



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

MR. BENNETT, Chair (Math &
Computer Science)
DR. WOZENCRAFT Chair
(Natural Science)
DR. CARY
MRS. HOLTGREN
DR. ISAAC
DR. KROON, Emeritus
DR. R. MYERS

MR. SCHWING
DR. SHAFER
DR. J. SMITH, Emeritus
MRS. STUMP
DR. SUCIPTO
DR. WEAKLAND
DR. WHITE-STEVENS
DR. WORDEN

DIVISION OF MATH/COMPUTER SCIENCE

Computer Information Systems
Computer Science
Computer Science/Mathematics
Engineering
Mathematics
Math Education

DIVISION OF NATURAL SCIENCES

Biology
Chemistry
Computational Physics
Environmental Biology
Physics
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 therapy, veterinary medicine and occupational therapy. Students interested in these programs typically complete a baccalaureate degree prior to admittance into a professional school or graduate school.

			HOURS
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	1.5
MATH	131	Calculus I, or	4
MATH	124	Applied Calculus	(3)
CHEM	163	General Chemistry I	4
			54-55
Major			
NS	110	Environmental Science	4
BIOL	210	Zoology	4
BIOL	211	Botany	4

MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES

			HOURS
BIOL	214	Anatomy & Physiology I	4
BIOL	215	Anatomy & Physiology II	4
BIOL	308	Molecular Cell Biology	4
BIOL	309	Genetics	4
BIOL	312	Microbiology	4
BIOL	460	Biochemistry	4
			<u>36</u>

Required Cognates

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
NS	333	Scientific Research Methods	3
			<u>22</u>

Electives needed to complete the degree **11-12**

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	4
			<u>24</u>

Biology Education 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	4
SCED	443	Methods in Science	2
			<u>26</u>

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, environmental consulting, land use planning, government agencies, missionary fieldwork 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

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			HOURS
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
MATH	131	Calculus I, or	4
MATH	124	Applied Calculus	(3)
CHEM	163	General Chemistry I	4
			54-55

Major

NS	110	Environmental Science	4
BIOL	210	Zoology	4
BIOL	211	Botany	4
BIOL	411	Comparative Vertebrate Anatomy	4
BIOL	330	Biodiversity	3
BIOL	313	Ecology	4
BIOL	309	Genetics	4
BIOL	420	Mammalogy	4
Au Sable		Ornithology	4
Au Sable		Field Botany	4
			39

Required Cognates

CHEM	164	General Chemistry II	4
CHEM	261	Organic Chemistry I	4
NS	291	Physical World, or	4
PHYS	121	General Physics I	(4)
MATH	111	Basic Probability & Statistics	3
NS	333	Scientific Research Methods	3
			18

Electives needed to complete the degree 12-13

Environmental Biology Minor

BIOL	313	Ecology	4
BIOL	330	Biodiversity	3
NS	110	Environmental Science	4
BIOL	210	Zoology	4
BIOL	211	Botany	4
			19

Environmental Biology Education Minor

Completion of the 19 hours required for the Environmental Biology minor, plus:
 SCED 443 Methods in Science 2

Chemistry Major

This major is designed to prepare students for further studies or for careers in the field. The B.S. in chemistry is the common "working degree," and graduates are ready for employment in the chemical industry, both locally and nationally. Students going on for additional study would be able to pursue medicine, dentistry or research or academic work in chemistry or biochemistry.

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			HOURS
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>
			47

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
MATH	131	Calculus I	4
MATH	132	Calculus II	4

Choose two from the following:			8
CHEM	360	Intermediate Inorganic Chemistry	(4)
CHEM	460	Biochemistry	(4)
PHYS	301	Quantum Physics	(4)

Choose six hours from the following:			6
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	<u>(4)</u>
			57

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

Choose one from the following:			
CHEM	262	Organic Chemistry II	4
CHEM	460	Biochemistry	(4)
CHEM	461	Physical Chemistry I	<u>(4)</u>
			20

Chemistry Education Minor

Completion of the 20 hours required for the Chemistry Minor, plus:

SCED	443	Methods in Science	2
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Computational Physics

			HOURS
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	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>
			47
Major			
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
CPSC	121	Computer Programming I	3
CPSC	122	Computer Programming II	3
MATH	131	Calculus I	4
MATH	132	Calculus II	4
MATH	231	Calculus III	3
MATH	232	Differential Equations	3
* MATH/CS/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.

Computer Information Systems Major

General Studies			
COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
ENGL	102	Written Communication III	3
PSYC	182	General Psychology	3
SOC	151	Principles of Sociology	3
MATH	111	Basic Probability & Statistics	3
MATH	124	Applied Calculus or Math 131	3
		Literature Elective	3
		History Elective	3

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			HOURS
		Art/Drama/Music Elective	3
BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3
THEO	110	Exploring the Christian Faith	3
PHYS	211	Electronics	4
		Research Methods, or Second Science with Lab	4
PHIL	150	Logic & Critical Thinking	2
PHIL	250	Introduction to Philosophy	3
PHIL	452	Senior Experience	1
PHED	100	Lifelong Physical Awareness	0.5
PHED	112-136	Physical Education Activities	1.5
			55
Computer Core			
CPSC	121	Computer Programming I	3
CPSC	122	Computer Programming II	3
CPSC	224	Computer Programming III	3
CPSC	225	Computer Programming IV	3
CPSC	301	Web Design	3
CPSC	321	Systems Analysis	3
CPSC	322	Computer Systems	3
CPSC	323	Database	3
CPSC	331	Network Design & Implementation	3
CPSC	355	Information Systems I	3
CPSC	455	Information Systems II	3
CPSC	422	Senior Project/ Internship	3
MATH	210	Discrete Mathematics, or	3
CPSC	411	Special Topics, or	(3)
CPSC	429	Independent Study	(3)
			39
Business Core			
ACCT	203	Fundamentals of Accounting I	3
ACCT	204	Fundamentals of Accounting II	3
ECON	233	Principles of Economics	3
ECON	329	Intermediate Macroeconomics, or	3
ECON	330	Intermediate Microeconomics	(3)
BADM	286	Finite Math for Business	3
BADM	321	Principles of Management	3
			18
		Electives needed to complete the degree	12
Computer Information Systems Minor			
CPSC	121-122	Computer Programming I & II	6
CPSC	321	Systems Analysis	3
CPSC	355	Information Systems I	3
CPSC	455	Information Systems II	3
CPSC		Elective in Computer Science	3
			18
Computer Science/Mathematics Major			
General Studies			
COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
ENGL	102	Written Communication III	3
PSYC	182	General Psychology	3

MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES

			HOURS
SOC	151	Principles of Sociology	3
		Literature	3
		History	3
		Art/Drama/Music	3
PHYS	121	General Physics I, or	4
NS	110	Environmental Science, or	(4)
BIOL	333	Biodiversity, or	(3)
CHEM	163	General Chemistry I	(4)
THEO	110	Exploring the Christian Faith	3
BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3
PHIL	150	Logic & Critical Thinking	2
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>
			45
Computer Core			
CPSC	121	Computer Programming I	3
CPSC	122	Computer Programming II	3
CPSC	224	Computer Programming III	3
CPSC	225	Computer Programming IV	3
CPSC	321	Systems Analysis	3
CPSC	322	Computer Systems	3
CPSC	422	Senior Project/Internship	<u>3</u>
			21
Plus nine hours from the following:			9
CPSC	301	Web Design	(3)
CPSC	323	Database	(3)
CPSC	331	Networks	(3)
CPSC	411	Special Topics	(3)
CPSC	429	Independent Study	(1-4)
Mathematics Core			
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	Mathematical Statistics	3
MATH	293	Mathematical Proofs	3
MATH	341	Abstract Algebra	<u>3</u>
			29
Required Cognate:			
PHYS	211	Electronics	4
Electives needed to complete the degree			19

Computer Science Major A.A. Degree

General Studies			
THEO	110	Exploring the Christian Faith	3
COMM	171	Speech Communication	3
ENGL	101	Written Communication II	3
PSYC	182	General Psychology	3
PHED	100	Lifelong Physical Awareness	0.5

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SOC	151	Principles of Sociology	3
BIBL	216	New Testament Literature, or	3
BIBL	215	Old Testament Literature	(3)
MATH	111	Basic Probability & Statistics	3
		Music/Art/Literature/Drama	3
PHED	112-136	Physical Education Activity	0.5
PHIL	150	Logic & Critical Thinking	<u>2</u>
			27
Major			
CPSC	121-122	Computer Programming I & II	6
CPSC	224-225	Computer Programming III & IV	6
CPSC	321	Systems Analysis	3
CPSC		Elective in Computer Science	<u>6</u>
			21
Required Cognate			
OADM	161	Basic Keyboarding, or	2
		Proficiency	(0)
		Electives needed to complete the degree	12

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.

General Studies

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>
			33

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Major			HOURS
CHEM	163	General Chemistry I	4
CHEM	164	General Chemistry II	4
CPSC	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>
			47

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>
			13

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

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

For those interested in Computer Science (Notre Dame)

CPSC	122	Computer Programming II	3
MATH	210	Discrete Mathematics	3
CPSC	224	Computer Programming III	3
CPSC	225	Computer Programming IV	<u>3</u>
			12

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>
			12

Recommended elective for those going to Notre Dame

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

Mathematics Major

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

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			HOURS
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

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	Mathematical Statistics	3
MATH	293	Mathematical Proofs	3
MATH	331	Modern Geometry	3
MATH	341	Abstract Algebra	3
MATH	461	Real Analysis	3
CPSC	121	Computer Programming I	3
CPSC	122	Computer Programming II	3
PHYS	121	General Physics I	4
PHYS	122	General Physics II	4
			<u>49</u>
		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	Mathematical 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)
			<u>23</u>

Mathematics Education Major

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
THEO	110	Exploring the Christian Faith	3
BIBL	215	Old Testament Literature	3
BIBL	216	New Testament Literature	3
		Foreign Language (two semesters)	6
		History Elective	3
HIST		Literature	3
LIT		Perspectives in Fine Arts	3
FA	170	Logic & Critical Thinking	2
PHIL	150	Introduction to Philosophy	3
PHIL	250		3

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			HOURS
PHIL	452	Senior Experience	1
PHED	112-136	Physical Education Activities	<u>1.5</u>
			47
Major			
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	Mathematical Statistics	3
MATH	293	Mathematical Proofs	3
MATH	331	Modern Geometry	3
MATH	341	Abstract Algebra	3
CPSC	121	Computer Programming I	3
PHYS	121	General Physics I	<u>4</u>
			39
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	<u>0-2</u>
			28-30

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

Mathematics Education Minor

MATH	131	Calculus I	4
MATH	132	Calculus II	4
MATH	210	Discrete Mathematics	3
MATH	241	Linear Algebra	3
MATH	293	Mathematical Proofs	3
MATH	331	Modern Geometry, or	3
MATH	341	Abstract Algebra	(3)
SCED	446	Specific Methods in Mathematics	<u>3</u>
			23

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	<u>4</u>
			20

Physics Education Minor

Completion of the 20 hours required for the Physics Minor, plus:			
SCED	443	Methods in Science	2

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

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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 1 year of Biology, 1 year of General Chemistry, 1 year of Organic Chemistry and 1 year of Physics (some also require a year of calculus)].

			HOURS
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
MATH	111	Basic Probability & Statistics	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
			50
Major			
BIOL	210	Zoology	4
BIOL	308	Molecular Cell Biology	4
CHEM	163, 164	General Chemistry I & II	8
CHEM	261, 262	Organic Chemistry I & II	8
MATH	131	Calculus I	4
PHYS	121, 122	General Physics I & II	8
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			
			60
Electives needed to complete the degree			14

Science Education (with Life Sciences and Physical Sciences Options)

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
HIST	246	Introduction to World Civilization	3
LIT		Literature	3
FA	170	Perspectives in Fine Arts	3
MATH	111	Basic Probability & Statistics	3
PHIL	150	Logic & Critical Thinking	2
PHIL	250	Introduction to Philosophy	3

MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES

			HOURS
THEO	110	Exploring the Christian Faith	3
PHIL	452	Senior Experience	1
PHED	112-136	Physical Education Activities	<u>1.5</u>
			50

Science Core

NS	251	Astronomy	4
CHEM	163	General Chemistry I	4
PHYS	121	General Physics I	4
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>
			23-24

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>
			28

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>
			28

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>
			27-29

Total hours in major

128-129

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 taxonomy, structure, physiology and the nat-

ural 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, or consent of the instructor.

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 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, or consent of instructor.

Recommended: 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.

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.

Prerequisite: 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 100 or math proficiency.

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. Four 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. (Offered on demand)
- 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.
Prerequisite: CHEM 261.
- 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.
- 463. Physical Chemistry II 4 Hours**
Same course as PHYS 301. Course description on page 143.
- 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.

Computer Science (CPSC)

- 121. Computer Programming I 3 Hours**
An introduction to Computer Science and programming using a high level, object oriented, GUI based language. Emphasis is on the use of problem solving methods, algorithm development, code design, documentation, debugging, and elementary data and control structures.
- 122. Computer Programming II 3 Hours**
Continuation of CPSC 121, with emphasis on data structures, pointers, objects, arithmetic and logical expressions, iterations, arrays, sorting and searching techniques and group programming.
Prerequisite: CPSC 121.

MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES

- 224. Computer Programming III 3 Hours**
Continuation of CPSC 122 with emphasis on economy and efficiency of code and data structure design.
Prerequisite: CPSC 122.
- 225. Computer Programming IV 3 Hours**
Continuation of CPSC 224.
Prerequisite: CPSC 224.
- 301. 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, optimization of web graphics and animation will be introduced. State-of-the-art web software applications will be used.
- 321. Systems Analysis 3 Hours**
Structured systems analysis and the development cycle, data flow diagrams, data dictionaries, decision trees and tables, query handling, structured design, with an emphasis on case studies.
Prerequisite: CPSC 122.
- 322. Computer Systems 3 Hours**
Survey of hardware and systems software, with a brief introduction to logic circuits and Boolean algebra, basic computer structure, addressing methods, machine program sequencing, process and memory management.
Prerequisites: CPSC 224, PHYS 211.
- 323. Database 3 Hours**
An introduction to the design, implementation and management of database systems. Database structures: a review of file properties, data structures, representation relationships through trees, networks and record pointers. Database modeling: logical and physical design, schemas and subschemas, analysis of hierarchical, network and relational database systems.
Prerequisite: CPSC 121 or permission of instructor.
- 331. Networks 3 Hours**
The study of computer network operating systems theory, administration and implementation. Emphasis is on developing and implementing a LAN.
- 355. Information Systems I 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 in central.
- 411. Special Topics 3 Hours**
An opportunity to study trends and areas of research in computer science that may not be covered in other courses. Emphasis is on career preparation. (Offered on demand.)
Prerequisite: CPSC 225.
- 422. Senior Project/Internship 3 Hours**
Research on a selected topic culminating in a written thesis and oral presentation, OR faculty supervised practical experience in an actual computing environment. (Offered on demand.)
Prerequisite: Permission of instructor and application from prior semester.
- 429. Independent Study in Computer Science 1-4 Hours**
An opportunity for directed study, research, or completion of a special project in computer science. (Offered on demand.)
Prerequisite: Permission of instructor.
- 455. Information Systems II 3 Hours**
A continuation of Information Systems I with an emphasis on communication skills, ethics, critical thinking and team-working.

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 102 or equivalent.
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. Three hours of lecture and two hours of lab each week.
Prerequisite: MATH 122 or equivalent.
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. (No prerequisite)
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. **Mathematical 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.

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. (No prerequisite.)

331. Modern Geometry 3 Hours

Historical and formal development of Euclidean and non-Euclidean geometry; role of axiomatic systems; incidence geometry; Hilbert's axioms; neutral geometry; history of the parallel postulate; philosophical implications.

Prerequisite: MATH 131, 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 241, 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.

Natural Science (NS)

101. Natural Science Lab 1 Hour

A laboratory survey of various disciplines of the natural sciences, examining topics in the areas of biology, chemistry, physics and/or astronomy.

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.

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.

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.

Prerequisite: Permission of the department faculty.

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.

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, 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: A background in algebra.

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.

MATHEMATICS, COMPUTER SCIENCE & NATURAL SCIENCES

- 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.
- 421. Independent Study in
Physics 1-4 Hours**