chair.

MAT-400 History of the Mathematical Sciences (Capstone) 3/2
The development of the mathematical sciences historically in strands of numbers, geometry, analysis, and calculating technology. Examination of the impact of mathematical ideas on cultures from a Christian worldview perspective. Discussion of philosophic issues of infinity, existence of mathematical objects, absolute truth, and the roles of proofs and algorithms. Prerequisite: MAT-333 or MAT-341.

MAT-470 Readings in Mathematical Sciences 1- 6/6
Readings in specific mathematical sciences or mathematics education topics in areas of student need and interest. Required periodic reports with related discussions, labs, or creative/classroom activities. Prerequisites: Dependent upon topic selection. Permission of research advisor and instructor. May be repeated.

MAT-471 Secondary Mathematics Education 3+lab/2
Prospective teachers implement a secondary mathematics curriculum that models NCTM curriculum, teaching, and evaluation standards. They plan, implement, and evaluate a unit and lessons in algebra, geometry, functions, probability and statistics, trigonometry, precalculus and discrete mathematics. Explorations with manipulatives, computers, multimedia technologies, Internet, BASIC, calculator programming; statistics, graphing, and drawing tools. Computer software and/or a TI-92/200 graphing calculator is a required tool. Prerequisites: Completed MAT-234, MAT-241, MAT-245.

MAT-480 Advanced Topics in Mathematical Sciences 1-3/6
Selected topics in mathematical modeling, set theory, number theory; topology, complex variables; differential geometry, set theory, number theory; topology, complex variables; differential geometry, modern geometries; abstract linear algebra, advanced matrix algebra, vector analysis, numerical analysis, graph theory, combinatorics, computer programming. Advanced project topics in physics may be selected from Fourier series, transform calculus, partial differential equations, boundary value problems, complex variables, and vector calculus. Prerequisites: Permission of instructor. Designed for mathematical sciences majors' current needs and for students planning graduate study in the physical sciences or applied mathematics. May be repeated.

MAT-490 Independent Study 1 - 3/1
An opportunity to perform independent study/research/creative activity in the various branches of mathematical sciences and allied fields of application. Prerequisites: Major in mathematical sciences; permission of research advisor. Submission and approval of a research proposal must precede registration. May be repeated.

PHYSICS

PHY-111 Physics for Scientists and Engineers I 5/6
An introductory survey of the basic concepts of mechanics, heat, sound, and wave motion. Appropriate for students in the mathematical sciences and engineering. Lecture and lab. This course satisfies the core requirement for Lab Science.
Corequisite: MAT-131 or equivalent.

PHY-112 Physics for Scientists and Engineers II 5/6
An introductory survey of the basic concepts of electricity, magnetism, light, and modern physics. Appropriate for students in the mathematical sciences and engineering. Lecture and lab. Prerequisite: PHY-111 or equivalent and MAT 132 or equivalent.

PHY-211 General Physics I 4/2
An introduction survey of the basic concepts of mechanics, heat, sound, and wave motion. Appropriate for students in life sciences. Lecture and lab. This course satisfies the core requirement for Lab Science. Prerequisite: MAT-122 or equivalent.

PHY-212 General Physics II 4/2
An introductory survey of the basic concepts of electricity, magnetism, light and modern physics. Appropriate for students in life sciences. Lecture and lab. Prerequisite: PHY 211 or equivalent.

SCIENCE

SCI-100 Foundations of Scientific Inquiry 4/1
This course is designed to introduce students to the role and importance of the sciences in studying God's general revelation in both nature and themselves. A Christian philosophy of science is developed that demonstrates to the student the utility and value as well as the limitations of the natural and social sciences as tools for the empirical investigation of God's creation. Through both classroom and laboratory experience, the student is introduced to the scientific method as a means of knowing from the perspective of a Christian worldview. Integrated lecture and lab.

SCI-101 Foundations of Scientific Inquiry for Science Majors 1/2
This course is designed to introduce science majors to scientific inquiry from a Christian worldview perspective. It includes historical development of scientific thought, the place of Special Revelation in unfolding General Revelation, utility, value, and limitations of scientific methodology, experimental design, and scientific communication. Prerequisite: Core mathematics requirement met and permission of the instructor.

SCI-111 Physical Science 4/2
Introduction to the explanation and understanding of the natural, non-living world. The processes of information gathering and organizing will be stressed as they relate to the fields of physics, chemistry, geology and astronomy. Emphasis will be given to the biblical framework for each of these disciplines. Lecture and lab. This course satisfies the core requirement for Lab Science. Prerequisite: Core requirement in mathematics.

SCI-261 Astronomy 4/2
A study of the distinctive qualities of the planets, their moons, the stars, and galaxies through laboratory exercises in observations and calculations. Lecture and lab. This course satisfies the core requirement for Lab Science. Prerequisite: Core requirement in mathematics.

SCI-262 Geology 4/2
A study of the materials and processes of the earth, leading to a responsible Christian appreciation for it and its use. Explores basic principles through a survey of the history of the ideas about the earth. Applies basic insights of chemistry, biology, physics, and mathematics to the solution of problems such as earthquakes, volcanic eruptions,

floods, marine erosion, the nature and distribution of fossil fuels, metals, ground water, and other mineral resources. Studies man-imposed and natural boundaries to characterize geographic regions. Lecture and lab. This course satisfies the core requirement for Lab Science.

SCI-263 Atmosphere & Weather 2/4
This primarily on-line course is adopted from the American Meteorological Society *Online Weather Studies.* Students are led through the major aspects of atmospheric composition, weather production and parameters and forecasting models. Labratory activities include direct observation, data collection and analysis. Special emphasis will be placed on how to communicate this information in the classroom.

SCI-361 Origins 3/4
A scientific investigation of the feasibility of various origin theories with special emphasis on the creation vs. evolution debate. Explores the difference between origins science and operation science and analyzes the conflict in the Christian scientific community as well as the population at large. Prerequisites: SCI-111, BIO-111 or equivalents.

SCI-362 Biomedical Ethics (PHI-362) 3/4
A study of the ethical issues in modern medicine from a biblical, historical, theological and scientific perspective. The course surveys the current literature on reproductive medicine, organ transplants, genetic technologies, medical research and end-of-life concerns, with particular emphasis upon students developing a biblically-based model for ethical decision making.

SCI-380 Internship 1- 6
This course provides an opportunity to work in a supervised biological setting (e.g., DNR, nature center, public health agency). The experience must include opportunities to apply the theories and concepts learned in the discipline or to enhance biological science research skills.

SCI-400 Integrated Science Capstone 2/2
This course is designed to serve as the culminating course of science content for the integrated science major and minor, just prior to the directed teaching semester. Using the major themes motif, each subject will be explored for the common and varied approaches to understanding its physical, biological and earth/space science content and interconnections. Philosophical under pinnings and ethical considerations will be stressed for each theme along with its outworking. Students will be responsible for developing their own set of alternative solutions for each problem encountered, discovering strategies for communicating integrated content in their classroom and devising techniques to stimulate their students to join the quest. Prerequisite: Senior status.

SCI-423 Neuroscience 2/4
A special topics course which introduces workings of the brain and aspects of personality dealing with these at the level of the nerve cells and brain structures. Learned topics include: Perception, cognition, intelligence, the basis of emotional states, personality disorders and questions of guilt; progressive and degenerate diseases of the mind; nerve impulses and the synapses to understanding drug abuse and addictions; neural pathologies like speech disorders, attention deficit hyperactive disorder and the epilepsies; sen-

sations, reflexes and movement control; brain waves, sleeping and arousal, awareness, consciousness and the soul, along with investigating the neural brain of gender differences. Prerequisites: BIO-151 or BIO-241 or PSY-441 or permission of instructor.

SCI-461 Philosophy of Science 3/6
Analytical study of the philosophical bases of science and various interdisciplinary relationships.

SCI 465 Secondary Science Methods 3/2
This course focuses on specific knowledge, skills, and attitudes that are demonstrated by effective science teachers in the secondary schools. Students will learn to design, organize, present, and evaluate the learning of science subject matter utilizing various instructional models and methods of teaching science.

SCI-470 Readings in Science 1-3/1

SCI-480 Advanced Topics Seminar 3/6

SCI-490 Independent Study 1-3/1

SCI-495 Senior Research Project and Seminar 2/2
Independent laboratory and/or field research of an important scientific problem of interest to researcher and faculty mentor. Student will report findings of research before departmental faculty and science peers. Prerequisites: Senior status, majority of major field of study completed.

AUSABLE INSTITUTE COURSES
The following courses are offered through the AuSable Trails Institute of Environmental Studies. See page 61 for further details.

ECO-301 Land Resources 4
Systems-level perspective on land forms and ecosystems. Includes analysis and interpretation of on-site data recorded in the field, remote-sensing data derived from satellite and low-altitude aerial imagery and geographic information systems (GIS). Field trips to and analysis of forests, bogs, marshes, dunes, and rivers. Includes application to policy and land use planning. Prerequisite: One year of introductory science.

ECO-302 Water Resources 4
Field study of lakes and streams with applications to planning and management. Includes an introduction to limnology and investigation of representative lakes and streams of the region. Prerequisite: One year of general biology and one year of general chemistry.

ECO-303 Ecological Agriculture 4
Environmental analysis and natural resources in relation to people and policy. The focus is on ethnobotany, ecological agriculture, and land stewardship. It employs a discussion format both in classroom and field settings. Its emphasis is grappling with difficult practical and ethical problems and issues that require deep and persistent thought.

ECO-304 Natural Resources Practicum 4

Global Development and Ecological Stewardship: Environmental analysis and natural resources in relation to society and development issues. The focus is on ecological sustainability and sustainable society in the context of the various factors that are bringing environmental degradation and impoverishment of people and cultures. It deals with topics of tropical agriculture, hunger, poverty, international debt, appropriate technology, relief programs, missionary earthkeeping, conservation of wild nature, land tenure, and land stewardship. It employs a discussion format both in classroom and field settings. Its emphasis is grappling with difficult practical and ethical problems and issues that require deep and persistent thought.

ECO-305 Ornithology 4

Biology, behavior, ecology and identification of birds. Work is primarily conducted in the field and covers the major habitats of northern lower Michigan, including wetlands, lakes, rivers, forests, dunes, and open field communities. Emphasis will be placed on identification of the spring bird fauna of northern lower Michigan by sight and by call. Prerequisite: One course in introductory biology or zoology.

ECO-310 Winter Biology 4

Biology and environment of Northern Michigan plants and animals in winter condition. Lectures, films, and field experience. Prerequisite: One course in biology.

ECO-311 Field Botany 4

Field identification and ecology of vascular plants as components of natural communities in Michigan. Emphasis is placed upon on-site examination of plants in communities such as bog, dune, forest, marsh, meadow, and swamp. Plants difficult to study under field conditions are brought to the laboratory for microscopic examination and identification. Ecological features such as community stratification and plant zonation along ecological gradients are examined. Prerequisite: One year of general biology or one semester of botany.

ECO-312 Insect Biology and Ecology 4

A study of insect taxonomy, ecology, life histories, and economic importance. Special attention is given to environmental stewardship issues including use of insecticides, biological control, integrated pest management, and impact of cultivation on formation of pest faunas. Field methods are stressed.

ECO-315 Woody Plants 4

Taxonomy, ecology, management, and stewardship of trees and shrubs. Presents the systematic botany of local woody flora including identification by foliage, twigs, wood and bark, and trees of major economic importance worldwide. Given in the context of ethical and global questions of deforestation, global warming trends, old growth forest values, lumbering, forest ecosystem restoration, and land stewardship. Prerequisite: One year of general biology or one semester of botany.

ECO-321 Animal Ecology 4

Interrelationships between animals and their biotic and physical environments emphasizing behavioral aspects. A field course that centers on the ecology of northern Michigan fauna from a stewardship perspective. Included are individual student projects. Prerequisite: One year of introductory science.

ECO-322 Aquatic Biology 4

Ecology, identification, systematics, culture and care of aquatic plants and animals, and adaptations to freshwater environments. Aquatic life is studied in lakes, ponds, bogs, marshes, streams, and in the laboratory. The course assesses human impact on aquatic species and ecosystems, presents procedures for the stewardship of aquatic habitats, and introduces aquatic restoration ecology. Prerequisite: One year of general biology or one semester each of general zoology and general botany.

ECO-332 Environmental Chemistry 4

Principles and analysis of chemical movement and distribution both natural and human-induced in natural environments. Sampling and analytical methods are included for water, soil, and air. Work is conducted both on site in natural habitats and the laboratory. Prerequisite: One year of general chemistry and one semester of either biochemistry or organic chemistry.

ECO-346 Winter Stream Ecology 4

Geological, physical and chemical features of streams in winter with a focus on ecological interactions and applications to the stewardship of streams and watersheds. Not open to students who have taken ECO-322. Prerequisite: One year of general biology.

ECO-350 Environmental Ethics 4

Contemporary problems of environmental stewardship are investigated, including use of renewable and non-renewable natural resources, pollution, appropriate land use and development, their world concerns and preservation of wild nature. These problems are set in a historical perspective of human relationships to the natural environment, especially as this relationship is viewed in the light of Christian thought and doctrine. Current attempts to develop a theology of nature and principles of Christian stewardship are considered.

ECO-361 Natural History in Spring 4

Springtime plants and animals, their field identification, field biology, behavior and landscape context with a focus on spring flora, amphibia, and birds.

ECO-411 Advanced Field Botany 4

Extended field identification and ecology of vascular plants as components of natural communities. Selection and study of a specific plant community for intensive taxonomic and ecological research and preparation of herbarium specimens according to established museum techniques. Taught concurrently with ECO-311. Students who take this as their only course during a given academic session must also enroll in ECO-499 Research for two credits. Prerequisite: Biol-311 Field Botany taken at another Au Sable Institute location.

ECO-427 Ecology of the Indian Tropics 4

Tropical ecology of South India, including an introduction to and comparative analysis of coastal ecosystems, the plains, and montane tropical ecosystems of the Western Ghats including altitudinal zonation. The course will be taught on-site at a variety of ecosystem preserves and national parks. If suitable arrangements can be made, a number of ecosystems will be studied on the Andaman Islands. Topics include tropical eco-

system structure and function, adaptations of flora and fauna, biodiversity surveys, past and present human interactions with the landscape, and autecology of selected plant and animal species. Prerequisite: Upper division standing and at least one ecology course (preferably completed at AuSable).

ECO-471 Conservation Biology 4

Principles of conservation biology with applications to sustainable human society and biospheric integrity. An integrative approach to biology and society that interrelates population biology, ecological principles, biogeochemical cycles, ecosystem functions, and human society in the context of biospheric degradation. The course develops a stewardship perspective rooted in biological principles and directed at conservation of plant and animal species, biotic communities, ecosystems, and human society. Included are topics of human development, poverty, and economic growth. Prerequisite: One year in biology and one course in ecology, or permission of professor.

ECO-482 Restoration Ecology 4

Ecological foundations and techniques for ecosystem and biotic community restoration. This course applies ecological principles and environmental ethics to redeeming and restoring degraded and damaged ecosystems and endangered species. Field studies include analysis of restoration and rehabilitation work with the Kirtland Warbler, an officially designated wild river, coastal dunes, kettlehole bogs, old growth forest, deforested lands, degraded residential and farming sites, and abandoned oil wells. A practical field laboratory is included in which techniques are applied to a specific site.

ECO-499 Directed Independent Research 4

Field or laboratory study of a problem selected by the student in consultation with a professor and presented as a written proposal in advance of the session in which the study is to be conducted. Normally, problems are outgrowths of previous coursework with a given professor. Prerequisite: Permission of professor.