



**DIVISION *of* MATHEMATICS  
AND COMPUTER SCIENCE  
and  
DIVISION *of* NATURAL SCIENCES**

MR. RONALD D. BENNETT  
DR. LYNNE C. CARY  
MRS. JUDY K. HOLTGREN  
DR. BRYAN J. ISAAC  
DR. JAMES KROON, Emeritus  
DR. ROBERT K. MYERS  
MR. DONALD L. SCHWING  
DR. KATHRYN G. SHAFER

DR. JOHN SMITH, Emeritus  
MRS. CHRISTINE A. STUMP  
DR. ERWIN SUCIPTO  
DR. CATHY A. WEAKLAND  
DR. RODRIC H. WHITE-STEVENS  
DR. NELSON W. WORDEN  
DR. W. CHRIS WOZENCRAFT

**DIVISION OF MATH/COMPUTER SCIENCE**  
Engineering  
Information Technology Management  
Mathematics  
Math Education

**DIVISION OF NATURAL SCIENCES**  
Biology  
Chemistry  
Computational Physics  
Engineering  
Environmental Biology  
Pre-Med  
Science Education

# **MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES**

All majors in this division receive the Bachelor of Science (B.S.) degree.

## **Goals of the Natural Sciences Division**

**Mission Statement:** As the division of natural sciences, our purpose is:

- To glorify God by using His creation to know Him and make Him known;
- To use the process of science to explore, investigate and discover the natural and empirical aspects of creation; and
- To promote the process of learning within the context of a Christian community of scholars.

**Goals statement:** As the division of natural sciences, our goal is that students should be able to:

1. Explore the relationship between Christian faith and the sciences;
2. Gain the skills needed to understand and evaluate natural phenomena;
3. Be competent at investigative methods, instrumental techniques and analysis of data;
4. Develop critical thinking skills, applying them to solving real-world problems;
5. Be empowered with a sense of understanding, ownership and responsibility that promotes a lifelong learning process of scientific discovery;
6. Interact with faculty as a community of scholars; and
7. Be empowered with professional job skills or graduate school capabilities.

## **Biology Major**

This major is designed to prepare students for further studies in medicine, cellular and molecular biology, biological laboratory sciences, physical and occupational therapy and medical school. Students interested in these programs typically complete a baccalaureate degree prior to admittance into a professional school or graduate school.

			<b>HOURS</b>
<b>General Studies</b>			
COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
ENGL	102	Written Communication III	3
PSYC	182	General Psychology	3
PHED	100	Lifelong Physical Awareness	0.5
SOC	151	Principles of Sociology	3
BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3
		Foreign Language, Two Semesters	6
		History Elective	3
		Art/Drama/Music	3
		Literature	3
PHIL	150	Logic & Critical Thinking	2
PHIL	250	Introduction to Philosophy	3
THEO	110	Exploring the Christian Faith	3
PHIL	452	Senior Experience	1
PHED	112-136	Physical Education Activities	1.5
			<b>47</b>
<b>Major</b>			
NS	110	Environmental Science	4
BIOL	210	Zoology	4
BIOL	211	Botany	4
BIOL	214	Anatomy & Physiology I	4
BIOL	215	Anatomy & Physiology II	4
BIOL	308	Molecular Cell Biology	4
BIOL	309	Genetics	4

# **MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES**

			<b>HOURS</b>
BIOL	312	Microbiology	4
BIOL	460	Biochemistry	<u>4</u>
			<b>36</b>
<b>Required Cognates</b>			
CHEM	163	General Chemistry I	4
CHEM	164	General Chemistry II	4
CHEM	261	Organic Chemistry I	4
CHEM	262	Organic Chemistry II	4
PHYS	121	General Physics I	4
MATH	111	Basic Probability & Statistics	3
MATH	131	Calculus I, or	4
MATH	124	Applied Calculus	(3)
NS	333	Scientific Research Methods	<u>3</u>
			<b>29-30</b>
Electives needed to complete the degree			<b>11-12</b>

## **Biology Minor**

BIOL	115	Human Biology, or	4
NS	110	Environmental Science	(4)
BIOL	210	Zoology	4
BIOL	211	Botany	4
BIOL	308	Molecular Cell Biology, or	4
BIOL	312	Microbiology	(4)
BIOL	309	Genetics	4
CHEM	163	General Chemistry I	<u>4</u>
			<b>24</b>

## **Environmental Biology Major**

This program is designed to educate biologists in the area of the environmental sciences especially as related to organismal or field biology. This should prepare them for careers in wildlife ecology, veterinary medicine, environmental consulting, land use planning, government agencies, missionary field-work as related to sustainable development and general environmental stewardship. The program emphasizes hands-on fieldwork, biodiversity approaches to environmental concerns and integration of a biblical basis for creation with sound scientific principles. The Environmental Biology major operates in partnership with Au Sable Institute in Michigan. It requires that the student take at least two courses during the summer semester at one of the Au Sable campuses.

### **General Studies**

COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
ENGL	102	Written Communication III	3
PSYC	182	General Psychology	3
PHED	100	Lifelong Physical Awareness	0.5
SOC	151	Principles of Sociology	3
BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3
		Foreign Language (two semesters)	6
		History Elective	3
		Art/Drama/Music	3
		Literature	3
PHIL	150	Logic & Critical Thinking	2
PHIL	250	Introduction to Philosophy	3
THEO	110	Exploring the Christian Faith	3
PHIL	452	Senior Experience	1
PHED	112-136	Physical Education Activities	<u>1.5</u>
			<b>47</b>

***MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES***

			HOURS
<b>Major</b>			
BIOL	210	Zoology	4
BIOL	211	Botany	4
BIOL	309	Genetics	4
BIOL	313	Ecology	4
BIOL	317	Wildlife Techniques	4
BIOL	330	Biodiversity	3
BIOL	411	Comparative Vertebrate Anatomy	4
BIOL	420	Mammalogy	4
Au Sable		Ornithology	4
Au Sable		Field Botany	<u>4</u>
			<b>39</b>

**Required Cognates**

MATH	111	Basic Probability & Statistics	3
MATH	131	Calculus I, or	4
MATH	124	Applied Calculus	(3)
CHEM	163	General Chemistry I	4
CHEM	164	General Chemistry II	4
CHEM	261	Organic Chemistry I	4
NS	291	Physical World, or	4
PHYS	121	General Physics I	(4)
NS	333	Scientific Research Methods	<u>3</u>
			<b>25-26</b>

Electives needed to complete the degree 19-21

**Environmental Biology Minor**

BIOL	313	Ecology	4
BIOL	330	Biodiversity	3
NS	110	Environmental Science	4
BIOL	210	Zoology	4
BIOL	211	Botany	<u>4</u>
			<b>19</b>

**Chemistry Major**

This major is designed to prepare students for employment in the field of chemistry or for further study in medicine, chemistry, or biochemistry. The B.S. in chemistry is the common “working degree,” and graduates are ready for employment in the chemical industry, both locally and nationally.

**General Studies**

COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
ENGL	102	Written Communication III	3
PSYC	182	General Psychology	3
PHED	100	Lifelong Physical Awareness	0.5
SOC	151	Principles of Sociology	3
BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3
		Foreign Language (two semesters)	6
		History Elective	3
		Art/Drama/Music	3
		Literature	3
PHIL	150	Logic & Critical Thinking	2
PHIL	250	Introduction to Philosophy	3
THEO	110	Exploring the Christian Faith	3
PHIL	452	Senior Experience	1
PHED	112-136	Physical Education Activities	<u>1.5</u>
			<b>47</b>

# ***MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES***

			<b>HOURS</b>
<b>Major</b>			
CHEM	163	General Chemistry I	4
CHEM	164	General Chemistry II	4
CHEM	261	Organic Chemistry I	4
CHEM	262	Organic Chemistry II	4
CHEM	280	Analytical Chemistry	4
CHEM	461	Physical Chemistry I	4
NS	333	Scientific Research Methods	3
PHYS	121	General Physics I	4
PHYS	122	General Physics II	4
MATH	131	Calculus I	4
MATH	132	Calculus II	4
<b>Choose two from the following:</b>			<b>8</b>
CHEM	360	Intermediate Inorganic Chemistry	(4)
CHEM	460	Biochemistry	(4)
PHYS	301	Quantum Physics	(4)
<b>Choose six hours from the following:</b>			<b>6</b>
BADM	121	Introduction to Business	(3)
BADM	321	Principles of Management	(3)
BADM	322	Principles of Marketing	(3)
CAPP	229	Introduction to Database Management	(2)
CAPP	230	Introduction to Spreadsheet	(2)
MATH	231 or 252	Calculus III or Statistics	(3)
CHEM	360 or 362 or PHYS 301	whichever was not taken to fulfill major requirements above	(4)
			<b>57</b>
Electives needed to complete the degree			20

## **Chemistry Minor**

CHEM	163-164	General Chemistry I & II	8
CHEM	261	Organic Chemistry I	4
CHEM	280	Analytical Chemistry	4
<b>Choose one from the following:</b>			
CHEM	262	Organic Chemistry II	4
CHEM	460	Biochemistry	(4)
CHEM	461	Physical Chemistry I	(4)
			<b>20</b>

## **Computational Physics**

<b>General Studies</b>			
COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
ENGL	102	Written Communication III	3
PSYC	182	General Psychology	3
PHED	100	Lifelong Physical Awareness	0.5
SOC	151	Principles of Sociology	3
BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3
		Foreign Language (two semesters)	6
		History	3
		Art/Drama/Music	3
		Literature	3
PHIL	150	Logic & Critical Thinking	2
PHIL	250	Introduction to Philosophy	3
THEO	110	Exploring the Christian Faith	3
PHIL	452	Senior Experience	1
PHED	112-136	Physical Education Activities	1.5
			<b>47</b>

***MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES***

			HOURS
<b>Major</b>			
PHYS	121	General Physics I	4
PHYS	122	General Physics II	4
PHYS	211	Electronics	4
PHYS	225	Statics	3
PHYS	226	Dynamics	3
PHYS	301	Quantum Physics	4
PHYS	332	Waves & Optics	4
PHYS	344	Electricity & Magnetism	3
ITSC	120	Introduction to Computing	3
ITSC	121	Computer Programming I	3
MATH	131	Calculus I	4
MATH	132	Calculus II	4
MATH	231	Calculus III	3
MATH	232	Differential Equations	3
* MATH/ITSC/PHYSICS Electives: (at the level of 200 or above):			6 <hr/> 55
Electives needed to complete the degree			22 <hr/> 124

\* Upper level physics courses in digital electronics, statistical mechanics, analytical mechanics, quantum mechanics and astrophysics are available through the NICE consortium at nearby colleges.

**Engineering Major  
Combination Program—B.S. in Math/Physics**

Bethel College offers two cooperative engineering programs—one through the University of Notre Dame and the other through Tri-State University. A student enrolled for either program completes three years of study at Bethel College and two additional years of study at the cooperating university selected. At the end of one year of satisfactory study at the university, Bethel College awards a B.S. degree in mathematics/physics, and at the end of the second year, the university awards a B.S. degree in engineering. As part of Bethel College’s requirements, each engineering student must maintain a 3.0 cumulative grade point average; earn a grade of at least “C” in all courses in the major; and receive a favorable recommendation from the chair of the division of mathematics and computer science and the chair of the division of natural science and be accepted by one of the cooperating institutions. These are Bethel College’s requirements and may not correspond to the cooperating institutions’ requirements. The student should talk to one of Bethel’s advisors of the engineering students about the current requirements of each of the cooperating universities. During the third year of study at Bethel College, the student must officially apply for admission to the cooperating university as part of the transfer process. Students interested in majoring in engineering should contact the office of admission and the divisional chairperson for further information regarding performance standards and available programs.

			HOURS
<b>General Studies</b>			
COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
ENGL	102	Written Communication III	3
PSYC	182	General Psychology, or	3
SOC	151	Principles of Sociology	(3)
BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3
		Economics/History Elective	3
FA	170	Perspectives in Fine Arts, or	3
LIT		Literature Elective	(3)
THEO	110	Exploring the Christian Faith	3

# **MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES**

PHIL	250	Introduction to Philosophy	3
PHIL	452	Senior Experience	1
PHED	100	Lifelong Physical Awareness	0.5
PHED	112-136	Physical Education Activities	<u>1.5</u>
			<b>33</b>

**Major**

CHEM	163	General Chemistry I	4
CHEM	164	General Chemistry II	4
ITSC	121	Computer Programming I	3
MATH	131	Calculus I	4
MATH	132	Calculus II	4
MATH	231	Calculus III	3
MATH	232	Differential Equations	3
MATH	241	Linear Algebra	3
MATH	252	Probability & Statistics	3
PHYS	121	General Physics I	4
PHYS	122	General Physics II	4
PHYS	211	Electronics	4
PHYS	301	Quantum Physics	<u>4</u>
			<b>47</b>

Plus **one** of the following sequences:

For those interested in Mechanical or Civil Engineering (Notre Dame or Tri-State)

PHYS	225	Statics	3
PHYS	226	Dynamics	3
PHYS	310	Thermodynamics	3
PHYS	327	Solid Mechanics	<u>4</u>
			<b>13</b>

For those interested in Electrical Engineering (Notre Dame or Tri-State) or Computer Engineering (Tri State)

ITSC	122	Computer Programming II	3
MATH	210	Discrete Mathematics	3
PHYS	332	Waves & Optics	3
PHYS	344	Electricity & Magnetism	<u>3</u>
			<b>12</b>

For those interested in Computer Science (Notre Dame)

ITSC	122	Computer Programming II	3
MATH	210	Discrete Mathematics	3
		ITSC or PHYS electives	<u>6</u>
			<b>12</b>

For those interested in Chemical Engineering (Notre Dame or Tri-State)

CHEM	261	Organic Chemistry I	4
CHEM	262	Organic Chemistry II	4
CHEM	280	Analytical Chemistry, or	4
CHEM	461	Physical Chemistry I	<u>(4)</u>
			<b>12</b>

Recommended elective for those going to Notre Dame

BIOL	308	Molecular Cell Biology	<u>4</u>
		Total	<b>93-98</b>

## **BS Information Technology Management**

**General Studies**

BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3

**MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES**

			<b>HOURS</b>
COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
ENGL	102	Written Communication III	3
PHED	100	Lifelong Physical Awareness	0.5
PHED	112-137	Physical Education Activities	1.5
PHIL	150	Logic & Critical Thinking	2
PHIL	250	Introduction to Philosophy	3
PHIL	452	Senior Experience	1
PSYC	182	General Psychology	3
SOC	151	Principles of Sociology	3
THEO	110	Exploring the Christian Faith	3
		Art/Theatre/Music Electives	3
		Literature Elective	3
		Mathematics Elective	3
		Science Elective w/Lab	4
		History Elective	<u>3</u>
			<b>48</b>
<b>Major</b>			
ACCT	203	Fundamentals of Accounting I	3
BADM	321	Principles of Management	3
CAPP	325	Adv. SS & Database Mgt.	3
ECON	233	Principles of Economics	3
ITSC	110	Practical Security	2
ITSC	120	Introduction to Computing	3
ITSC	121	Computer Programming I	3
ITSC	122	Computer Programming II	3
ITSC	210	Web Design	3
ITSC	321	Systems Analysis	3
ITSC	323	Database	3
ITSC	331	Network Design & Implementation	3
ITSC	333	e-Commerce	3
ITSC	355	Information Systems	3
ITSC	410	Information Security	3
ITSC	422	Senior Project/Internship	<u>3</u>
			<b>47</b>
		Electives needed to complete the degree	29

**Mathematics Major**

<b>General Studies</b>			
COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
ENGL	102	Written Communication III	3
PSYC	182	General Psychology	3
PHED	100	Lifelong Physical Awareness	0.5
SOC	151	Principles of Sociology	3
BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3
		Foreign Language (two semesters)	6
		History Elective	3
		Art/Drama/Music	3
		Literature	3
PHIL	150	Logic & Critical Thinking	2
PHIL	250	Introduction to Philosophy	3
THEO	110	Exploring the Christian Faith	3
PHIL	452	Senior Experience	1
PHED	112-136	Physical Education Activities	<u>1.5</u>
			<b>47</b>

# **MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES**

<b>Major</b>			<b>HOURS</b>
MATH	131	Calculus I	4
MATH	132	Calculus II	4
MATH	210	Discrete Mathematics	3
MATH	231	Calculus III	3
MATH	232	Differential Equations	3
MATH	241	Linear Algebra	3
MATH	252	Probability & Statistics	3
MATH	293	Mathematical Proofs	3
MATH	331	Modern Geometry	3
MATH	341	Abstract Algebra	3
MATH	461	Real Analysis	3
ITSC	120	Introduction to Computing	3
ITSC	121	Computer Programming I	3
PHYS	121	General Physics I	4
PHYS	122	General Physics II	4
			<b>49</b>
		Electives needed to complete the degree	28

## **Mathematics Minor**

MATH	131	Calculus I	4
MATH	132	Calculus II	4
MATH	210	Discrete Mathematics	3
MATH	241	Linear Algebra	3
MATH	252	Probability & Statistics	3
MATH	293	Mathematical Proofs	3
MATH	331	Modern Geometry, or	3
MATH	341	Abstract Algebra, or	(3)
MATH	461	Real Analysis, or	(3)
MATH	231	Calculus III, or	(3)
MATH	232	Differential Equations	(3)
			<b>23</b>

## **Mathematics Education Major**

<b>General Studies</b>			
COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
ENGL	102	Written Communication III	3
PSYC	182	General Psychology	3
PHED	100	Lifelong Physical Awareness	0.5
SOC	151	Principles of Sociology	3
THEO	110	Exploring the Christian Faith	3
BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3
		Foreign Language (two semesters)	6
HIST		History Elective	3
LIT		Literature	3
		Art/Drama/Music	3
PHIL	150	Logic & Critical Thinking	2
PHIL	250	Introduction to Philosophy	3
PHIL	452	Senior Experience	1
PHED	112-136	Physical Education Activities	1.5
			<b>47</b>

<b>Major</b>			
MATH	131	Calculus I	4
MATH	132	Calculus II	4
MATH	210	Discrete Mathematics	3
MATH	231	Calculus III	3
MATH	232	Differential Equations	3
MATH	241	Linear Algebra	3

# **MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES**

			<b>HOURS</b>
MATH	252	Probability & Statistics	3
MATH	293	Mathematical Proofs	3
MATH	331	Modern Geometry	3
MATH	341	Abstract Algebra	3
ITSC	120	Introduction to Computing	3
PHYS	121	General Physics I	4
			<b>39</b>

## **Professional Education**

EDUC	102	Foundations of Education	3
EDUC	204	Diversity in the Classroom	3
EDUC	205	Educational Pedagogy I	3
EDUC	305	Educational Pedagogy II	3
PSYC	285	Adolescent Growth & Development	2
SCED	446	Specific Methods in Math	3
SCED	448	Developmental Reading	3
SCED	449	Student Teaching	8
EDUC	441	Professional Education Seminar	0-2
			<b>28-30</b>

Electives needed to complete the degree 8-10

*See TEACHER EDUCATION (page 76) for program admission and other information.*

## **Physics Minor**

PHYS	121	General Physics I	4
PHYS	122	General Physics II	4
PHYS	211	Electronics	4
PHYS	301	Quantum Physics	4
PHYS		Elective in Physics	4
			<b>20</b>

## **Pre-Medicine Major**

This program is designed to meet the entrance requirements for professional schools such as medical, dental, physical therapy and veterinary schools. The courses in this major are specifically chosen to prepare students for the MCAT (Medical Colleges Admissions Test), to allow flexibility in additional training in the sciences, and to allow students to take helpful courses in non-science disciplines. Students are advised to include anatomy—either Comparative Vertebrate Anatomy or Human Anatomy & Physiology I & II.

It should be noted that only a small percentage of students going to medical schools take a “pre-med” major. With this in mind, students are encouraged to also consider majors such as Biology or Chemistry (or a number of other fields), as there are more common ways to train for entrance into these types of professional programs. [Minimal requirements for most medical schools are one year of Biology, one year of General Chemistry, one year of Organic Chemistry and one year of Physics (some also require a year of calculus)].

### **General Studies**

COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
ENGL	102	Written Communication III	3
PSYC	182	General Psychology	3
PHED	100	Lifelong Physical Awareness	0.5
SOC	151	Principles of Sociology	3
BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3
		Foreign Language	6
		History Elective	3
		Art/Drama/Music	3
		Literature	3

# ***MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES***

			<b>HOURS</b>
PHIL	150	Logic & Critical Thinking	2
PHIL	250	Introduction to Philosophy	3
THEO	110	Exploring the Christian Faith	3
PHIL	452	Senior Experience	1
PHED	112-136	Physical Education Activities	<u>1.5</u>
			<b>47</b>
<b>Major</b>			
BIOL	210	Zoology	4
BIOL	308	Molecular Cell Biology	4
CHEM	163	General Chemistry I	4
CHEM	164	General Chemistry II	4
CHEM	261	Organic Chemistry I	4
CHEM	262	Organic Chemistry II	4
MATH	111	Basic Probability & Statistics	3
MATH	131	Calculus I	4
PHYS	121	General Physics I	4
PHYS	122	General Physics II	<u>4</u>
Electives chosen from:			24
BIOL courses – 200 level or above,			
CHEM courses – 200 level or above,			
PHYS courses – 200 level or above,			
NS 333			
MATH 132			
			<b>63</b>
Electives needed to complete the degree			<b>14</b>

## **Science Education (with Life Sciences and Physical Sciences Options)**

<b>General Studies</b>			
COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
ENGL	102	Written Communication III	3
PSYC	182	General Psychology	3
PHED	100	Lifelong Physical Awareness	0.5
SOC	151	Principles of Sociology	3
BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3
			6
Foreign Language (two semesters)			
HIST	246	Introduction to World Civilization	3
LIT		Literature	3
			3
Art, Music, Theatre			
PHIL	150	Logic & Critical Thinking	2
PHIL	250	Introduction to Philosophy	3
THEO	110	Exploring the Christian Faith	3
PHIL	452	Senior Experience	1
PHED	112-136	Physical Education Activities	<u>1.5</u>
			<b>47</b>
<b>Science Core</b>			
NS	251	Astronomy	4
CHEM	163	General Chemistry I	4
PHYS	121	General Physics I	4
MATH	111	Basic Probability & Statistics	3
MATH	131/124	Calculus I or Applied Calculus	4-3
NS	110	Environmental Science	4
BIOL	214	Human Anatomy & Physiology I, or	4
BIOL	308	Molecular Cell Biology	<u>(4)</u>
			<b>26-27</b>

# **MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES**

Select either Physical or Life Sciences Option			HOURS
<b>Physical Sciences Option</b>			
CHEM	164	General Chemistry II	4
MATH	132	Calculus II	4
PHYS	122	General Physics II	4
CHEM	261	Organic Chemistry I	4
CHEM	280	Analytical Chemistry	4
PHYS	301	Quantum Physics	4
Elective		CHEM/PHYS 200+	<u>4</u>
			<b>28</b>
<b>Life Sciences Option</b>			
CHEM	164	General Chemistry II	4
CHEM	261	Organic Chemistry I	4
BIOL	210	Zoology	4
BIOL	211	Botany	4
BIOL	309	Genetics	4
BIOL	214 or 308	A&P I or Molecular Cell Biology (beyond Core)	4
Elective		BIOL 200+	<u>4</u>
			<b>28</b>
<b>Professional Education</b>			
EDUC	102	Foundations of Education	3
EDUC	204	Diversity in the Classroom	3
EDUC	205	Educational Pedagogy I	3
EDUC	305	Educational Pedagogy II	3
PSYC	285	Adolescent Growth & Development	2
SCED	443	Specific Methods in Science	2
SCED	448	Developmental Reading	3
SCED	449	Secondary Student Teaching	8
EDUC	441	Professional Education Seminar	<u>0-2</u>
			<b>27-29</b>
<b>Total hours in major</b>			<b>128-129</b>

Note: See Teacher Education (page 76) for program admission and other information.

# COURSE DESCRIPTIONS

Note: All prerequisites listed for Natural Science, Mathematics and Computer Science courses must be completed at a level of C- or better.

## **Biology (BIOL)**

Unless noted, all four-credit science classes consist of three hours of lecture and a three-hour lab each week.

### **114. Survey of Human Biology 3 Hours**

A one-term survey of human anatomy and physiology, especially for non-science majors. The major functioning systems of the body are reviewed with integration of physiological aspects with anatomy. No lab. (This course does not meet lab-based general studies requirements.)

### **115. Human Biology 4 Hours**

This is a one-semester course in human anatomy and physiology prepared especially for sociology, psychology, education and general studies majors. The major functioning organ systems of the body are reviewed with full integration of physiological aspects with anatomy. Those wishing to major in Biology or the medical fields should not take this class.

### **210. Zoology 4 Hours**

An introductory survey of all animal forms from the most primitive single-celled organisms through the most complex mammals. Laboratory exercises focus on the comparative anatomy of organisms and organ systems surveyed throughout the animal phyla. Emphasis placed on taxonomy, structure, physiology and the natural history and ecology of the animals. Animals that have important economic or health impact on humans are highlighted.

**Prerequisite:** A college level course in science.

### **211. Botany 4 Hours**

An introductory survey of all plant and fungi, from the most primitive single-celled organisms, through the most complex seed plants. Laboratory exercises focus on the comparative anatomy of organisms and plant physiology as surveyed through the plant and fungi divisions. Emphasis is placed on taxon-

omy, structure, physiology and the natural history and ecology of plants and fungus. Plants and fungus that have important economic or health impact on humans are highlighted.

**Prerequisite:** A college level course in science.

### **214. Human Anatomy & Physiology I 4 Hours**

This is the first semester of a two-semester course. This first part provides a general introduction to the human body. The chemical, cellular, tissue and organ structure and function of the human body is followed by a more detailed exploration of the integumentary, osseous, muscular and nervous systems.

**Recommended:** A course in Chemistry before this class.

### **215. Human Anatomy & Physiology II 4 Hours**

This course is the second of a two-part series which provides an introduction to the anatomy and physiology of the human body. A detailed introduction to the endocrine, cardiovascular, respiratory, digestive, nervous, urinary and reproductive systems are given.

**Prerequisite:** BIOL 214

**Concurrent:** BIOL 215

### **308. Molecular Cell Biology 4 Hours**

A study of cellular structure and function at the molecular level, with emphasis on enzymes and nucleic acids. Topics will include membrane-bound organelles in the eukaryotic cell, cell motility, signal transduction, regulation of the cell cycle and the development of cancer. Laboratory included.

**Prerequisite:** CHEM 163, 164.

### **309. Genetics 4 Hours**

A study of the principles of heredity, with emphasis on the chromosomal theory of inheritance, the mapping and analysis of genomes, transcription and translation at the molecular level and gene regulation in both prokaryotes and eukaryotes. Laboratory work will involve techniques associated with recombinant DNA technology.

**Prerequisite:** CHEM 261.

### **312. Microbiology 4 Hours**

A study of the fundamental principles of

the morphology and physiology of microorganisms. Microbes that cause infectious disease will be highlighted and the human response to microbes will be addressed. Laboratory exercises will involve sterile techniques, staining methods for identification and the use of antimicrobial agents for microbial control.

**Prerequisite:** A college course in biology and chemistry.

- 313. Ecology 4 Hours**  
A general study of the relationship of living organisms to environment, and the structural and functional properties of nature. Topics covered include population and community ecology, ecosystem management, biodiversity, competition and predation.  
**Prerequisites:** BIOL 210 and 211.  
**Recommended:** MATH 111.
- 317. Wildlife Techniques 4 Hours**  
This course covers common techniques used in wildlife research. Skills will be developed in basic sampling design and biostatistics, writing for wildlife research, use of topographic maps, cover mapping, GIS and GPS in ecological inventory, analysis of habitats (wetland, farmland and forests), estimation of population size, home range, and survival, capture and handling birds and mammals, sexing and aging of game species and radio tracking. Each student will be required to participate in a field study and attend two weekend field trips. Three hours of lecture and three hours of lab per week.  
**Prerequisites:** BIOL 210, 211, MATH 111.
- 330. Biodiversity 3 Hours**  
This course focuses on the preservation and restoration of our natural environments through modern conservation theories of biological diversity. Major topics covered are: conservation biology, species preservation and conservation, habitat fragmentation, conservation reserves, global biodiversity, the role of genetics in conservation biology, ecological restoration, ecology, politics and environment and sustainable development.
- 399. Internship in Biology 1-4 Hours**  
Field experience in a selected area of interest, including on-the-job experience and practical training.  
**Prerequisite:** Permission of instructor.
- 411. Comparative Vertebrate Anatomy 4 Hours**  
A comparative study of vertebrate systems and organs, using representatives of the classes for laboratory study. The course will cover the basic organ systems as represented throughout the vertebrates and compare differences within and among major classification schemes. Laboratory work will combine comparative morphology with physiology to promote an understanding of biological aspects of development.  
**Prerequisite:** BIOL 210.
- 412. Developmental Biology 4 Hours**  
A study of the vertebrate embryo and its morphogenesis from fertilization to the development of organ systems. Lab work will focus on identification of developmental pathways for organ systems, histological slide preparation and understanding the growth of the vertebrate from the single cell stage to the adult organism.  
**Prerequisite:** BIOL 210.
- 413. Independent Study in Biology 1-2 Hours**  
An opportunity to engage in independent study and research. A paper is required as evidence of accomplishment. May be repeated for credit.  
**Prerequisite:** BIOL 210 or 211. Permission of instructor.
- 420. Mammalogy 4 Hours**  
This course will cover the ecology, natural history, systematics and classification of the orders of mammals found throughout the world. Mammals will be studied from the aspect of comparative biology with emphasis on morphology, ecology and behavior. Special emphasis will be given to those mammals found in the Indiana-Great Lakes region.  
**Prerequisite:** BIOL 210.
- 430. Histology 4 Hours**  
Students will be required to produce a set of plant and animal tissue slides, along with appropriate lectures concerning techniques, stains and reagents. This course will reinforce all the concepts learned in other biology courses concerning cells and cell structures and is a hands-on laboratory experience in cell preparation.  
**Prerequisites:** BIOL 308, 309.
- 460. Biochemistry 4 Hours**  
See description for CHEM 460.

**Chemistry (CHEM)**

- 110. Introduction to Chemistry 2 Hours**  
The basic principles of chemistry, including atomic structure, the periodic table, the gas laws, bonding, solutions, equilibrium, etc., in a nonlaboratory course.  
**Prerequisite:** MATH 090.
- 150. Introduction to General, Organic & Biochemistry 4 Hours**  
A survey of general, organic and biological chemistry designed for students in the nursing and related health professions. Three lectures and one three-hour laboratory each week.  
**Prerequisite:** High school chemistry or adequate algebra skill or permission of instructor.
- 163. General Chemistry I 4 Hours**  
An introduction to fundamental concepts and tools of chemistry, to include atomic structure, stoichiometry, mechanical behavior of bulk matter thermodynamics and chemical bonding. This course is designed for science and engineering majors. Lecture and laboratory.
- 164. General Chemistry II 4 Hours**  
A continuation of the introduction to fundamental concepts and tools of chemistry, to include equilibrium, kinetics, thermodynamics and electrochemistry. This course is designed for science and engineering majors. Lecture and laboratory.  
**Prerequisite:** CHEM 163.
- 261. Organic Chemistry I 4 Hours**  
A systematic study of the chemistry of carbon and compounds and their derivatives. Three lectures and one three-hour laboratory period each week.  
**Prerequisite:** CHEM 163, 164.
- 262. Organic Chemistry II 4 Hours**  
A continuation of Organic Chemistry I, with some emphasis given to the place of organic compounds in living organisms. Three lectures and one three-hour laboratory period each week.  
**Prerequisite:** CHEM 261.
- 280. Analytical Chemistry 4 Hours**  
A blend of the traditional quantitative analysis and instrumental analysis. Subjects covered include the treatment of analytical data, gravimetry, spectrophotometry, titrimetry, oxidation-reduction procedures of analysis, chromatography and others. Three lectures and one three-hour laboratory per week.  
**Prerequisite:** CHEM 164.
- 360. Intermediate Inorganic Chemistry 4 Hours**  
A study of the structure, properties, reactions and identification of inorganic ions and molecules. Lecture and laboratory.  
**Prerequisite:** CHEM 164.
- 399. Internship in Chemistry 1-4 Hours**  
Field experience in a selected area of interest, including on-the-job experience and practical training.  
**Prerequisite:** Permission of instructor.
- 460. Biochemistry 4 Hours**  
An introduction to the major groups of biochemical molecules, the catabolic processes which derive energy from them and the anabolic processes which produce them. Special attention is given to basic metabolic cycles and pathways (glycolysis, the TCA cycle, electron transport and oxidation phosphorylation) and to carbohydrate, lipid, protein and nucleic acid biosynthesis. These processes are related to cells and cellular substructure. Three lectures and one three-hour laboratory period each week.
- 461. Physical Chemistry I 4 Hours**  
A study of the fundamental laws of chemistry, emphasizing a more mathematical and thorough approach than prior courses. Topics of study include gas laws, thermodynamics, phase equilibria and kinetic theory. Three lectures and one three-hour laboratory each week.  
**Prerequisites:** CHEM 163, 164, PHYS 122, MATH 132.
- 465. Independent Study in Chemistry 1-2 Hours**  
An opportunity for a chemistry major to engage in independent study and research. A research paper is required as evidence of accomplishment. May be repeated for credit.

**Information Technology Management (ITSC)**

- 110. Practical Security 2 Hours**  
Introduction to security awareness and its practical application in the world of the individual.

# ***MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES***

- 120. Introduction to Computing 3 Hours**  
Introduction to the computing field. Areas of study include: ethical and societal issues, information management, computer applications and programming.
- 121. Computer Programming I 3 Hours**  
An introduction to computer application development using a high level, object oriented, GUI based language. Emphasis is on the use of problem solving methods, algorithms, control structures, documentation and debugging.  
**Prerequisite:** ITSC 120
- 122. Computer Programming II 3 Hours**  
Continuation of ITSC 121, with emphasis on creating classes, data integration and data structures, web programming and exception handling.  
**Prerequisite:** ITSC 121
- 210. Web Design 3 Hours**  
This course is an introduction to the basic elements of web design and will focus on web layout, design, implementation, testing and updating. The HTML language and optimization of web graphics will be introduced. State-of-the-art web software applications will be used.
- 321. System Analysis 3 Hours**  
Structured systems analysis issues and tools used in the design, development, and maintenance of an information system. Topics include the development life cycle, UML object modeling, project management and prototyping with an emphasis on case studies.
- 323. Database 3 Hours**  
An introduction to the design, implementation and management of database systems. Data integrity, normalization, querying, presentation and security are studied using existing database management systems.
- 331. Network Design & Implementation 3 Hours**  
An introduction to data communications and computer networking. Topics include the OSI model, standards, protocols, applications, wired and wireless networks, hardware and software. Current network systems are used with an emphasis on Ethernet and the TCP/IP suite.
- 333. e-Commerce 3 Hours**  
Introduction to the landscape of online commerce including both

the technical and strategic aspects using real-world case studies.

- 355. Information Systems 3 Hours**  
An introduction to the management, use and development of information technology systems in business. The role of computer hardware, software, personnel and administration in computer-based information systems.
- 410. Information Security 3 Hours**  
The managerial and ethical aspects of computer security, information security, and network security. Laboratory topics include encryption, protocols, security models, trusted systems, attacks, defenses and tools.
- 422. Internship/Senior Project 3 Hours**  
Faculty supervised practical experience in a local business or nonprofit organization OR research on a selected topic culminating in a written thesis and oral presentation.

## **Mathematics (MATH)**

- 101. College Algebra I 3 Hours**  
Review of real numbers; arithmetic of whole numbers, fractions, decimals and signed numbers; simple algebraic expressions; linear equations and inequalities in one variable; integral exponents; radicals; fractional exponents; multiplication of algebraic expressions; factoring; fractional expressions; and quadratics.  
**Prerequisite:** SAT math score of 450 or equivalent.
- 102. College Algebra II 3 Hours**  
Algebraic expressions; equations and inequalities; relations and their graphs; introduction to the study of functions including exponential, logarithmic, polynomial and rational functions; and systems of equations.  
**Prerequisite:** MATH 101 or equivalent.
- 111. Basic Probability & Statistics 3 Hours**  
A general studies course in statistics covering such subjects as averages, variability, standard scores, normal curves, correlation, linear regression, probability, sampling, hypothesis testing and chi-square.  
**Prerequisite:** MATH 090 or proficiency.
- 122. Precalculus & Trigonometry 3 Hours**  
Trigonometric functions and identities;

laws of sine and cosine; analytical geometry; in-depth study of functions; and introduction to the concept of a limit.  
**Prerequisite:** MATH 101.

- 124. Applied Calculus 3 Hours**  
One semester of differential and integral calculus with emphasis on graphical, numerical and descriptive techniques. Topics from multivariable calculus and differential equations. Applications to economics, life sciences, physical sciences and other areas of student interest are emphasized throughout via student projects and presentations.  
**Prerequisite:** MATH 102 or equivalent.
- 131. Calculus I 4 Hours**  
Functions; limits; continuity; concept of the derivative; differentiation of algebraic, rational, exponential, logarithmic and trigonometric functions; Rolle's Theorem; the Mean Value Theorem; applications of the derivative, including maxima and minima, graphing and optimization. Four hours of lecture each week.  
**Prerequisite:** Permission from instructor.
- 132. Calculus II 4 Hours**  
Anti-differentiation; Riemann integration; Fundamental Theorem of Calculus; techniques of integration; applications of integrals, including finding areas and volumes; improper integrals; indeterminate forms and L'Hopital's Rule; infinite sequences; infinite series; and parametric forms.  
**Prerequisite:** MATH 131.
- 210. Discrete Mathematics 3 Hours**  
A study of mathematical induction and logic, counting, set theory, relations and functions, algorithms, circuits, combinatorics and graph theory.  
**Prerequisite:** MATH 131
- 231. Calculus III 3 Hours**  
Fundamentals of vectors; vector-valued functions; limits, derivatives and integrals of vector-valued functions; fundamentals of multivariable functions; partial differentiation; chain rule for multivariable functions; extrema of multivariable functions; multiple integrals; cylindrical coordinates, spherical coordinates, vector fields; line integrals; surface integrals; Green's Theorem; Stoke's Theorem; and the Divergence Theorem.  
**Prerequisite:** MATH 132.
- 232. Differential Equations 3 Hours**  
Introduction to mathematical modeling with differential equations. First-order differential equations and initial-value problems; graphical solutions via slope fields; numerical solutions via Euler's method; analytic solutions for separable and linear equations. First-order systems with graphical, analytic and numerical solution techniques. Modeling with first-order systems. Linear systems with graphical and analytic solutions; second-order equations via linear systems. Other topics selected from nonlinear systems, Laplace transforms and advanced numerical methods.  
**Prerequisite:** MATH 231.
- 241. Linear Algebra 3 Hours**  
Systems of equations; matrices; properties of matrices; determinants; vectors and vector spaces; linear independence; basis; dimension; linear transformations; matrix representation of a linear transformation; eigenvalues; eigenvectors.  
**Prerequisite:** MATH 132.
- 252. Probability & Statistics 3 Hours**  
Probability; Descriptive statistics; sampling distributions; theory of estimation; confidence intervals; hypothesis testing; linear correlation; chi-square.  
**Prerequisite:** MATH 231.
- 281. Math for Teachers: Content & Pedagogy 3 Hours**  
This course is designed to review elementary math content and promote a shift in the focus of the student from learner to instructor. It will act as bridge from previously learned content to current forms of pedagogical approaches which will be necessary for success in the elementary instructional environment. Various modeling techniques, modes of explanation and facets of description will be discussed. Emphasis will be placed on the understanding and creation of a learning community which will promote critical thinking and collaborative problem solving skills.
- 282. Mathematics for Teachers II 3 Hours**  
This course is designed to acquaint the student with modern geometry as applied to the elementary school classroom, a study of the metric system and an introduction to probability and statistics.

## ***MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES***

- 293. Mathematical Proofs 3 Hours**  
This course provides an introduction to mathematical logic and proof techniques that are used in higher mathematics. Also covered: equivalence relations, functions, cardinality of sets and number theory.  
**Prerequisite:** MATH 131.
- 331. Modern Geometry 3 Hours**  
Historical and formal development of Euclidean and non-Euclidean geometry; role of axiomatic systems; fractals; Hilbert's axioms; finite geometry; history of the parallel postulate; philosophical implications.  
**Prerequisite:** MATH 293.
- 341. Abstract Algebra 3 Hours**  
Introduction to the theory of groups and rings. Symmetries; multiplication of symmetries; symmetries using matrices; isometries. Groups; permutation groups; subgroups; cyclic groups; the dihedral groups. Homomorphisms and isomorphisms; cosets and Lagrange's Theorem; equivalence relations and partitions; the homomorphism theorems; quotient groups; direct and semidirect products. Group actions on sets and finite abelian groups. Rings; polynomial divisibility; integral domains; Euclidean domains; irreducibility.  
**Prerequisite:** MATH 293.
- 461. Real Analysis 3 Hours**  
Rigorous treatment of fundamentals of single variable calculus: limits; continuity; differentiation; convergence of series and sequences; and integration.  
**Prerequisites:** MATH 231, MATH 241, MATH 293.
- 481. Independent Study in Mathematics 1-4 Hours**  
An opportunity for a mathematics major to engage in independent study or research. May be repeated for credit.
- 200. Science & Faith Seminar 1 Hour**  
This seminar series is a special seminar for students and faculty to interact on a regular basis on issues of faith and science. Topics may vary from semester to semester; may be organized around particular themes, or be based on short-term assessment of the professional literature. May be repeated.
- 201. Special Topics in the Natural Sciences 1-4 Hours**  
A study of a special topic in the sciences. Topics may vary from semester to semester and will pertain to scientific disciplines. They may be organized around particular themes, or be taught as seminars involving both faculty and students, or be based on short-term assessment of the professional literature. May be repeated for credit.
- 211. Nutrition ADN & BSN 3 Hours**  
A comprehensive study of the nutrients in food and how the body utilizes these to promote growth and wellness. Normal nutrition, nutrition throughout the life cycle and diet-oriented clinical nutrition units promote the student's knowledge and understanding of appropriate food-related behaviors. This course is oriented to the nursing and health-related major.  
**Prerequisite:** BIOL 215.
- 250. Survey of Astronomy 3 Hours**  
A survey of the characteristics, composition and structure of the extraterrestrial universe, with emphasis on the physical laws which govern its behavior. Current space projects are discussed. No lab (this course does not meet lab-based general studies requirements).
- 251. Astronomy 4 Hours**  
A study of the characteristics, composition and structure of the extraterrestrial universe, with emphasis on the physical laws which govern its behavior. Current space projects are discussed. Three lectures and several hours of laboratory and observations each week.  
**Prerequisite:** NS 251.

### **Natural Science (NS)**

- 110. Environmental Science 4 Hours**  
This class is a basic introduction to the biological world through the interdisciplinary focus of Environmental Science. Topics to be addressed are: ecosystem and community ecology and management, biodiversity, pollution, energy conservation, species conservation, nature reserves and population dynamics.
- 291. Physical World 4 Hours**  
This course serves to acquaint primarily nonscientists with basic scientific principles governing our world, how new understanding is gained through the process of the scientific method, and several key contributions of outstanding

scientists in the areas of motion, heat, sound, electricity, light, atoms, nuclei, chemistry, geology and of the entire universe. Basic algebra is assumed and some quantitative problem solving is included. Emphasis is placed on responsible use of physical resources and how our worldview is influenced by discoveries in physical science.

- 333. Scientific Research Methods 3 Hours**  
This course will be a combination of four main themes: (1) technical and scientific writing; (2) introduction to research methods, journals and procedures; (3) review of the recent scientific research in their major area of interest; and (4) covering strategies to be successful during college and after leaving (preparing resumes, GRE, looking for graduate schools, job hunting, etc.) The student will be expected to produce both written and oral research reports.

## **Physics (PHYS)**

- 121. General Physics I 4 Hours**  
A calculus-based introductory physics course, covering Newtonian mechanics of particles, conservation laws, rigid bodies and rotation, oscillations, waves, sound, heat and thermodynamics. Three lectures and one three-hour laboratory each week.  
**Prerequisites:** MATH 131 or MATH 124 or permission of instructor.
- 122. General Physics II 4 Hours**  
Electrostatics, electric circuits, magnetism, induction, physical and geometrical optics. Three lectures and one three-hour laboratory each week.  
**Prerequisites:** MATH 131 or PHYS 121.
- 211. Electronics 4 Hours**  
An introduction to electricity and electronics, both from a basic theoretical viewpoint and from a practical, hands-on perspective, to include the analysis of DC and AC circuits using resistors, capacitors, inductors and semiconductor devices such as diodes, transistors and operational amplifiers. Lab exercises involve circuit modeling and electrical measurements. Three lectures and one two-hour laboratory each week.  
**Prerequisite:** PHYS 122.
- 225. Statics 3 Hours**  
Equilibrium of coplanar and noncoplanar force systems, analysis of forces in rigid systems, friction, centroids and moments of inertia.  
**Prerequisites:** MATH 132, PHYS 121.
- 226. Dynamics 3 Hours**  
Motion of particles; relative motion; kinetics of rotation, translation and motion in a plane; impulse-momentum; work and energy.  
**Prerequisites:** MATH 132, PHYS 121.
- 301. Quantum Physics 4 Hours**  
Topics include special theory of relativity, introduction to quantum theory, the equation, atoms, nuclei and solid state. Three lectures and one three-hour laboratory per week.  
**Prerequisites:** MATH 132, PHYS 122.
- 310. Thermodynamics 3 Hours**  
Introducing basic concepts and fundamental laws of thermodynamics and some of their applications in engineering and chemistry. Topics of study include kinetic theory, basic concepts of thermodynamics, the first and second laws of thermodynamics, heat engines and refrigerators, thermodynamics potentials and phase transition.  
**Prerequisites:** MATH 132, PHYS 122.
- 327. Solid Mechanics 4 Hours**  
Study of tension, compression, shear, axially loaded members, torsion, shear forces and bending moments, stresses in beams, analysis of shear and strain, plane stress, deflection of beams and buckling.  
**Prerequisite:** PHYS 225.
- 332. Waves & Optics 4 Hours**  
Mechanical waves, waves on a string, sound waves, geometrical optics, propagation of electromagnetic waves, physical optics, diffraction, interference, polarization, lasers and holography. Three lectures and one three-hour laboratory per week.  
**Prerequisites:** MATH 231, PHYS 122.
- 344. Electricity & Magnetism 3 Hours**  
Electro and magnetostatics, Laplace's and Poisson's equations, boundary value problems, Maxwell's equations, radiation and multiple fields, electric and magnetic properties of matter.  
**Prerequisites:** MATH 231, PHYS 122.
- 399. Internship in Physics 1-4 Hours**  
Field experience in a selected area of interest, including on-the-job experience and practical training.  
**Prerequisite:** Permission of instructor.

**MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES**

421. Independent Study in  
Physics

1-4 Hours