

## Department of Physical Sciences

### Mission statement

Our purpose is:

To use the process of science to explore, investigate and discover the natural and empirical aspects of creation;

To promote the application of learning to engineering, chemistry, medical sciences, and other fields;

To glorify God by using His creation to know him and make him known.

Our goal is that students should be able to:

Gain the skills needed to understand and evaluate natural phenomena;

Develop critical thinking skills, applying them to solving real-world problems;

Be competent at investigative methods, instrumental techniques and analysis of data;

Explore the relationship between Christian faith and the physical sciences;

Be empowered with a sense of understanding, ownership and responsibility that promotes a life-long learning process of application and discovery; and

Be empowered with, professional job skills, graduate school capabilities, or skills to join an engineering program.

## 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

			HOURS
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
			<u>47</u>

### Major

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

			<b>HOURS</b>
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)
			<u>57</u>
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)
			<u>20</u>

### 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
			<u>47</u>
<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

## PHYSICAL SCIENCES

			HOURS
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):			<u>6</u> 55
Electives needed to complete the degree			<u>22</u> 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.

### B.S. Math/Physics (Engineering Combination Program)

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
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>
<b>Major</b>			
CHEM	163	General Chemistry I	4
CHEM	164	General Chemistry II	4
ITSC	121	Computer Programming I	3
MATH	131	Calculus I	4

			<b>HOURS</b>
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	4
			<u>47</u>

Plus **one** of the following concentrations:

For those interested in Mechanical or Civil Engineering

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

For those interested in Electrical Engineering or Computer Engineering

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

For those interested in Computer Science

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

For those interested in Chemical Engineering

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

## 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
			<u>20</u>

## 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)].

# PHYSICAL SCIENCES

---

			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	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 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
			<hr/>
			47
<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	4
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			
			<hr/>
			63
Electives needed to complete the degree			14

## 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
		Foreign Language (two semesters)	6
HIST	246	Introduction to World Civilization	3
LIT		Literature	3
		Art, Music, Theatre	3
PHIL	150	Logic & Critical Thinking	2
PHIL	250	Introduction to Philosophy	3
THEO	110	Exploring the Christian Faith	3

			<b>HOURS</b>
PHIL	452	Senior Experience	1
PHED	112-136	Physical Education Activities	<u>1.5</u>
			<b>47</b>

**Science Core**

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>

Select either Physical or Life Sciences Option

**Physical Sciences Option**

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>

**Life Sciences Option**

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>

**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	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>

**Total hours in major**

**128-129**

Note: See Teacher Education (page 140) for program admission and other information.