

MICHIGAN STATE  
UNIVERSITY

# College of Natural Science

## UNDERGRADUATE CURRICULUM GUIDES



College of Natural Science  
103 Natural Science Building  
East Lansing, MI 48824-1115  
Phone (517) 355-4470  
[naturalscience.msu.edu](http://naturalscience.msu.edu)

Updated: 5-21-2008

# COLLEGE OF NATURAL SCIENCE

MICHIGAN STATE UNIVERSITY • UNDERGRADUATE STUDENT AFFAIRS • 103 NATURAL SCIENCE BUILDING

**Kathy Doig, Ph.D.** *Associate Dean*  
(517) 353-1698  
doig@msu.edu

**Debra Dotterer, M.A.** *Director*  
(517) 355-4475  
dotterer@msu.edu

## Biochemistry and Molecular Biology

Dr. Neil Bowlby  
105 Biochemistry Building  
Michigan State University  
East Lansing, MI 48824  
(517) 353-8949  
bowlby@msu.edu

## Biomedical Laboratory Diagnostics

Dr. Kathy Doig  
323A N. Kedzie  
Michigan State University  
East Lansing, MI 48824  
(517) 353-7800  
doig@msu.edu

## Chemistry

Dr. Michael Rathke  
320 Chemistry Building  
Michigan State University  
East Lansing, MI 48824  
(517) 355-9715 ext. 341  
ugrad@cem.msu.edu

## Charles Drew Program

Dr. Jerry Caldwell  
G48 Hubbard Hall  
(517) 355-5174  
jcaldwell@msu.edu

## Geological Sciences

Dr. Bob Anstey  
307 Natural Science Building  
Michigan State University  
East Lansing, MI 48824  
(517) 353-9009  
anstey@msu.edu

## Human Biology

Heidi Purdy  
108 Natural Science  
Michigan State University  
East Lansing, MI 48824  
(517) 432-2381  
purdyh@msu.edu

## Interdepartmental Programs

Ms. Nicole Lemon  
117 N. Kedzie  
Michigan State University  
East Lansing, MI 48824  
(517) 432-2152 ext. 115  
nlemon@msu.edu

## Mathematics

Dr. William Brown  
A212 Wells Hall  
Michigan State University  
East Lansing, MI 48824  
(517) 355-9683  
brownw@msu.edu

## Microbiology and Molecular Genetics

Dr. Thomas Corner  
2215E Biomed & Phys Sci Bldg  
Michigan State University  
East Lansing, MI 48824  
(517) 355-6463 ext. 1511  
corner@msu.edu

## Nutritional Science

Dr. Dale Romsos  
106C Trout Building  
Michigan State University  
East Lansing, MI 48824  
(517) 355-8474 ext. 104  
dromsos@msu.edu

## Physics and Astronomy

Dr. Dan Stump  
1312B Biomed & Phys Sci Bldg  
Michigan State University  
East Lansing, MI 48824  
(517) 355-9200 ext. 2131  
stump@msu.edu

## Physiology

Dr. Tom Adams  
2240B Biomed & Phys Sci Bldg  
Michigan State University  
East Lansing, MI 48824  
(517) 355-6475 ext. 1130  
adamst@msu.edu

## Plant Biology

Dr. Diane Ebert-May  
166 Plant Biology  
Michigan State University  
East Lansing, MI 48824  
(517) 432-7171  
ebertmay@msu.edu

## Statistics and Probability

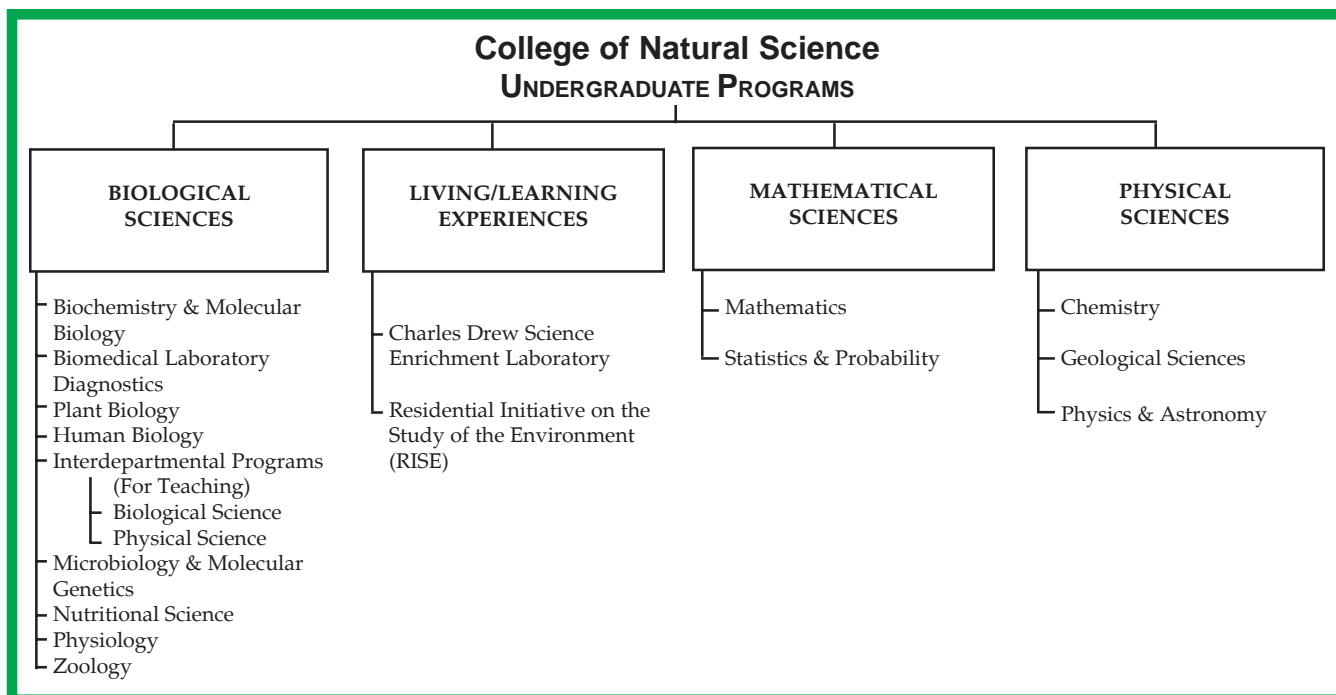
Dr. Vincent Melfi  
A432 Wells Hall  
Michigan State University  
East Lansing, MI 48824  
(517) 355-3287  
melfi@stt.msu.edu

## Zoology

Dr. Richard Snider  
235 Natural Science Building  
Michigan State University  
East Lansing, MI 48824  
(517) 355-8473  
snider@msu.edu

## Environmental Studies Specialization & RISE (Residential Initiative on the Study of the Environment)

Dr. Laurie Thorp  
G47 Hubbard Hall  
Michigan State University  
East Lansing, MI 48824  
(517) 432-4944  
thorpl@msu.edu



# CONTENTS

---

<b>Biochemistry and Molecular Biology</b>	
Biochemistry and Molecular Biology	<i>Bachelor of Science</i> ..... 5
Biochemistry & Molecular Biology/Biotechnology	<i>Bachelor of Science</i> ..... 6-7
<b>Biological Science (Interdepartmental)</b>	
Biological Science	<i>Bachelor of Science</i> ..... 8
<b>Plant Biology</b>	
Plant Biology	<i>Bachelor of Science</i> ..... 9-10
Environmental Biology/Plant Biology	<i>Bachelor of Science</i> ..... 11
<b>Chemistry</b>	
Chemical Physics	<i>Bachelor of Science</i> ..... 12
Chemistry	<i>Bachelor of Arts</i> ..... 13
Chemistry	<i>Bachelor of Science</i> ..... 14
Computational Chemistry	<i>Bachelor of Science</i> ..... 15
<b>Earth Science (Interdepartmental)</b>	
Earth Science	<i>Bachelor of Science</i> ..... 16
<b>Environmental Studies</b>	
Environmental Biology/Plant Biology	<i>Bachelor of Science</i> ..... 11
Environmental Biology/Microbiology	<i>Bachelor of Science</i> ..... 35
Environmental Biology/Zoology	<i>Bachelor of Science</i> ..... 17
Specialization in Environmental Studies	<i>Certification accompanying degree</i> ..... 18
<b>Geological Sciences</b>	
Environmental Geosciences	<i>Bachelor of Science</i> ..... 19
Geological Sciences	<i>Bachelor of Science</i> ..... 20
Geophysics Option	<i>To accompany Geological Sciences B.S.</i> ..... 20
Geophysics	<i>Bachelor of Science</i> ..... 21
<b>Human Biology</b>	
Human Biology	<i>Bachelor of Science</i> ..... 22-23
<b>Lyman Briggs</b>	
LB Field of Concentration or Dept. Major	<i>Bachelor of Science</i> ..... 24
<b>Mathematics</b>	
Actuarial Science Specialization	<i>Can accompany any MSU Bachelor's degree</i> ..... 25
Computational Mathematics	<i>Bachelor of Arts</i> ..... 26
Computational Mathematics	<i>Bachelor of Science</i> ..... 27
Mathematics	<i>Bachelor of Arts</i> ..... 28
Mathematics	<i>Bachelor of Science</i> ..... 29
Mathematics	<i>Minor in Mathematics</i> ..... 30
<b>Biomedical Laboratory Diagnostics (formerly titled Medical Technology Program)</b>	
Clinical Laboratory Science	<i>Bachelor of Science</i> ..... 31
Diagnostic Molecular Science	<i>Bachelor of Science</i> ..... 32
Medical Technology	<i>Bachelor of Science</i> ..... 33
<b>Microbiology and Molecular Genetics</b>	
Microbiology and Molecular Genetics	<i>Bachelor of Science</i> ..... 34
Genomics and Molecular Genetics	<i>Bachelor of Science</i> ..... 35
<b>Nutritional Science</b>	
Nutritional Science	<i>Bachelor of Science</i> ..... 37
<b>Physical Science (Interdepartmental)</b>	
Physical Science	<i>Bachelor of Science</i> ..... 38
<b>Physics and Astronomy</b>	
Astrophysics	<i>Bachelor of Science</i> ..... 39
Physics	<i>Bachelor of Arts</i> ..... 40
Physics	<i>Bachelor of Science</i> ..... 41
Physics and Geophysics	<i>Bachelor of Science</i> ..... 42
<b>Physiology</b>	
Physiology	<i>Bachelor of Science</i> ..... 43
<b>Preprofessional Coursework</b>	<i>Professional school preparation (not a degree)</i> ..... 44
<b>Statistics and Probability</b>	
Statistics	<i>Bachelor of Arts</i> ..... 45
Statistics	<i>Bachelor of Science</i> ..... 46
<b>Zoology</b>	
Zoology	<i>Bachelor of Arts</i> ..... 47
Zoology	<i>Bachelor of Science</i> ..... 48-49

## Why choose a B.A. or a B.S.?

The College of Natural Science offers both Bachelor of Science and the Bachelor of Arts degrees. The Bachelor of Science (B.S.) requires more science and mathematics credits and less non-science, humanities and social science, coursework in the 120 credit program. The B.S. is intended for individuals preparing for professional work in the sciences or for graduate/professional school.

In contrast, the Bachelor of Arts (B.A.) is designed for individuals pursuing K-12 teaching careers or scientific application areas such as public policy, technical sales, law, and communications. The B.A. requires more humanities and social science credits to be completed than a B.S., providing greater balance between science and non-science credits in its 120 credit program.

### UNIVERSITY REQUIREMENTS FOR ALL MAJORS BACHELOR OF ARTS & SCIENCE DEGREES EARNED WITHIN THE COLLEGE OF NATURAL SCIENCE

#### University Requirements

	Cr.		Cr.
<b>Writing</b>		<b>Integrative Studies in Biological Science</b>	
WRA 110-195H Tier 1	4	Waived with College Level Biological	
in the major Tier 2	2-4	Science Requirement	
<b>Integrative Studies in Social Science</b>		<b>Integrative Studies in Physical Science</b>	
ISS 210-2254		Waived with College Level Chemistry and	
ISS 310-335B	4	Physics Requirement	
<b>Integrative Studies in Arts and Humanities</b>		<b>Biological/Physical Sciences lab experience</b>	2
IAH 201-210	4	(A variety of labs satisfy this requirement. For	
IAH 211 or higher	4	your situation—see your advisor.)	

# BIOCHEMISTRY AND MOLECULAR BIOLOGY - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		MTH 133 Calculus II	4
BS 110 Organisms and Populations	4	2. MTH 152H Honors Calculus I	3
		MTH 153H Honors Calculus II	3
<b>Chemistry</b>		<b>Physics</b>	
One of the following (group 1, 2, 3 etc.):		One of the following (group 1, 2, 3 etc.):	
1. CEM 141 General Chemistry	4	1. PHY 183 Physics for Scientists	
CEM 142 General/Inorganic Chemistry	3	and Engineers I	4
CEM 161 Chemistry Lab	1	PHY 184 Physics for Scientists	
2. CEM 151 Principles of Chemistry I	4	and Engineers II	4
CEM 152 Principles of Chemistry II	3	2. PHY 181B Basics Physics I	3
CEM 161 Chemistry Lab	1	PHY 182B Basics Physics II	3
3. CEM 181H Honors Chemistry I	4	3. PHY 193H Honors Physics I	3
CEM 182H Honors Chemistry II	4	PHY 294H Honors Physics II	3
CEM 185H Honors Chemistry Lab	2		
<b>Mathematics</b>		<b>300 and 400 Level Courses</b>	30
One of the following (group 1 or 2):			
1. MTH 132 Calculus I	3		

## Department Requirements

	Cr.		Cr.
<b>All of the following:</b>		<b>One of the following (group 1 or 2):</b>	
BMB 461 Biochemistry I	3	1. CEM 251 Organic Chemistry I	3
BMB 462 Biochemistry II	3	CEM 252 Organic Chemistry II	3
BMB 471 Biochemistry Lab I	2	2. CEM 351 Organic Chemistry I	3
BMB 472 Biochemistry Lab II	2	CEM 352 Organic Chemistry II	3
BMB 495 Undergraduate Seminar	2	<b>One of the following (group 1 or 2):</b>	
BS 111 Cells and Molecules	3	1. CEM 484 Molecular Thermodynamics	3
BS 111L Cell & Molecular Biology Lab	2	CEM 483 Quantum Chemistry	3
CEM 162 Chemistry Laboratory II	1	2. CEM 383 Intro Physical Chemistry	3
or CEM 186H Honors Chemistry Lab	1	CEM 384 Intro Physical Chemistry	3
CEM 262 Quantitative Analysis	3	<b>Complete one from each of the following</b>	
CEM 355 Organic Chemistry Lab I	2	<b>(group 1 and 2):</b>	
CEM 356 Organic Chemistry Lab II	2	1. CEM 333 Instrumental Methods	3
CSE 101 Comput. Concepts/Competencies		CEM 395 Analytical Physical Laboratory	2
Track C: Spreadsheets & Data Analysis	3	2. BMB 101 Frontiers in Biochemistry	1
Additional Biology credits (300-400 level)	7		
<b>Foreign Language</b> - first year competency			

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

# BIOCHEMISTRY & MOLECULAR BIOLOGY/BIOTECHNOLOGY - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		<b>Mathematics</b>	
BS 110 Organisms and Populations	4	One of the following (group 1 or 2):	
		1. MTH 132 Calculus I	3
		MTH 133 Calculus II	4
<b>Chemistry</b>		2. MTH 152H Honors Calculus I	3
One of the following (group 1, 2, 3 etc.):		MTH 153H Honors Calculus II	3
1. CEM 141 General Chemistry	4	<b>Physics</b>	
CEM 142 General/Inorganic Chemistry	3	One of the following (group 1, 2, 3 etc.):	
CEM 161 Chemistry Lab	1	1. PHY 183 Physics for Scientists	
2. CEM 151 Principles of Chemistry I	4	and Engineers I	4
CEM 152 Principles of Chemistry II	3	PHY 184 Physics for Scientists	
CEM 161 Chemistry Lab	1	and Engineers II	4
3. CEM 181H Honors Chemistry I	4	2. PHY 181B Basics Physics I	3
CEM 182H Honors Chemistry II	4	PHY 182B Basics Physics II	3
CEM 185H Honors Chemistry Lab	2	3. PHY 193H Honors Physics I	3
		PHY 294H Honors Physics II	3
		<b>300 and 400 Level Courses</b>	<b>30</b>

## Department Requirements

	Cr.		Cr.
<b>All of the following:</b>		<b>One of the following (Group 1 or 2):</b>	
BMB 101 Frontiers in Biochemistry	1	1. CEM 351 Organic Chemistry I	3
BMB 461 Biochemistry I	3	CEM 352 Organic Chemistry II	3
BMB 462 Biochemistry II	3	2. CEM 251 Organic Chemistry I	3
BMB 471 Biochemistry Laboratory	3	CEM 252 Organic Chemistry II	3
BMB 495 Undergraduate Seminar	2	<b>One of the following:</b>	
BS 111 Cells and Molecules	3	BMB 472 Biochemistry Laboratory	3
BS 111L Cell & Molecular Biology Lab	2	MMG 408 Advanced Microbiology Lab.	3
CEM 262 Quantitative Analysis	3	<b>One of the following:</b>	
CEM 355 Organic Laboratory I	2	CSS 350 Introduction to Plant Genetics	3
CEM 356 Organic Laboratory II	2	ZOL 341 Fundamental Genetics	4
CEM 383 Introductory Physical Chem. I	3		
CHE 201 Material and Energy Balances	3		
CSE 101 Comput. Concepts/Competencies			
Track C: Spreadsheets & Data Analysis	3		
MMG 445 Basic Biotechnology	3		
<b>Foreign Language</b> —first year competency			
<b>One of the following:</b>			
CEM 162 Chemistry Laboratory II	1		
CEM 186H Honors Chemistry Lab II	1		

*Continued on next page.*

**At least 8 credits from the following:**

ANS 314	Genetic Imp. of Dom. Animals	4
ANS 407	Food and Animal Toxicology	3
ANS 425	Principles of Animal Biotech.	3
CHE 321	Thermodynamics for Chemical Engineering	4
CSS 441	Plant Breeding and Biotech.	3
CSS 486	Biotechnology in Agriculture: Applications and Ethical Issues	3
FSC 325	Food Processing: Unit Ops.	4
FSC 429	Fundamentals of Food Eng.	3
FSC 440	Food Microbiology	3
FSC 441	Food Microbiology Laboratory	2
MMG 301	Introductory Microbiology	3
MMG 302	Introductory Micro. Lab.	1
MMG 421	Prokaryotic Cell Physiology	3
MMG 431	Microbial Genetics	3
MMG 433	Microbial Genomics	3
MMG 451	Immunology	3
PHM 450	Intro. to Chemical Toxicology	3
PSL 420	Membrane Biophysics Intro.	2
PLB 336	Useful Plants	3
PLB 402	Biology of Fungi	3
PLB 415	Plant Physiology	3
PLP 405	Plant Pathology	4
TSM 224	Digital Systems, Sensors and Measurements	3
ZOL 316	General Parasitology	3
ZOL 316L	General Parasitology Lab.	1
ZOL 343	Genetics Laboratory	2
ZOL 425	Cells and Development (W)	4
ZOL 428	Frontiers in Developmental and Tissue Biology (W)	3
ZOL 450	Cancer Biology (W)	3
ZOL 482	Cytochemistry (W)	4

# BIOLOGICAL SCIENCE (INTERDEPARTMENTAL) (FOR TEACHING ONLY) - BACHELOR OF SCIENCE

Administered by the College of Natural Science Dean's Office through the Division of Science and Mathematics Education.

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		4. MTH 132 Calculus I	3
BS 110 Organisms and Populations	4	STT 201 Statistical Methods	4
<b>Chemistry</b>		* 5. MTH 152H Honors Calculus I	3
One of the following (group 1, 2, 3 etc.):		MTH 153H Honors Calculus II	3
1. CEM 141 General Chemistry	4	* Option 1,2, or 5 recommended	
CEM 142 General/Inorganic Chemistry	3	<b>Physics</b>	
CEM 161 Chemistry Lab	1	One of the following (group 1, 2, 3 etc.):	
2. CEM 151 Principles of Chemistry I	4	1. PHY 183 Physics for Scientists	
CEM 152 Principles of Chemistry II	3	and Engineers I	4
CEM 161 Chemistry Lab	1	PHY 184 Physics for Scientists	
3. CEM 181H Honors Chemistry I	4	and Engineers II	4
CEM 182H Honors chemistry II	4	2. PHY 231 Physics I	3
CEM 185H Honors Chemistry Lab I	2	PHY 232 Intro Physics II	3
<b>Mathematics</b>		* PHY 251 Intro Physics Lab I	1
One of the following (group 1, 2, 3 etc.):		PHY 252 Intro Physics Lab II	1
* 1. MTH 124 Survey of Calculus I	3	3. PHY 193H Honors Physics I	3
MTH 126 Survey of Calculus II	3	PHY 294H Honors Physics II	3
* 2. MTH 132 Calculus I	3	<b>300 and 400 Level Courses</b>	30
MTH 133 Calculus II	4		
3. MTH 124 Survey of Calculus		* If you complete Physics option 1 or 3, you must	
with Applications I	3	also complete PHY 191 & 192 or PHY 251 & 252.	
STT 201 Statistical Methods	4		

## Department Requirements

	Cr.		Cr.
<b>All of the following:</b>		<b>Two of the following:</b>	
BS 111 Cells and Molecules	3	BMB 401 Basic Biochemistry	4
BS 111L Cell & Molecular Biology Lab	2	ZOL 408 Histology	4
CEM 162 Chemistry Lab II	1	ZOL 482 Cytochemistry	4
CEM 251 Organic Chemistry I	3	1 [ MMG 301 Intro Microbiology	3
CEM 252 Organic Chemistry II	3	MMG 302 Intro Microbiology Lab	1
CEM 255 Organic Chemistry Laboratory	2	<b>One of the following:</b>	
CEM 262 Quantitative Analysis	3	PLB 301 Intro Plant Physiology	3
SME 401 Sci. Lab. for Sec. Schools (W)	4	PLP 405 Plant Pathology	3
PSL 250 Intro Physiology	4	PLB 418 Plant Systematics	3
ZOL 355 Ecology	3	PLB 434 Plant Structure and Functions	4
ZOL 355L Ecology Laboratory	1	Complete Requirements for	
ZOL 341 Fundamental Genetics	4	Teacher Certification including formal	
ZOL 445 Evolution	3	admission to the College of Education.	

# PLANT BIOLOGY - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		2. MTH 132 Calculus I	3
One of the following:		MTH 133 Calculus II	4
PLB 105 Plant Biology	3	3. MTH 124 Survey of Calculus with Applications I	
BS 110 Organisms and Populations	4	STT 231 Statistics for Scientists	3
LB 144 Biology I: Organismal Biology	4	4. MTH 132 Calculus I	3
BS 148H Honors Organismal Biology	3	STT 231 Statistics for Scientists	3
<b>Chemistry</b>		5. MTH 152H Honors Calculus I	3
One of the following (group 1, 2, 3 etc.):		MTH 153H Honors Calculus II	3
1. CEM 141 General Chemistry	4	<b>Physics</b>	
CEM 142 General/Inorganic Chemistry	3	One of the following (group 1, 2, 3 etc.):	
CEM 161 Chemistry Lab	1	1. PHY 183 Physics for Scientists and Engineers I	4
2. CEM 151 Principles of Chemistry I	4	PHY 184 Physics for Scientists and Engineers II	4
CEM 152 Principles of Chemistry II	3	2. PHY 231 Physics I	3
CEM 161 Chemistry Lab	1	PHY 232 Intro Physics II	3
3. CEM 181H Honors Chemistry I	4	PHY 251 Intro Physics Lab I	1
CEM 182H Honors Chemistry II	4	PHY 252 Intro Physics Lab II	1
CEM 185H Honors Chemistry Lab I	2	3. PHY 193H Honors Physics I	3
<b>Mathematics</b>		PHY 294H Honors Physics II	3
One of the following (group 1, 2, 3 etc.):			
1. MTH 124 Survey of Calculus I	3		
MTH 126 Survey of Calculus II	3		
		<b>300 and 400 Level Courses</b>	<b>30</b>

	Cr.		Cr.
<b>All of the following:</b>		<b>Both of the following:</b>	
BS 111 Cells and Molecules	3	PLB 434 Plant Structure and Function	4
BS 111L Cell and Molecular Biology Lab	1	ZOL 355 Ecology	3
BMB 461 Biochemistry I	3	<b>One of the following:</b>	
CEM 251 Organic Chemistry I	3	PLB 218 Plants of Michigan	3
CEM 252 Organic Chemistry II	3	PLB 418 Plant Systematics	3
PLB 105 Plant Biology	3	<b>One of the following:</b>	
PLB 203 The Biology of Plants	3	PLB 441 Plant Ecology	3
PLB 316 Experiments in Plant Biology	4	ZOL 355L Ecology Laboratory	1
PLB 415 Plant Physiology	3	<b>One of the following:</b>	
PLB 445 Evolution	3	PLB 335 Plants Through Time	3
PLB 498 Undergraduate Research	3	PLB 336 Useful Plants	3
PLB 499 Senior Seminar	2	PLB 402 Biology of Fungi	3
<b>One of the following:</b>		PLB 424 Algal Biology	4
CSS 350 Introductory Plant Genetics	3	PLB 440 Field Ecology & Evolution	4
ZOL 341 Fundamental Genetics	4	PLP 405 Plant Pathology	3
<b>Concentrations (Select one):</b>		PLP 407 Diseases and Insects of Forest and Shade Trees	4

GENERAL PLANT BIOLOGY

Continued on next page.

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

*PLANT ECOLOGY AND EVOLUTION*

**All of the following:**

PLB 418 Plant Systematics	3
PLB 434 Plant Structure and Function	4
PLB 441 Plant Ecology	3
ZOL 355 Ecology	3

**One of the following:**

FW 417 Wetland Ecology & Management	3
PLB 335 Plants Through Time	3
PLB 402 Biology of Fungi	3
PLB 424 Algal Biology	4
PLB 440 Field Ecology and Evolution	4
ZOL 355L Ecology Laboratory	1

*PLANT PHYSIOLOGICAL, MOLECULAR, AND CELLULAR BIOLOGY*

**Both of the following:**

BMB 462 Biochemistry II	3
MMG 409 Eukaryotic Cell Biology	3

**Two of the following:**

FW 417 Wetland Ecology & Management	3
MMG 431 Microbial Genetics	3
PLB 402 Biology of Fungi	3
PLB 405 Plant Pathology	3
PLB 418 Plant Systematics	3
PLB 424 Algal Biology	4
PLB 434 Plant Structure and Function	4
PLB 441 Plant Ecology	3
*ZOL 355 Ecology	3

\*If ZOL 355 is chosen, the student must concurrently enroll in ZOL 355L for 1 credit.

# ENVIRONMENTAL BIOLOGY/PLANT BIOLOGY - BACHELOR OF SCIENCE

Administered by the Department of Plant Biology

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		<b>Physics</b>	
BS 110 Organisms and Populations	4	One of the following (group 1, 2, 3 etc.):	
<b>Chemistry</b>		1. PHY 183 Physics for Scientists	4
One of the following (group 1, 2, 3 etc.):		and Engineers I	
1. CEM 141 General Chemistry	4	PHY 184 Physics for Scientists	4
CEM 142 General/Inorganic Chemistry	3	and Engineers II	
CEM 161 Chemistry Lab	1	2. PHY 231 Intro Physics I	3
2. CEM 151 General/Descriptive Chemistry	4	PHY 232 Intro Physics II	3
CEM 152 Principles of Chemistry	3	PHY 251 Intro Physics Lab I	1
CEM 161 Chemistry Lab I	1	PHY 252 Intro Physics Lab II	1
3. CEM 181H Honors Chemistry I	4	3. PHY 193H Honors Physics I	3
CEM 182H Honors Chemistry II	4	PHY 294H Honors Physics II	3
CEM 185H Honors Chemistry Lab I	2	<b>300 and 400 Level Courses</b>	30
<b>Mathematics</b>			
One of the following (group 1 or 2):			
1. MTH 124 Survey of Calculus I	3		
STT 231 Statistics for Scientists	3		
2. MTH 132 Calculus I	3		
STT 231 Statistics for Scientists	3		

## Department Requirements

	Cr.		Cr.
<b>One of the following (group 1, 2 or 3):</b>		<b>One of the following courses:</b>	
1. BS 111 Cells and Molecules	3	PLB 218 Plants of Michigan	3
BS 111L Cell and Molecular Biology Lab	2	PLB 418 Plant Systematics	3
PLB 105 Plant Biology	3	<b>One of the following courses:</b>	
2. LB 148H Honors Organismal Biology	3	PLB 301 Introductory Plant Physiology	3
LB 149H Honors Cell & Molecular Bio.	2	PLB 415 Plant Physiology	3
3. LB 144 Biology I: Organismal Biology	4	<b>One of the following courses:</b>	
LB 145 Biology II: Cell & Molecular Bio	5	CSS 350 Introductory Plant Genetics	3
<b>Each of the following:</b>		ZOL 341 Fundamental Genetics	4
CEM 251 Organic Chemistry I	3	<b>One of the following courses:</b>	
CEM 252 Organic Chemistry II	3	PLP 405 Plant Pathology	3
CSS 210 Fund Soil Science	3	PLP 407 Disease & Insect & Shade Tree	4
GEO 221 Intro Geographic Information	3	ENT 404 Fundamentals of Entomology	3
FW 417 Wetland Ecology & Management	3	<b>One of the following courses:</b>	
PLB 498 Undergraduate Research	3	FW 410 Upland Ecosystem Management	3
PLB 499 Senior Seminar	2	FW 412 Wetland Ecosystem Management	3
ZOL 355 Ecology	3	FW 444 Conservation Biology	3
ZOL 355L Ecology Lab	1	<b>Two additional 300-400 level courses related to environmental biology</b>	

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

# CHEMICAL PHYSICS - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		2. CEM 181H Honors Chemistry 1	4
One of the following:		CEM 182H Honors Chemistry II	4
PLB 105 Plant Biology	3	CEM 185 H Honors Chemistry Lab. I	2
BS 110 Organisms and Populations	4	<b>Mathematics</b>	
BS 111 Cells and Molecules	3	MTH 132 Calculus I	3
ENT 205 Pests, Society and Environment	3	MTH 133 Calculus II	4
PSL 250 Introductory Physiology	4	<b>Physics</b>	
ZOL 141 Introductory Human Genetics	3	One of the following 2 groups:	
MMG 201 Fundamentals of Microbiology	3	1. PHY 183 Physics for Scientists and Engineers I	4
<b>Chemistry</b>		PHY 184 Physics for Scientists and Engineers II	4
One of the following 2 groups:		2. PHY 193H Honors Physics I - Mechanics	3
1. CEM 151 Principles of Chemistry I	4	PHY 294H Honors Physics II - Electromagnetism	3
CEM 152 Principles of Chemistry II	3		
CEM 161 Chemistry Laboratory I	1		

## Department Requirements

	Cr.		Cr.
<b>300 and 400 Level Courses</b>	30	<b>One of the following:</b>	
<b>All of the following:</b>		PHY 215 Thermodynamics and Modern Physics	3
CEM 411 Inorganic Chemistry	4	PHY 431 Optics I	3
CEM 434 Advanced Analytical Chemistry	3	PHY 410 Thermal and Statistical Physics	3
CEM 499 Chemical Physics Seminar	2	PHY 422 Classical Mechanics II	3
(Must be taken twice)		PHY 472 Quantum Physics II	3
MTH 234 Multivariable Calculus	4	PHY 482 Electricity and Magnetism II	3
MTH 235 Differential Equations	3	<b>One of the following:</b>	
PHY 191 Physics Lab. for Scientists I	1	CEM 162 Chemistry Laboratory II	1
PHY 192 Physics Lab. for Scientists II	1	CEM 186H Honors Chemistry Lab. II	2
PHY 321 Classical Mechanics I	3	<b>Organic chemistry courses (other than CEM 143)</b>	6
PHY 471 Quantum Physics I	3	<b>One of the following:</b>	
PHY 481 Electricity and Magnetism I	3	CEM 333 Instrumental Methods & Applications	3
<b>One of the following courses:</b>		CEM 395 Analytical/Physical Laboratory	2
MTH 310 Abstract Algebra I and		CEM 435 Analytical Chemistry Laboratory	2
Number Theory	3	CEM 495 Molecular Spectroscopy	2
MTH 320 Analysis I	3	<b>One of the following:</b>	
MTH 351 Elements of Numerical Analysis	3	MTH 309 Linear Algebra I	3
MTH 421 Analysis II	3	MTH 314 Matrix Algebra with Applications	3
MTH 425 Complex Analysis	3	<b>Two of the following:</b>	
MTH 441 Ordinary Differential Equations II	3	CEM 434 Advanced Analytical Chemistry	3
MTH 442 Partial Differential Equations	3	CEM 483 Quantum Chemistry	3
MTH 443 Boundary Value Problems for Engineers	3	CEM 484 Molecular Thermodynamics	3
MTH 451 Numerical Analysis I	3		

# CHEMISTRY - BACHELOR OF ARTS

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		<b>Mathematics</b>	
One of the following:		MTH 132 Calculus I	3
PLB 105 Plant Biology	3	MTH 133 Calculus II	4
BS 110 Organisms and Population	4		
BS 111 Cells and Molecules	3	<b>Physics</b>	
ENT 205 Pests, Society and Environment	3	PHY 231 Introductory Physics I	3
PSL 250 Introductory Physiology	4		
ZOL 141 Introductory Human Genetics	3	<b>Additional Arts &amp; Letters/Social Science</b>	
		Arts & Letters/Social Sci. beyond University	
<b>Chemistry</b>		Integrative Studies requirements	6
CEM 141 General Chemistry	4		
		<b>300-400 Level Courses</b>	30

## Department Requirements

	Cr.
<b>All of the following:</b>	
CEM 142 General & Inorganic Chemistry	3
CEM 161 Chemistry Laboratory I	1
CEM 162 Chemistry Laboratory II	1
CEM 251 Organic Chemistry I	3
CEM 252 Organic Chemistry II	3
CEM 255 Organic Chemistry Laboratory	2
CEM 262 Quantitative Analysis	3
CEM 333 Instrumental Methods & Applications	3
CEM 383 Introductory Physical Chemistry I	3
CEM 384 Introductory Physical Chemistry II	3
CEM 411 Inorganic Chemistry	4
CEM 444 Chemical Safety	1
PHY 232 Introductory Physics II	3
PHY 251 Introductory Physics Laboratory I	1
PHY 252 Introductory Physics Laboratory II	1
<b>Foreign language</b> —first year competency	

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

# CHEMISTRY - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		<b>Mathematics</b>	
One of the following:		One of the following (group 1 or 2):	
PLB 105 Plant Biology	3	1. MTH 132 Calculus I	3
BS 110 Organisms and Populations	4	MTH 133 Calculus II	4
BS 111 Cells and Molecules	3	2. MTH 152H Honors Calculus I	3
ENT 205 Pests, Society and Environment	3	MTH 153H Honors Calculus II	3
PSL 250 Introductory Physiology	4		
ZOL 141 Intro Human Genetics	3	<b>Physics</b>	
		One of the following (group 1 or 2):	
<b>Chemistry</b>		1. PHY 183 Physics for Scientists	
One of the following (group 1 or 2):		and Engineers I	4
1. CEM 151 Principles of Chemistry I	4	PHY 184 Physics for Scientists	
CEM 152 Principles of Chemistry II	3	and Engineers II	4
CEM 161 Chemistry Lab	1	2. PHY 193H Honors Physics I	3
2. CEM 181H Honors Chemistry I	4	PHY 294H Honors Physics II	3
CEM 182H Honors Chemistry II	4		
CEM 185H Honors Chemistry Lab I	2	<b>300-400 Level Courses</b>	30

## Department Requirements

	Cr.		Cr.
<b>All of the following:</b>		<b>One of the following (group 1 or 2):</b>	
CEM 351 Organic Chemistry I	3	1. BMB 401 Basic Biochemistry	4
CEM 352 Organic Chemistry II	3	2. BMB 461 Biochemistry I	3
CEM 355 Organic Chemistry Lab I	2	BMB 462 Biochemistry II	3
CEM 356 Organic Chemistry Lab II	2	<b>One of the following (group 1 or 2):</b>	
CEM 484 Molecular Thermodynamics	3	1. CEM 162 Chemistry Laboratory II	1
CEM 395 Analytical-Physical Lab	2	CEM 262 Quantitative Analysis	3
CEM 411 Inorganic Chemistry I	4	2. CEM 186H Honors Chemistry Lab. II	2
CEM 415 Advanced Synthesis Laboratory	3		
CEM 434 Advanced Analytical Chemistry	3	<b>Foreign Language- first year competency</b>	
CEM 435 Analytical Chemistry Laboratory	2		
CEM 483 Quantum Chemistry	3		
CEM 495 Molecular Spectroscopy	2		
MTH 234 Multivariable Calculus	4		
MTH 235 Differential Equations	3		
PHY 191 Physics Lab for Scientists I	1		
PHY 192 Physics Lab for Scientists II	1		

# COMPUTATIONAL CHEMISTRY - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		<b>Mathematics</b>	
One of the following:		One of the following (group 1 or 2):	
PLB 105 Plant Biology	3	1. MTH 132 Calculus I	3
BS 110 Organisms and Populations	4	MTH 133 Calculus II	4
BS 111 Cells and Molecules	3	2. MTH 152H Honors Calculus I	3
ENT 205 Pests, Society and Environment	3	MTH 153H Honors Calculus II	3
PSL 250 Introductory Physiology	4		
ZOL 141 Intro Human Genetics	3	<b>Physics</b>	
MMG 205 Allied Health Microbiology	3	One of the following (group 1 or 2):	
		1. PHY 183 Physics for Scientists	
<b>Chemistry</b>		and Engineers I	4
One of the following (group 1 or 2):		PHY 184 Physics for Scientists	
1. CEM 151 Principles of Chemistry I	4	and Engineers II	4
CEM 152 Principles of Chemistry II	3	2. PHY 193H Honors Physics I	3
CEM 161 Chemistry Lab	1	PHY 294H Honors Physics II	3
2. CEM 181H Honors Chemistry I	4		
CEM 182H Honors Chemistry II	4	<b>300-400 Level Courses</b>	30
CEM 185H Honors Chemistry Lab I	2		

## Department Requirements

	Cr.		Cr.
<b>All of the following:</b>			
CEM 351 Organic Chemistry I	3	MTH 235 Differential Equations	3
CEM 352 Organic Chemistry II	3	MTH 314 Matrix Algebra w/ Applications	3
CEM 355 Organic Chemistry Lab I	2	MTH 451 Numerical Analysis I	3
CEM 356 Organic Chemistry Lab II	2	PHY 191 Physics Lab for Scientists I	1
CEM 391 Molecular Thermodynamics	3	PHY 192 Physics Lab for Scientists II	1
CEM 395 Analytical-Physical Lab	2	<b>One of the following (group 1 or 2):</b>	
CEM 411 Inorganic Chemistry I	4	1. CEM 162 Chemistry Laboratory II	1
CEM 415 Advanced Synthesis Laboratory	3	CEM 262 Quantitative Analysis	3
CEM 434 Advanced Analytical Chemistry	3	2. CEM 186H Honors Chemistry Lab. II	2
CEM 435 Analytical Chemistry Laboratory	2		
CEM 495 Molecular Spectroscopy	2	<b>Foreign Language- first year competency</b>	
CEM 481 Computational Chem. Seminar	3		
CSE 231 Introduction to Programming I	4		
CSE 260 Discrete Structures in Computer Sci	3		
CSE 320 Computer Organization & Assembly			
Language Programming	4		
CSE 232 Introduction to Programming II	4		
MTH 234 Multivariable Calculus	4		

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

# EARTH SCIENCE (INTERDEPARTMENTAL) - BACHELOR OF SCIENCE

Administered by the Geological Sciences Department

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>	<b>3-4</b>	<b>Mathematics</b>	
One course from any of the following departments: Biological Science, Plant Biology, Entomology, Microbiology, Physiology, Zoology		One of the following groups:	
<b>Chemistry</b>		1. MTH 132 Calculus I	3
One of the following groups:		MTH 133 Calculus II	4
1. CEM 141 General Chemistry I	4	2. MTH 132 Calculus I	3
CEM 142 General Chemistry II	3	STT (200 or 201 or 231 or 421)	3-4
CEM 161 Chemistry Lab I	1	<b>Physics</b>	
2. CEM 151 General & Descriptive Chem.	4	One of the following groups:	
CEM 152 Principles of Chemistry	3	1. PHY 231 Intro. Physics I	3
CEM 161 Chemistry Lab I	1	PHY 232 Intro. Physics II	3
		PHY 251 Intro. Physics Lab I	1
		PHY 252 Intro. Physics Lab II	1
		2. PHY 183 Physics for Scientists and Engineers I	4
		PHY 184 Physics for Scientists and Engineers II	4
		<b>300-400 Level Courses</b>	<b>30</b>

## Department Requirements

	Cr.		Cr.
<b>Complete the following six courses:</b>		GLG 422 Aquatic and Marine Organic Geochemistry (W)	3
AST 207 Science of Astronomy	3	GLG 434 Evolutionary Paleobiology	4
GEO 203 Introduction to Meteorology	3	PLB 335 Plants Through Time	3
GLG 201 The Dynamic Earth	4	<b>2. METEOROLOGY/ATMOSPHERIC SCIENCES</b>	
GLG 303 Oceanography	4	GEO 405 Weather Analysis and Forecasting	4
GLG 304 Phys & Biol History of Earth	4	MTH 133 Calculus II	4
GLG 401 Plate Tectonics (W)	4	MTH 234 Multivariable Calculus	4
<b>Complete one of the following 2 concentrations:</b>		MTH 235 Differential Equations	3
<b>1. GENERAL EARTH SCIENCE</b>		PHY 183 Physics for Scientists & Engineers I	4
GLG 321 Mineralogy and Geochemistry	4	PHY 184 Physics for Scientists & Engineers II	4
<b>One of the following:</b>		<b>One of the following courses:</b>	
GEO 306 Environmental Geomorphology	3	GEO 402 Agricultural Climatology	3
GLG 412 Glacial Geol & Climate Chg	4	GEO 409 Global Climate Change & Variability	3
<b>Six credits from the following:</b>		[The course selected to meet this requirement may also satisfy the requirement below.]	
AST 303 Planetary System Astronomy	3	<b>Three of the following courses:</b>	
AST 312 Observational Astronomy	1	GEO 324 Remote Sensing of Environment	4
ENT 319 Intro to Earth System Science	3	GEO 402 Agricultural Climatology	3
GEO 402 Agricultural Climatology	3	GEO 409 Global Climate Change & Variability	3
GEO 405 Weather Analysis & Forecasting	4	GLG 411 Hydrogeology	3
GEO 409 Global Climate Chg & Variability	3	GLG 412 Glacial and Quaternary Geology	4
GEO 424 Advanced Remote Sensing	4	GLG 421 Environmental Geochemistry	4
GLG 411 Hydrogeology	3		
GLG 421 Environmental Geochemistry	4		

# ENVIRONMENTAL BIOLOGY/ZOOLOGY - BACHELOR OF SCIENCE

Administered by the Department of Zoology

## UNIVERSITY REQUIREMENTS

As stipulated at the lower portion of page 4.

## College Requirements

### Biological Science

BS 110 Organisms and Populations 4

### Chemistry

One of the following (group 1, 2, 3 etc):

1. CEM 141 General Chemistry 4

CEM 142 General/Inorganic Chemistry 3

CEM 161 Chemistry Lab 1

2. CEM 151 Principles of Chemistry I 4

CEM 152 Principles of Chemistry II 3

CEM 161 Chemistry Lab 1

3. CEM 181H Honors Chemistry I 4

CEM 182H Honors Chemistry II 4

CEM 185H Honors Chemistry Lab I 2

4. CEM 141 General Chemistry 4

CEM 251 Organic Chemistry I 3

CEM 161 Chemistry Lab 1

### Mathematics

One of the following (group 1, 2, 3 etc):

1. MTH 124 Survey of Calculus I 3

MTH 126 Survey of Calculus II 3

2. MTH 132 Calculus I 3

MTH 133 Calculus II 4

3. MTH 124 Survey of Calculus I 3

STT (201, 231, 351, 421) 3-4

4. MTH 132 Calculus I 3

STT (201, 231, 421) 3-4

5. MTH 152H Honors Calculus I 3

MTH 153H Honors Calculus II 3

### Physics

One of the following ( group 1, 2, 3 etc.)

1. PHY 183 Physics for Scientists & Engineers I 4

PHY 184 Physics for Scientists & Engineers II 4

2. PHY 231 Intro Physics I 3

PHY 232 Intro Physics II 3

PHY 251 Intro Physics Lab I 1

PHY 252 Intro Physics Lab II 1

3. PHY 193H Honors Physics I 3

PHY 294H Honors Physics II 3

**300-400 Level Courses** 30

## Department Requirements

### All of the following:

BS 111 Cells and Molecules 3

BS 111L Cell & Molecular Biology Lab 2

CEM 251 Organic Chemistry I 3

CEM 252 Organic Chemistry II 3

CEM 255 Organic Chemistry Lab 2

ZOL 341 Fundamental Genetics 4

ZOL 355 Ecology 3

ZOL 355L Ecology Laboratory (W) 1

ZOL 445 Evolution (W) 3

ZOL 306 Invertebrate Biology 4

ZOL 483 Environmental Physiology (W) 4

PLB 441 Plant Ecology 3

CSS 210 Fund of Soil & Landscape Sci. 3

### Complete one course from each of the following groups:

1. ZOL 360 Biology of Birds 4

ZOL 365 Biology of Mammals 4

2. PLB 218 Plants of Michigan 3

PLB 418 Plant Systematics 3

3. ZOL 431 Aquatic Ecology 4

FW 472 Limnology 3

GLG 421 Environmental Geochemistry 4

4. FW 420 Stream Ecology 3

PLB 423 Aquatic Plant Biology 4

ZOL 353 Marine Biology (W) 4

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

# SPECIALIZATION IN ENVIRONMENTAL STUDIES

Administered by the College of Natural Science

This specialization is available as an option to all students enrolled in the Colleges of Agriculture and Natural Resources, Engineering, Social Science, Communication Arts and Sciences, and Natural Science. It is designed to provide knowledge for understanding human interaction with the physical environment. The specialization will illuminate the direct and indirect effects of social and economic policy on the environment.

The specialization is not a degree in its own right. Upon completion of the following requirements, the Office of the Registrar will record the Environmental Studies certification on the student's transcript. Students need to contact Laurie Thorp, [thorpl@msu.edu](mailto:thorpl@msu.edu) to enroll in this specialization.

## Specialization Requirements

### All of the following:

ISS 310 People and Environment 4

### Biological and Physical Dimensions of the Environment Emphasis 13-15

#### 1. Both of the following courses (7 credits):

GLG 201 Earth Processes and History 4

NSC 192 Environmental Issues Seminar 1

#### 2. One of the following courses (3 or 4 credits):

BS 110 Organisms and Populations 4

FW 203 Resource Ecology 3

#### 3. One of the following courses (3 or 4 credits):

CE 280 Intro to Environ. Engineering 3

CSS 210 Fund. of Soil & Landscape Science 3

CSS 455 Pollutants in the Soil Environ. 3

FOR 404 Forest and Agricultural Ecol. 3

FW 207 Great Lakes: Biology and Mgmt. 3

FW 364 Ecosystem Problem Solving 3

FW 444 Conservation Biology 3

GEO 203 Introduction to Meteorology 3

GEO 206 Physical Geography 3

GLG 421 Environmental Geochemistry 3

<sup>1</sup> RD 324 Water Resource Management 3

ZOL 355 Ecology 4

ZOL 355L Ecology Laboratory 1

### Social-Environmental Interactions Emphasis 6

#### 1. One of the following courses (3 credits):

ANP 470 Food, Hunger, & Society 3

FOR 464 Nat. Res. Econ. & Social Sci. 3

JRN 408 Environmental Journalism 3

PKG 370 Packaging and the Envir. 3

PLS 342 Comp. Political Economy 3

EEP 260 World Food, Population & Poverty 3

EEP 320 Environmental Economics 3

PRR 302 Envir. Attitudes and Concepts 3

RD 201 Environmental & Nat. Res. 3

RD 430 Law and Resources 3

RD 460 Natural Resource Economics 3

SOC 452 Environment and Society 3

UP 353 Land Use Planning 3

ZOL 446 Envir. Issues and Public Policy 3

#### 2. One of the following courses (3 credits):

PLS 301 American State Government 3

PLS 310 Public Bureaucracy in the

Policy Process 3

PLS 313 Public Policy Analysis 3

PLS 324 American Legislative Process 3

PLS 331 Political Parties and

Interest Groups 3

TC 310 Basic Telecommunication Policy 4

# ENVIRONMENTAL GEOSCIENCES - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>	<b>3-4</b>	<b>Mathematics</b>	
One course from any of the following departments: Biological Science, Plant Biology, Entomology, Microbiology, Physiology, Zoology		One of the following groups:	
		1. MTH 132 Calculus I	3
		MTH 133 Calculus II	4
		2. MTH 152H Honors Calculus I	3
		MTH 153H Honors Calculus II	3
<b>Chemistry</b>		<b>Physics</b>	
One of the following groups:		One of the following three groups:	
1. CEM 141 General Chemistry I	4	1. PHY 231 Introductory Physics I	3
CEM 142 General and Inorganic Chem.	3	PHY 232 Introductory Physics II	3
CEM 161 Chemistry Laboratory I	1	PHY 251 Introductory Physics Lab. I	1
2. CEM 151 General and Descriptive Chem.	4	PHY 252 Introductory Physics Lab. II	1
CEM 152 Principles of Chemistry	3	2. PHY 183 Physics for Scientists and Engineers I	4
CEM 161 Chemistry Laboratory I	1	PHY 184 Physics for Scientists and Engineers II	4
3. CEM 181H Honors Chemistry I	4	3. PHY 193H Honors Physics I	3
CEM 182H Honors Chemistry II	4	PHY 294H Honors Physics II	3
CEM 185H Honors Chemistry Lab I	2	<b>300-400 Level Courses</b>	<b>30</b>

## Department Requirements

	Cr.		Cr.
<b>All of the following:<sup>1</sup></b>		<b>One of the following:</b>	
GLG 201 The Dynamic Earth	4	MTH 234 Multivariable Calculus	4
GLG 304 Physical & Bio. History of the Earth	4	One Semester of STT (200, 201, 231, 421)	3-4
GLG 321 Mineralogy and Geochemistry	4	GLG electives at the 300-400 level <sup>1,2,3</sup>	4-5
GLG 351 Structural Geology & Tectonics	4		
GLG 411 Hydrogeology	3		
GLG 421 Environmental Geochemistry	4	<sup>1</sup> Total of these five requirements must equal a minimum of 40 credits.	
GLG 431 Sedimentology and Stratigraphy (W)	4	<sup>2</sup> Credits used to satisfy this requirement may not be used to satisfy any other University, College or Department requirement for this degree.	
GLG 492 Senior Exp. in Earth Sciences (W)	4	<sup>3</sup> The credits that are used to satisfy this requirement may be used to satisfy either the requirements for the environmental geosciences major or the requirements for the geological sciences major, but not both of those requirements.	
<b>One of the following:<sup>1</sup></b>			
ZOL 303 Oceanography	4		
GEO 203 Intro to Meteorology	3		
GEO 324 Remote Sensing of the Env.	4		
GEO 325 Geographic Info Systems	3		
GLG 412 Glacial Geol & Climate Chg	4		
GLG 471 Applied Geophysics	4		
GLG 481 Reservoirs and Aquifers	3		
GEO 306 Environmental Geomorphology	3		
GEO 408 Soil Geomorphology Field Study	4		
STT 464 Statistics for Biologists	3		
<b>One of the following:<sup>2</sup></b>		<b>Concentration in Geophysics:</b>	
CEM 251 Organic Chemistry I	3	Available only to those students who are enrolled in the Bachelor of Science degree program with a major in environmental geosciences. See requirements under Geological Sciences, page 20. (Other Geophysics offerings see pp. 21, 39.)	
CE 421 Engineering Hydrology	3		
CE 481 Environmental Engineering Chem.	4		
CSS 455 Pollutants in the Soil Environment	3		
MMG 426 Biogeochemistry	3		

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

# GEOLOGICAL SCIENCES - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>	<b>3-4</b>		
One course from any of the following departments: Biological Science, Plant Biology, Entomology, Microbiology, Physiology, Zoology		1. MTH 132 Calculus I	3
		MTH 133 Calculus II	4
		2. MTH 152H Honors Calculus I	3
		MTH 153H Honors Calculus II	3
<b>Chemistry</b>		<b>Physics</b>	
One of the following groups:		One of the following groups:	
1. CEM 141 General Chemistry	4	1. PHY 231 Introductory Physics I	3
CEM 142 General & Inorganic Chemistry	3	PHY 232 Introductory Physics II	3
CEM 161 Chemistry Lab I	1	PHY 251 Intro Physics Lab I	1
2. CEM 151 General & Descriptive Chem.	4	PHY 252 Intro Physics Lab II	1
CEM 152 Principles of Chemistry	3	2. PHY 183 Physics for Scientists and Engineers I	4
CEM 161 Chemistry Lab	1	PHY 184 Physics for Scientists and Engineers II	4
3. CEM 181H Honors Chemistry I	4	3. PHY 193H Honors Physics I	3
CEM 182H Honors Chemistry II	4	PHY 294H Honors Physics II	3
CEM 185H Honors Chemistry Lab I	2	<b>300-400 Level Courses</b>	<b>30</b>
<b>Mathematics</b>			
One of the following groups:			

## Department Requirements

	Cr.		Cr.
<b>All of the following:</b>		<b>One of the following:</b>	
GLG 201 The Dynamic Earth	4	MTH 234 Multivariable Calculus I	4
GLG 304 Physical & Bio. History of the Earth	4	STT (200, 201, 231, 421)	3-4
GLG 321 Mineralogy and Geochemistry	4		
GLG 351 Structural Geology	4		
GLG 361 Petrology (W)	4		
GLG 431 Sedimentology & Stratigraphy (W)	4		
GLG 491 Field Geology (W)	6		
GLG 492 Senior Exper. in Earth Sci. (W)	1		
<b>Additional 300-400 level GLG credits</b>			
approved by academic advisor <sup>1</sup>	9		

<sup>1</sup>The credits that are used to satisfy this requirement may **not** be used to satisfy an other University, College or Department requirement for this degree. The credits that are used to satisfy this requirement may be used to satisfy either the requirements for the geological sciences major or the requirements for the environmental geosciences major, but not both of those requirements. GLG 492 satisfies capstone requirement.

## CONCENTRATION IN GEOPHYSICS

Available to those students who are enrolled in the Bachelor of Science degree program with a major in geological sciences and environmental geosciences. Students must complete the following courses. The concentration will be noted on the student's transcript.

See other Geophysics offerings (pp. 21, 41).

- |    |   |     |
|----|---|-----|
| 1. | MTH 234 Multivariable Calculus                  | 4   |
|    | MTH 235 Differential Equations                  | 3   |
| 2. | PHY 183 Physics for Scientists and Engineers I  | 4   |
|    | PHY 184 Physics for Scientists and Engineers II | 4   |
| 3. | A minimum of seven credits from the following:  |     |
|    | GLG 471 Applied Geophysics                      | 4   |
|    | GLG 470 Principles of Modern Geophysics         | 3   |
|    | PHY Approved 400 level courses                  | 3-7 |

# GEOPHYSICS - BACHELOR OF SCIENCE

Administered by the Department of Geological Sciences

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>	3-4	<b>Mathematics</b>	
One course from any of the following departments: Biological Science, Plant Biology, Entomology, Microbiology, Physiology, Zoology		MTH 132 Calculus I	3
		MTH 133 Calculus II	4
<b>Chemistry</b>		<b>Physics</b>	
One of the following groups:		PHY 183 Physics for Scientists & Engineers I	4
1. CEM 141 General Chemistry	4	PHY 184 Physics for Scientists & Engineers II	4
CEM 142 General & Inorganic Chem.	3		
CEM 161 Chemistry Laboratory I	1	<b>300-400 Level Courses</b>	<b>30</b>
2. CEM 151 General & Descriptive Chem.	4		
CEM 152 Principles of Chemistry	3		
CEM 161 Chemistry Laboratory I	1		

## Department Requirements

	Cr.		Cr.
<b>All of the following:</b>			
CSE 231 Introduction to Programming I	4	GLG 304 Physical & Biological Hist. of Earth	4
MTH 234 Multivariable Calculus	4	GLG 321 Mineralogy and Geochemistry	4
MTH 235 Differential Equations	3	GLG 351 Structural Geology	4
PHY 215 Thermodynamics & Modern Physics	3	GLG 361 Petrology	4
PHY 321 Classical mechanics I	3	GLG 411 Hydrogeology	4
PHY 481 Electricity and Magnetism I	3	GLG 431 Sedimentology and Stratigraphy	4
GLG 201 The Dynamic Earth	4	GLG 470 Principles of Modern Geophysics	3
		GLG 471 Applied Geophysics	4

See other Geophysics offerings (pp. 20, 41).

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

# HUMAN BIOLOGY - BACHELOR OF SCIENCE

Administered by the College of Natural Science Dean's Office

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		3. MTH 124 Survey of Calculus I	3
BS 110 Organisms and Populations	4	STT 201 Statistical Methods	4
<b>Chemistry</b>		<b>OR</b> - STT 231 Stats for Scientists	3
One of the following (group 1, 2, 3 etc.):		4. MTH 132 Calculus I	3
1. CEM 141 General Chemistry	4	STT 201 Statistical Methods	4
CEM 142 General/Inorganic Chemistry	3	<b>OR</b> - STT 231 Stats for Scientists	3
CEM 161 Chemistry Lab I	1	5. MTH 152H Honors Calculus I	3
2. CEM 151 Principles of Chemistry I	4	MTH 153H Honors Calculus II	3
CEM 152 Principles of Chemistry II	3		
CEM 161 Chemistry Lab I	1	<b>Physics</b>	
3. CEM 181H Honors Chemistry I	4	One of the following (group 1, 2, or 3):	
CEM 182H Honors chemistry II	4	1. PHY 183 Physics for Scientists & Eng I	4
CEM 185H Honors Chemistry Lab I	2	PHY 184 Physics for Scientists & Eng II	4
CEM 186H Honors Chemistry Lab II	2	PHY 191 Physics Lab for Scientists I	1
		PHY 192 Physics Lab for Scientists II	1
<b>Mathematics</b>		2. PHY 231 Intro Physics I	3
One of the following (group 1, 2, 3 etc.):		PHY 232 Intro Physics II	3
1. MTH 124 Survey of Calculus I	3	PHY 251 Intro Physics Lab I	1
MTH 126 Survey of Calculus II	3	PHY 252 Intro Physics Lab II	1
2. MTH 132 Calculus I	3	3. PHY 193H Honors Physics I	3
MTH 133 Calculus II	4	PHY 294H Honors Physics II	3
		<b>300-400 Level Courses</b>	<b>30</b>

## Department Requirements

	Cr.		Cr.
<b>All of the following:</b>		<b>One of the Following (either 1 or 2)</b>	
BS 111 Cells and Molecules	3	1. BMB 401 Basic Biochemistry	4
BS 111L Cells and Molecules Laboratory	2	2. BMB461 Biochemistry I	3
CEM 162 Chemistry Lab II	1	BMB462 Biochemistry II	3
CEM 251 Organic Chemistry I	3		
CEM 252 Organic Chemistry II	3	<b>One of the Following (either 1 or 2)</b>	
CEM 255 Organic Chemistry Laboratory	2	1. PSL 310 Physiology for Pre-Health Pro.	4
NSC 495 Capstone in Human Biology (W)	2	2. PSL 431 Human Physiology I	3
ZOL 341 Fundamental Genetics	4	PSL 432 Human Physiology II	3
<b>One of the following courses:</b>			
BLD 434 Clinical Immunology	3		
MMG 409 Eukaryotic Cell Biology	3		
MMG 413 Virology	3		
MMG 451 Immunology	3		

Continued on next page.

## HUMAN BIOLOGY (CONTINUED)

### 12 credits from the following courses:

ANP 441 Osteology & Forensic Anthropol.	4
BLD 434 Clinical Immunology	3
EPI 390 Disease and Society	4
HNF 453 Nutrition & Human Develop.	3
KIN 310 Phys. of Basic Physical Activity	3
KIN 330 Structural & Mechanical Analysis of Physical Activity	3
MMG 301 Introductory Microbiology	3
MMG 302 Introductory Micro. Laboratory	1
MMG 409 Eukaryotic Cell Biology	3
MMG 413 Virology	3
MMG 431 Microbial Genetics	3
MMG 451 Immunology	3
MMG 461 Molecular Pathogenesis	3
MMG 463 Medical Microbiology	3
BLD 324 Fundamentals of Hematology, Hemostatis and Urinology	3
BLD 416 Clinical Chemistry	4
NSC 496 Directed Study in Human Biol.	1-3
NSC 497 Internship in Human Biol.	1-3
NSC 498 Research in Human Biol.	1-3
PHM 350 Intro. Human Pharmacology	3
PHM 450 Intro. Chemical Toxicology	3
PHM 431 Pharmacology of Drug Addiction	3
ZOL 402 Neurobiology	3
ZOL 404 Human Genetics	3
ZOL 408 Histology	4
ZOL 425 Cells and Development	4
ZOL 450 Cancer Biology	3
ZOL 482 Cytochemistry	4
ZOL 483 Environmental Physiology	4

### One of the following courses 3-4 credits

ANTR 350 Human Gross Anat & Struct. Biol	3
ZOL 320 Developmental Biology	4
ZOL 328 Comp. Anat. & Bio. of Vertebrates	4

# LYMAN BRIGGS - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		CEM 251 Organic Chemistry I	3
One of the following 3 options:		CEM 351 Organic Chemistry I	3
1. LB 144 Biology I: Organismal Biology	4	<b>Mathematics</b>	
2. BS 110 Organisms and Populations	4	One of the following groups:	
3. LB 148H Honors Organismal Biology	3	1. LB 118 Calculus I	5
LB 158H Honors Organismal Bio. Lab.	2	LB 119 Calculus II	4
<b>Chemistry</b>		2. LB 118 Calculus I	5
One of the following groups:		STT 231 Statistics for Scientists	3
1. LB 171 Prin. of Chemistry I—Structure	4	3. MTH 152H Honors Calculus I	3
LB 171L Introductory Chemistry Lab. I	1	MTH 153H Honors Calculus II	3
LB 172 Prin. of Chemistry II—Reactivity	3	*4. MTH 132 Calculus I	3
LB 172L Prin. of Chem. II—Reactivity Lab	1	MTH 133 Calculus II	4
2. CEM 141 General Chemistry	4	<b>Physics</b>	
CEM 142 General and Inorganic Chem.	3	One of the following groups:	
CEM 161 Chemistry Laboratory I	1	1. LB 271 Physics I	3
3. CEM 141 General Chemistry	4	LB 271L Physics Laboratory I	1
CEM 143 Survey of Organic Chemistry	4	LB 272 Physics II	3
CEM 161 Chemistry Laboratory I	1	LB 272L Physics Laboratory II	1
4. CEM 151 General and Descriptive Chem.	4	2. PHY 231/231B/231C Intro. Physics I	3
CEM 152 Principles of Chemistry	3	PHY 232/232B/232C Intro. Physics II	3
CEM 161 Chemistry Laboratory I	1	PHY 251 Introductory Physics Lab. I	1
5. CEM 141 General Chemistry	4	PHY 252 Introductory Physics Lab. II	1
CEM 251 Organic Chemistry I	3	3. PHY 183/183B Physics for Sci. & Engineers I	4
CEM 161 Chemistry Laboratory I	1	PHY 184/184B Physics for Sci. & Engineers II	4
6. CEM 181H Honors Chemistry I	4	4. PHY 181B Basic Physics I, CBI	3
CEM 182H Honors Chemistry II	4	PHY 182B Basic Physics II, CBI	3
CEM 185H Honors Chemistry Lab. I	2	PHY 251 Introductory Physics Lab. I	1
7. LB 171 Prin. of Chemistry I—Structure	4	PHY 252 Introductory Physics Lab. II	1
LB 171L Introductory Chemistry Lab. I	1	5. PHY 193H Honors Physics I-Mechanics	3
and one of the following		PHY 294H Honors Physics II-Electromagnetism	3
CEM 143 Survey of Organic Chemistry	4		

## Core Curriculum

	Cr.		Cr.
<b>All of the following:</b>		<b>One of the following groups:</b>	
LB 492 Senior Seminar	4	1. LB 133 and two other LB STS courses	
*If Math option 4 above, then one of the following:		at the 300 level or above	11-12
STT 231 Statistics for Scientists	3	2. ATL 110-150 and two other LB STS courses	
MTH 234 Multivariable Calculus	4	at the 300 level or above	11-12
<b>One of the following three options:</b>		<b>Completion of an LB Field of Concentration or</b>	
1. LB 145 Bio. II: Cell & Molecular Biology	5	<b>a departmental coordinate major:</b> minimum 24	
2. BS 111 Cells and Molecules	3	<b>Credits numbered 300 and above:</b> minimum 30	
BS 111L Cell and Molecular Laboratory	2		
3. LB 149H Honors Cell & Molecular Bio.	3		
LB 159H Honors Cell & Molec. Bio. Lab	2		

# ACTUARIAL SCIENCE- SPECIALIZATION

*NOTE: This specialization, available to any Bachelor's degree student at MSU, is administered by the Department of Mathematics.*

The Specialization in Actuarial Science, which is administered by the Department of Mathematics within the College of Natural Science, is available as an elective to students who are enrolled in any bachelor's degree program at Michigan State University. This specialization complements a number of major fields such as mathematics, statistics and probability, finance, and economics. It is intended to prepare students for work in insurance companies, banks, investment firms, government work, hospitals, and business firms where there is a need to weigh the financial consequences of risk. With the approval of the department that administers the student's degree program, courses that are used to satisfy the requirements for the specialization may also be used to satisfy the requirements for the bachelor's degree.

## Specialization Requirements

Cr.

**The students must complete all of the following courses (21 credits):**

1. All of the following courses (18 credits):

FI 311 Financial Management	3
FI 321 Theory of Investments	3
FI 379 Advanced Derivatives (D)	3
MTH 360 Theory of Mathematical Interest	3
STT 441 Probability & Statistics I: Probability	3
STT 455 Actuarial Models	3
2. One of the following courses (3 credits):

MTH 457 Intro. to Financial Mathematics	3
STT 442 Probability & Statistics II: Statistics	3

Upon completion of the requirements for the Specialization in Actuarial Science, the students should contact the Chairperson of the Department of Mathematics and request certification for the completion of the specialization. After the certification is approved by the Chairperson of the Department of Mathematics and the Associate Dean of the College of Natural Science, the Office of the Registrar will enter on the student's academic record the name of the specialization and the date that it was completed. This certification will appear on the student's transcript.

# COMPUTATIONAL MATHEMATICS - BACHELOR OF ARTS

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>	<b>3-4</b>	<b>Physics</b>	
One course in Biological Science, Plant Biology, Entomology, Microbiology, Physiology, or Zoology.		PHY 183 Physics for Scientists and Engineers I	4
<b>Chemistry</b>		<b>300-400 level courses</b>	<b>30</b>
One of the following:		<b>Additional Arts &amp; Letters/Social Science</b>	
CEM 141 General Chemistry	4	Arts & Letters/Social Sci. beyond University	
CEM 181H Honors Chemistry I	4	Integrative Studies requirements	6
<b>Mathematics</b>			
One of the following (group 1 or 2):			
1. MTH 132 Calculus I	3		
MTH 133 Calculus II	4		
2. MTH 152H Honors Calculus I	3		
MTH 153H Honors Calculus II	3		

## Department Requirements

	Cr.		Cr.
<b>Foreign Language —2nd-year competency</b>		MTH 360 Theory of Mathematical Interest	3
<b>OR</b>		MTH 415 Applied Linear Algebra	3
<b>For students admitted to the teacher certification program, foreign language 1st-year competency and completion of the Professional Education sequence.</b>		MTH 416 Intro. to Algebraic Coding	3
MTH 234 Multivariable Calculus	4	MTH 441 Ordinary Differential Equations II	3
MTH 309 Linear Algebra I	3	MTH 452 *Numerical Analysis II	3
MTH 310 Abstract Algebra I and Number Theory	3	MTH 457 Intro. to Financial Mathematics	3
MTH 320 Analysis I	3	MTH 472 Mathematical Logic	3
MTH 451 Numerical Analysis I	3	MTH 482 *Discrete Mathematics II	3
MTH 481 Discrete Mathematics I	3	STT 351 Prob. & Stat. for Engineering	3
MTH 496 Capstone in Mathematics	3	STT 430 Intro. to Probability and Statistics	3
CSE 231 Introduction to Programming	4	STT 441 Prob. and Stat. I: Probability	3
CSE 232 Introduction to Programming II	4	STT 455 Actuarial Models	3
1. <b>One of the following:</b>		STT 461 Computations in Probability and Statistics	3
1. MTH 452 *Numerical Analysis II	3	3. <b>One of the following:</b>	
2. MTH 482 *Discrete Mathematics II	3	MTH 235 Differential Equations	3
2. <b>One of the following:</b>		MTH 340 Ordinary Differential Equations I	3
CSE 331 Algorithms & Data Structures	3	*This course may be counted toward either the requirement 1 or 2 but not toward both of those requirements.	
CSE 440 Intro. to Artificial Intelligence	3		

# COMPUTATIONAL MATHEMATICS - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>	<b>3-4</b>	<b>Mathematics</b>	
One course in Biological Science, Plant Biology, Entomology, Microbiology, Physiology, or Zoology.		One of the following (group 1 or 2):	
		1. MTH 132 Calculus I	3
		MTH 133 Calculus II	4
		2. MTH 152H Honors Calculus I	3
		MTH 153H Honors Calculus II	3
<b>Chemistry</b>		<b>Physics</b>	
One of the following 2 groups:		PHY 183 Physics for Scientists & Engineers I	4
1. CEM 141 General Chemistry	4	PHY 184 Physics for Scientists & Engineers II	4
CEM 142 General and Inorganic Chemistry	3		
CEM 161 Chemistry Laboratory I	1	<b>300 and 400 Level Courses</b>	<b>30</b>
2. CEM 181H Honors Chemistry I	4		
CEM 182H Honors Chemistry II	4		
CEM 185H Honors Chemistry Lab. I	2		

## Department Requirements

	Cr.		Cr.
<b>Foreign Language —1st-year competency</b>		MTH 360 Theory of Mathematical Interest	3
<b>OR</b>		MTH 415 Applied Linear Algebra	3
<b>For students admitted to the teacher certification program, completion of the Professional Education sequence.</b>		MTH 416 Intro. to Algebraic Coding	3
		MTH 441 Ordinary Differential Equations II	3
		MTH 452 *Numerical Analysis II	3
		MTH 457 Intro. to Financial Mathematics	3
		MTH 472 Mathematical Logic	3
		MTH 482 *Discrete Mathematics II	3
		STT 351 Prob. & Stat. for Engineering	3
		STT 430 Intro. to Probability and Statistics	3
		STT 441 Prob. and Stat. I: Probability	3
		STT 455 Actuarial Models	3
		STT 461 Computations in Probability and Statistics	3
		<b>3. One of the following:</b>	
		MTH 235 Differential Equations	3
		MTH 340 Ordinary Differential Equations I	3
MTH 234 Multivariable Calculus	4		
MTH 309 Linear Algebra I	3		
MTH 310 Abstract Algebra I and Number Theory	3		
MTH 320 Analysis I	3		
MTH 451 Numerical Analysis I	3		
MTH 481 Discrete Mathematics I	3		
MTH 496 Capstone in Mathematics	3		
CSE 231 Introduction to Programming	4		
CSE 232 Introduction to Programming II	4		
<b>1. One of the following courses:</b>			
MTH 452 *Numerical Analysis II	3		
MTH 482 *Discrete Mathematics II	3		
<b>2. One of the following courses:</b>			
CSE 331 Algorithms & Data Structures	3		
CSE 440 Intro. to Artificial Intelligence	3		
		*This course may be counted toward either the requirement 1 or 2 but not toward both of those requirements.	

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

# MATHEMATICS - BACHELOR OF ARTS

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>	<b>3-4</b>	<b>Physics</b>	
One course in Biological Science, Plant Biology, Entomology, Microbiology, Physiology, or Zoology.		PHY 183 Physics for Scientists and Engineers I	4
		<b>300-400 Level Courses</b>	<b>30</b>
<b>Chemistry</b>		<b>Additional Arts &amp; Letters/Social Science</b>	
One of the following:		Arts & Letters/Social Sci. beyond University	
CEM 141 General Chemistry	4	Integrative Studies requirements	6
CEM 181H Honors Chemistry I	4		
<b>Mathematics</b>			
One of the following (group 1 or 2):			
1. MTH 132 Calculus I	3		
MTH 133 Calculus II	4		
2. MTH 152H Honors Calculus I	3		
MTH 153H Honors Calculus II	3		

## Department Requirements

	Cr.		Cr.
<b>Foreign Language —2nd-year competency</b>		<b>One of the following groups:</b>	
<b>OR</b>		1. MTH 320 Analysis I	3
<b>For students admitted to the teacher certification program, foreign language 1st-year competency and completion of the Professional Education sequence.</b>		MTH 421 Analysis II	3
		(MTH 425 or 441 or 442 may substitute for MTH 421.)	
<b>All of the following</b>		2. MTH 428H Honors Analysis I	3
MTH 234 Multivariable Calculus	4	MTH 429H Honors Analysis II	3
MTH 309 Linear Algebra I	3	<b>One of the following courses:</b>	
MTH 496 Capstone in Mathematics	3	MTH 330 Higher Geometry	3
<b>One of the following two groups:</b>		MTH 340 Ordinary Differential Equations I	3
1. MTH 310 Abstract Algebra and		MTH 432 Axiomatic Geometry	3
Number Theory	3	<b>MTH courses at the 300 level or above</b>	<b>24</b>
MTH 411 Abstract Algebra I	3	(four of these courses must be	
(MTH 414 or MTH 417 or 418H or 481 may substitute for MTH 411.)		400 level or above) but, may not use	
2. MTH 418H Honors Algebra I	3	MTH 415, 424, 443.	
MTH 419H Honors Algebra II	3		

Students in the teacher certification program must take either Mathematics 300 or 432. Students not in the teacher certification program must take Mathematics 340. Students not in the teacher certification program with prior credit in Mathematics 235 or 255H may substitute an approved 400-level Mathematics course for Mathematics 340.

# MATHEMATICS - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>	<b>3-4</b>	<b>Mathematics</b>	
One course in Biological Science, Plant Biology, Entomology, Microbiology, Physiology, or Zoology.		One of the following (group 1 or 2):	
		1. MTH 132 Calculus I	3
		MTH 133 Calculus II	4
		2. MTH 152H Honors Calculus I	3
		MTH 153H Honors Calculus II	3
<b>Chemistry</b>		<b>Physics</b>	
One of the following groups (1 or 2):		One of the following (group 1 or 2):	
1. CEM 141 General Chemistry	4	1. PHY 183 Physics for Scientists and Engineers I	4
CEM 142 General and Inorganic Chemistry	3	PHY 184 Physics for Scientists and Engineers II	4
CEM 161 Chemistry Lab I	1	2. PHY 193H Honors Physics I	3
2. CEM 181H Honors Chemistry I	4	PHY 294H Honors Physics II	3
CEM 182H Honors Chemistry II	4		
CEM 185H Honors Chemistry Lab I	2		
		<b>300-400 Level Courses</b>	<b>30</b>

## Department Requirements

	Cr.		Cr.
<b>Foreign Language —1st-year competency</b>		MTH 421 Analysis II	3
<b>OR</b>		(MTH 425 or 441 or 442 may substitute for MTH 421.)	
<b>For students admitted to the teacher certification program, completion of the Professional Education sequence.</b>		2. MTH 428H Honors Analysis I	3
		MTH 429H Honors Analysis II	3
<b>All of the following:</b>		<b>One of the following courses:</b>	
MTH 234 Multivariable Calculus	4	MTH 330 Higher Geometry	3
MTH 309 Linear Algebra I	3	MTH 340 Ordinary Differential Equations I	3
MTH 496 Capstone in Mathematics	3	MTH 432 Axiomatic Geometry	3
<b>One of the following (group 1 or 2):</b>		<b>MTH courses at the 300 level or above</b>	<b>24</b>
1. MTH 310 Abstract Algebra and Number Theory	3	(four of these courses must be 400 level or above) but, may not use MTH 415, 424, 443.	
MTH 411 Abstract Algebra I	3		
(MTH 414 or MTH 417 or 418H or 481 may substitute for MTH 411.)			
2. MTH 418H Honors Algebra I	3		
MTH 419H Honors Algebra II	3		
<b>One of the following (group 1 or 2):</b>			
1. MTH 320 Analysis I	3		

Students in the teacher certification program must take either Mathematics 300 or 432. Students not in the teacher certification program must take Mathematics 340. Students not in the teacher certification program with prior credit in Mathematics 235 or 255H may substitute an approved 400-level Mathematics course for Mathematics 340.

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

## MINOR IN MATHEMATICS

The Minor in Mathematics, which is administered by the Department of Mathematics, broadens students' understanding and application of mathematical concepts to their chosen field of study. This minor is available as an elective to students who are enrolled in bachelor's degree programs at Michigan State University other than the Bachelor of Arts and Bachelor of Science Degree in Mathematics. With the approval of the department and college that administer the student's degree program, the courses that are used to satisfy the minor may also be used to satisfy the requirements for the bachelor's degree. Students who plan to complete the requirements of the minor should consult the undergraduate adviser in the Department of Mathematics.

### Minor in Mathematics Requirements

Cr.

**The students must complete all of the following courses (23 credits):**

1. All of the following courses (20 credits):

MTH 132 Calculus I	3
MTH 133 Calculus II	4
MTH 234 Multivariable Calculus	4
MTH 309 Linear Algebra I	3
MTH 310 Abstract Algebra & Number Theory	3
MTH 320 Analysis I	3
2. One of the following courses (3 credits):

(one 400-level Mathematics course)	3
------------------------------------	---

# CLINICAL LABORATORY SCIENCE - BACHELOR OF SCIENCE

NOTE: Enrollment in this major is limited and you must apply for admission through Biomedical Laboratory Diagnostics Program.

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		<b>Mathematics</b>	
BS 111 Cells and Molecules	3	One of the following (group 1, 2, or 3):	
<b>Chemistry</b>		1. MTH 124 Survey of Calculus I	3
One of the following (group 1, 2, or 3):		STT (200 or 201 or 231 or 351 or 421)	3-4
1. CEM 141 General Chemistry	4	2. MTH 132 Calculus I	3
CEM 161 Chemistry Lab	1	STT (200 or 201 or 231 or 351 or 421)	3-4
2. CEM 151 Principles of Chemistry I	4	*3. MTH 152H Honors Calculus I	3
CEM 161 Chemistry Lab	1	MTH 153H Honors Calculus II	3
3. CEM 181H Honors Chemistry I	4	<b>Physics</b>	
CEM 185H Honors Chemistry Lab I	2	One of the following (group 1, 2, 3 etc.):	
		1. PHY 183 Physics for Scientists and Engineers I	4
		PHY 184 Physics for Scientists and Engineers II	4
		2. PHY 231 Intro Physics I	3
		PHY 232 Intro Physics II	3
		3. PHY 193H Honors Physics I	3
		PHY 294H Honors Physics II	3
		<b>300-400 Level Credits</b>	minimum 30

## Department Requirements

	Cr.		Cr.
<b>Degree requires 136 total credits</b>		BLD 476 Adv Clinical Immunology & Immunohematology	1
BLD 204 Mechanisms of Disease	3	BLD 477 Adv Clinical Microbiology Lab.	3
BLD 213 Application of Clin. Lab. Principles	2	BLD 478 Adv Clinical Microbiology	1
BLD 220 Preparing for Health Prof. Career	1	BLD 479 Professional Behavior in the Clinical Laboratory	1
BLD 324 Fundamental Heme, Coag, Urine	3	BLD 496 Integr. Correlations in Clin. Lab. Sci. I	1
BLD 324L Intro. Lab. Heme, Coag, & Urine	1	BLD 498 Integr. Correl. in Clin. Lab. Sci. III	2
BLD 416 Clinical Chemistry	4	BMB 401 Basic Biochemistry	4
BLD 417 Qual. Process in Diagn. Lab. Testing	2	BS 111L Cell and Molecular Laboratory	2
BLD 424 Adv. Heme, Coag, and Urinalysis	2	CEM 162 Chemistry Lab II	1
BLD 424L Adv. Lab. Heme, Coag, & Urinalysis	1	CEM 251 Organic Chemistry I	3
BLD 430 Molecular Laboratory Diagnostics	2	CEM 252 Organic Chemistry II	3
BLD 433 Clin. Immunol. & Immunohematology Lab.	1	CEM 333 Instrument Methods	3
BLD 434 Clinical Immunology	3	MMG 301 Intro Microbiology	3
BLD 435 Transfusion & Transplantation Med.	3	MMG 463 Medical Microbiology	3
BLD 442 Educ. & Mgmt. in the Clin. Lab.	3	MMG 464 Diagnostic Microbiology Lab.	2
BLD 450 Eukaryotic Pathogens	3	PSL 250 Intro Physiology	4
BLD 455 Integrating Clin. Lab. Sci Disciplines (W)	2	<b>*If option 3 from above (Math), then the following:</b>	
BLD 471 Advanced Clinical Chemistry Lab	3	STT (200 or 201 or 231 or 351 or 421)	3-4
BLD 472 Advanced Clinical Chemistry	1		
BLD 473 Adv Clin. Hematology & Body Fluid Lab	4		
BLD 474 Adv Clin. Hematology & Body Fluid	1		
BLD 475 Adv Clinical Immunology & Immunohematology Lab	2		

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

# DIAGNOSTIC MOLECULAR SCIENCE - BACHELOR OF SCIENCE

NOTE: Enrollment in this major is limited and you must apply for admission through Biomedical Laboratory Diagnostics Program.

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		<b>Physics</b>	
BS 111 Cells and Molecules	3	One of the following (group 1, 2, 3 etc.):	
<b>Chemistry</b>		1. PHY 183 Physics for Scientists and Engineers I	4
One of the following (group 1, 2, or 3):		PHY 184 Physics for Scientists and Engineers II	4
1. CEM 141 General Chemistry	4	2. PHY 231 Intro Physics I	3
CEM 161 Chemistry Lab	1	PHY 232 Intro Physics II	3
2. CEM 151 Principles of Chemistry I	4	3. PHY 193H Honors Physics I	3
CEM 161 Chemistry Lab	1	PHY 294H Honors Physics II	3
3. CEM 181H Honors Chemistry I	4	<b>300-400 Level Courses</b>	<b>30</b>
CEM 185H Honors Chemistry Lab I	2		
<b>Mathematics</b>			
One of the following (group 1, 2, or 3):			
1. MTH 124 Survey of Calculus I	3		
STT (200 or 201 or 231 or 351 or 421)	3-4		
2. MTH 132 Calculus I	3		
STT (200 or 201 or 231 or 351 or 421)	3-4		
3. MTH 152H Honors Calculus I	3		
MTH 153H Honors Calculus II	3		

## Department Requirements

	Cr.		Cr.
<b>All of the following:</b>		CEM 252 Organic Chemistry II	3
BLD 204 Mechanisms of Disease	3	CEM 332 Instrumental Methods	2
BLD 213 Application of Clin. Lab Prin.	2	PSL 250 Introductory Physiology	4
BLD 220 Prep for a Health Prof Career	1	STT (200 or 201 or 231 or 351 or 421)	3-4
BLD 417 Qual. Proc. in Diagn. Lab. Testing	2	STT 421 Statistics I	3
BLD 436 Prin. of Diagn Molecular Sci.	2	STT 464 Statistics for biologists	3
BLD 437 Clin. Apps of Diagn.Mol. Sci.	2	ZOL 341 Fundamental Genetics	4
BLD 438 Molecular Diagnostic Lab.	2	<b>Complete two of the following:</b>	
BLD 442 Educ. & Mgmt in the Clin. Lab.	3	BLD 324 Fundamental Heme, Coag, Urine	3
BLD 455 Integr. Clin. Lab. Sci. Discl. (W)	2	BLD 416 Clinical Chemistry	4
BLD 482 Adv. Diagn. Molecular Sci.	2	BLD 424 Adv. Heme, Coag, & Urinalysis	2
BLD 483 Molecular Experience Heme Onc.	2	BLD 434 Immunology	3
BLD 484 Molecular Exp. Infect Disease	2	MMG 301 Introductory Microbiology	3
BLD 485 Molecular Exp in Genetics	2	MMG 431 Microbial Genetics	3
BLD 486 Molecular Exp in Genotyping	2	MMG 433 Microbial Genomics	3
BLD 496 Integr. Correlations in Clin. Lab. Sci. I	1	MMG 445 Basic Biotechnology	3
BLD 497 Integr. Correlations in Clin. Lab. Sci. II	1	MMG 463 Medical Microbiology	3
BMB 461 Biochemistry I	3	ZOL 404 Human Genetics	3
BMB 462 Biochemistry II	3	ZOL 450 Cancer Biology	3
BS 111L Cell and Molecular Laboratory	2		
CEM 162 Chemistry Laboratory II	1		
CEM 251 Organic Chemistry I	3		

# MEDICAL TECHNOLOGY - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		<b>Physics</b>	
BS 111 Cells and Molecules	3	One of the following (group 1, 2, 3 etc.):	
		1. PHY 183 Physics for Scientists and Engineers I	4
<b>Chemistry</b>		PHY 184 Physics for Scientists and Engineers II	4
One of the following (group 1, 2 or 3):		* 2. PHY 231 Intro Physics I	3
1. CEM 141 General Chemistry	4	PHY 232 Intro Physics II	3
CEM 161 Chemistry Lab	1	3. PHY 193H Honors Physics I	3
2. CEM 151 Principles of Chemistry I	4	PHY 294H Honors Physics II	3
CEM 161 Chemistry Lab	1		
3. CEM 181H Honors Chemistry I	4	<b>300-400 Level Courses</b>	<b>30</b>
CEM 185H Honors Chemistry Lab I	2		
<b>Mathematics</b>			
One of the following (group 1, 2, or 3):			
1. MTH 124 Survey of Calculus I	3		
STT (200 or 201 or 231 or 351 or 421)	3-4		
2. MTH 132 Calculus I	3		
STT (200 or 201 or 231 or 351 or 421)	3-4		
3. MTH 152H Honors Calculus I	3		
MTH 153H Honors Calculus II	3		

## Department Requirements

	Cr.		Cr.
<b>All of the following:</b>			
BLD 204 Mechanisms of Disease	3	CEM 251 Organic Chemistry I	3
BLD 213 Appl. of Clin. Lab. Principles	2	CEM 252 Organic Chemistry II	3
BLD 220 Preparing for Health Prof. Career	1	CEM 162 Chemistry Laboratory II	1
BLD 324 Fund. of Heme, Coag& Urinalysis	3	CEM 332 Instrumental Methods	2
BLD 416 Clinical Chemistry	4	MMG 301 Intro Microbiology	3
BLD 417 Qual. Process in Diagn. Lab. Testing	2	MMG 463 Medical Microbiology	3
BLD 424 Adv. Heme, Coag, & Urinalysis	2	MMG 464 Diagnostic Microbiology Lab.	2
BLD 430 Molecular Laboratory Diagnostics	2	PSL 250 Intro Physiology	4
BLD 434 Clinical Immunology	3	<b>*If option 3 from above (Math), then the following:</b>	
BLD 435 Transfusion & Transplantation Med.	3	STT (200 or 201 or 231 or 351 or 421)	3-4
BLD 450 Eukaryotic Pathogens	3		
BLD 455 Integr. Clin. Lab. Sci. Disciplines (W)	2		
BLD 496 Integr. Correlations in Clin. Lab. Sci. I	1		
BLD 497 Integr. Correlations in Clin. Lab. Sci. II	1		
BMB 401 Basic Biochemistry	4		
BS 111L Cell and Molecular Laboratory	2		

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

# MICROBIOLOGY - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		3. MTH 124 Survey of Calculus I	3
BS 110 Organisms and Populations	4	STT (231, 421)	3-4
		4. MTH 132 Calculus I	3
<b>Chemistry</b>		STT (231, 421)	3-4
One of the following (group 1, 2, 3 etc.):		5. MTH 152H Honors Calculus I	3
1. CEM 141 General Chemistry	4	MTH 153H Honors Calculus II	3
CEM 142 General/Inorganic Chemistry	3		
CEM 161 Chemistry Lab	1	<b>Physics</b>	
2. CEM 151 Principles of Chemistry I	4	One of the following (group 1, 2, 3 etc.):	
CEM 152 Principles of Chemistry II	3	1. PHY 183 Physics for Scientists	
CEM 161 Chemistry Lab	1	and Engineers I	4
3. CEM 181H Honors Chemistry I	4	PHY 184 Physics for Scientists	
CEM 182H Honors Chemistry II	4	and Engineers II	4
CEM 185H Honors Chemistry Lab I	2	2. PHY 231 Intro Physics I	3
		PHY 232 Intro Physics II	3
<b>Mathematics</b>		PHY 251 Intro Physics Lab I	1
One of the following (group 1, 2, 3 etc.):		PHY 252 Intro Physics Lab II	1
1. MTH 124 Survey of Calculus I	3	3. PHY 193H Honors Physics I	3
MTH 126 Survey of Calculus II	3	PHY 194H Honors Physics II	3
2. MTH 132 Calculus I	3		
MTH 133 Calculus II	4	<b>300-400 Level Courses</b>	<b>30</b>

## Department Requirements

	Cr.		Cr.
<b>All of the following:</b>		MMG 499 Undergraduate Research	2
BMB 461 Biochemistry I	3	<b>Complete one of the following pairs of courses</b>	
BMB 462 Biochemistry II	3	1. MMG 413 Virology	3
BS 111 Cells and Molecules	3	MMG 451 Immunology	3
BS 111L Cell and Molecular Laboratory	2	2. MMG 433 Microbial Genomics	3
CEM 162 Chemistry Lab II	1	ZOL 341 Fundamental Genetics	4
CEM 251 Organic Chemistry I	3	3. MMG 433 Microbial Genomics	3
CEM 252 Organic Chemistry II	3	MMG 445 Basic Biotechnology	3
CEM 255 Organic Chemistry Laboratory	2	4. MMG 425 Microbial Ecology	3
MMG 301 Intro Microbiology	3	MMG 433 Microbial Genomics	3
MMG 302 Intro Microbiology Lab	1		
MMG 408 Adv Microbiology Lab	3	(Advisors may recommend individual course options	
MMG 409 Eukaryotic Cell Biology	3	to accommodate student needs and abilities.)	
MMG 421 Prokaryotic Cell Physiology	3	<b>Complete one additional course from a list of</b>	
MMG 431 Microbial Genetics	3	<b>approved electives.</b>	<b>3 or 4</b>
<b>One of the following groups</b>		(Copies of this list are available in the department	
1. MMG 491 Current Topics in Microbiology		office. A course may not be counted to satisfy more	
and Molecular Genetics	3	than one requirement.)	
2. MMG 492 Undergrad Research Seminar	1		

# GENOMICS AND MOLECULAR GENETICS - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		<b>Physics</b>	
BS 110 Organisms and Populations	4	PHY 231 Introductory Physics I	3
<b>Chemistry</b>		PHY 232 Introductory Physics II	3
CEM 141 General Chemistry	4	PHY 251 Introductory Physics Lab I	1
CEM 142 General and Inorganic Chemistry	3	PHY 252 Introductory Physics Lab II	1
CEM 161 Chemistry Laboratory I	1	<b>300-400 Level Courses</b>	<b>30</b>
<b>Mathematics</b>			
One of the following (group 1, 2, 3, or 4)			
1. MTH 124 Survey of Calculus I	3		
MTH 126 Survey of Calculus II	3		
2. MTH 132 Calculus I	3		
MTH 133 Calculus II	4		
3. MTH 124 Survey of Calculus I	3		
STT 231 or 421	3		
4. MTH 132 Calculus I	3		
STT 231 or 421	3		

## Department Requirements

	Cr.		Cr.
BMB 461 Biochemistry I	3	1. MMG 491 Current Topics in Microbiology	3
BMB 462 Biochemistry II	3	2. MMG 492 Undergraduate Research Seminar	1
BS 111 Cells and Molecules	3	And one of the following 2 courses	
BS 111L Cell and Molecular Biology Lab	2	MMG 499 Undergraduate Research	2
CEM 162 Chemistry Laboratory II	1	MMG 499H Honors Research	2
CEM 251 Organic Chemistry I	3	<b>Two of the following courses</b>	
CEM 252 Organic Chemistry II	3	ANS 425 Principles of Animal Biotechnology	3
CEM 255 Organic Chemistry Laboratory	2	CSS 350 Introduction to Plant Genetics	3
MMG 301 Introductory Microbiology	3	CSS 441 Plant Breeding and Biotechnology	3
MMG 302 Introductory Microbiology Lab	1	MMG 413 Virology	3
MMG 431 Microbial Genetics	3	MMG 425 Microbial Ecology	3
MMG 433 Microbial Genomics	3	MMG 445 Basic Biotechnology	3
MMG 434 Lab in Genomics and Molecular Genetics	3	MMG 451 Immunology	3
ZOL 341 Fundamental Genetics	4	ZOL 404 Human Genetics	3
<b>One of the following:</b>			
MMG 409 Eukaryotic Cell Biology	3		
MMG 421 Prokaryotic Cell Physiology	3		
<b>One of the following 2 options (3 credits)</b>			

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

# ENVIRONMENTAL BIOLOGY/MICROBIOLOGY- BACHELOR OF SCIENCE

Administered by the Department of Microbiology

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		<b>Physics</b>	
BS 110 Organisms and Populations	4	One of the following (group 1, 2, 3 etc.):	
		1. PHY 183 Physics for Scientists and Engineers I	4
<b>Chemistry</b>		PHY 184 Physics for Scientists and Engineers II	4
One of the following (group 1, 2, 3 etc.):		2. PHY 231 Intro Physics I	3
1. CEM 141 General Chemistry	4	PHY 232 Intro Physics II	3
CEM 142 General/Inorganic Chemistry	3	PHY 251 Intro Physics Lab I	1
CEM 161 Chemistry Lab	1	PHY 252 Intro Physics Lab II	1
2. CEM 151 Principles of Chemistry I	4	3. PHY 193H Honors Physics I	3
CEM 152 Principles of Chemistry II	3	PHY 194H Honors Physics II	3
CEM 161 Chemistry Lab	1		
3. CEM 181H Honors Chemistry I	4	<b>300-400 Level Courses</b>	<b>30</b>
CEM 182H Honors Chemistry II	4		
CEM 185H Honors Chemistry Lab I	2		
<b>Mathematics</b>			
One of the following (group 1, 2, 3 etc.):			
1. MTH 132 Calculus I	3		
STT 231 Statistics for Scientists	3		
2. MTH 152H Honors Calculus I	3		
STT 231 Statistics for Scientists	3		

## Department Requirements

	Cr.		Cr.
<b>All of the following:</b>		<b>One of the following:</b>	
BMB 461 Biochemistry I	3	CSE 101 Comput Concepts & Competencies	3
BMB 462 Biochemistry II	3	CSE 131 Intro Technical Computing	3
BS 111 Cells and Molecules	3	<b>One of the following groups:</b>	
BS 111L Cell and Molecular Biology Lab	2	1. MMG 491 Current Topics in Microbiology	3
CE 280 Intro Environmental Engineering	3	2. MMG 492 Undergrad Research Seminar	1
CEM 162 Chemistry Lab II	1	MMG 499 Undergraduate Research	2
CEM 251 Organic Chemistry I	3	<b>Complete two of the following:</b>	
CEM 252 Organic Chemistry II	3	1. FOR 404 Forest and Agricultural Ecology	4
CEM 255 Organic Chemistry Laboratory	2	2. FSC 440 Food Microbiology	3
CEM 332 Instrumental Methods	2	3. GEO 206 Physical Geography	3
GLG 201 The Dynamic Earth	4	or GEO 221 Intro Geographic Information	3
GLG 421 Environmental Geochemistry	3	4. MMG 426 Biogeochemistry	3
MMG 301 Introductory Microbiology	3	5. MMG 445 Basic Biotechnology	3
MMG 302 Intro Microbiology Laboratory	1	6. MMG 827 Diversity of Prokaryotes	3
MMG 408 Adv. Microbiology Laboratory (W)	3	7. RD 430 Law and Resources	3
MMG 421 Prokaryotic Cell Physiology	3	or ZOL 446 Environ Issues & Public Policy	3
MMG 425 Microbial Ecology	3	8. FW 472 Limnology	3
MMG 431 Microbial Genetics	3	or ZOL 431 Comparative Limnology	4
ZOL 355 Ecology	3		
ZOL 355L Ecology Lab	1		

# NUTRITIONAL SCIENCE - BACHELOR OF SCIENCE

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>		STT 201 Statistical Methods	4
BS 111 Cells and Molecules	3	STT 231 Statistics for Scientists	3
<b>Chemistry</b>		STT 421 Statistics I	3
One of the following (group 1, 2, 3)		2. MTH 132 Calculus I	3
1. CEM 141 General Chemistry	4	And one of the following courses:	
CEM 142 General & Inorganic Chemistry	3	MTH 133 Calculus II	4
CEM 161 Chemistry Lab	1	STT 201 Statistical Methods	4
2. CEM 151 General & Descriptive Chemistry	4	STT 231 Statistics for Scientists	3
CEM 152 Principles of Chemistry	3	STT 421 Statistics I	3
CEM 161 Chemistry Lab	1	<b>Physics</b>	
3. CEM 181HHonors Chemistry I	4	PHY 231 Introductory Physics I	3
CEM 182HHonors Chemistry II	4	PHY 232 Introductory Physics II	3
CEM 185H Honors Chemistry Laboratory I	2	PHY 251 Introductory Physics Lab. I	1
<b>Mathematics</b>		PHY 252 Introductory Physics Lab. II	1
One of the following 2 groups		<b>300 and 400 Level Courses</b>	<b>30</b>
1. MTH 124 Survey of Calculus I	3		
And one of the following courses:			
MTH 126 Survey of Calculus II	3		

## Department Requirements

	Cr.		Cr.
<b>All of the following courses</b>		<b>One of the following groups(1 or 2)</b>	
HNF 463 Nutritional Sciences Laboratory	3	<b>1. Both of the following courses:</b>	
HNF 150 Intro to Human Nutrition	3	HNF 375 Community Nutrition	2
HNF 461 Advanced Human Nutrition: Carbohydrates, Lipids, and Proteins	3	HNF 453 Nutrition & Human Development	3
HNF 462 Advanced Human Nutrition: Vitamins and Minerals	3	<b>2. Two of the following:</b>	
HNF 480 Concepts of Human Nutrition Research Methods	2	HNF 375 Community Nutrition	2
BS 111L Cell and Molecular Biology Lab	2	HNF 465 Nutritional Pathophysiology	4
CEM 251 Organic Chemistry I	3	HNF 466 Medical Nutrition Therapy	4
CEM 252 Organic Chemistry II	3	<b>One of the following groups(1 or 2)</b>	
CEM 255 Organic Chemistry Laboratory	2	1. BMB 401 Basic Biochemistry	4
MMG 301 Introductory Microbiology	3	2. BMB 461 Biochemistry I	3
MMG 302 Introductory Microbiology Lab	1	BMB 462 Biochemistry II	3
PSL 431 Human Physiology I	3	<b>One of the following courses:</b>	
PSL 432 Human Physiology II	3	ANTR 350 Human Gross Anatomy and Structural Biology	3
		CEM 162 Chemistry Lab II	1
		CEM 262 Quantitative Analysis	3
		MMG 409 Eukaryotic Cell Biology	3
		PHM 350 Intro Human Pharmacology	3
		ZOL 341 Fundamental Genetics	4
		ZOL 408 Histology	4

**NOTE:** THESE GUIDELINES ARE PRESENTED FOR PLANNING PURPOSES ONLY. STUDENTS MUST CONSULT A DEPARTMENT ADVISOR FOR RELIABLE AND EXACT DETERMINATION OF AN INDIVIDUAL'S COURSE REQUIREMENTS.

v5.21.08

# PHYSICAL SCIENCE (INTERDEPARTMENTAL) - BACHELOR OF SCIENCE

Administered by the College of Natural Science Dean's Office through the Division of Science and Mathematics Education.

## University Requirements

As stipulated at the lower portion of page 4.

## College Requirements

	Cr.		Cr.
<b>Biological Science</b>			
One of the following courses:			
BS 110 Organisms and Populations	4	2. CEM 151 Chemistry I	4
PLB 105 Plant Biology	3	CEM 152 Chemistry II	3
ENT 205 Pests, Society and Environment	3	CEM 161 Chemistry Lab I	1
PSL 250 Intro. Physiology	4	<b>Mathematics</b>	
ZOL 141 Intro. Human Genetics	3	MTH 132 Calculus I	3
<b>Chemistry</b> (one of the following two groups)			
1. CEM 141 General Chemistry	4	MTH 133 Calculus II	4
CEM 142 General and Inorganic Chemistry	3	<b>Physics</b>	
CEM 161 Chemistry Lab 1	1	PHY 183 Physics for Scientists and Engineers I	4
		PHY 184 Physics for Scientists and Engineers II	4
		<b>300-400 Level Courses</b>	<b>30</b>

## Department Requirements

	Cr.		Cr.
<b>Chemistry Concentration</b>			
CEM 162 Chemistry Laboratory II	1		
CEM 251 Organic Chemistry I	3		
CEM 252 Organic Chemistry II	3		
CEM 255 Organic Chemistry Lab.	2		
CEM 262 Quantitative Analysis	3		
CEM 383 Intro. Physical Chemistry I	3		
<b>Physics Concentration</b>			
PHY 191 Physics Laboratory for Scientists I	1		
PHY 192 Physics Laboratory for Scientists II	1		
PHY 215 Thermodynamics and Modern Physics	3		
PHY 431 Optics I	3		
PHY 440 Electronics	4		
MTH 234 Multivariable Calculus I	4		
MTH 235 Multivariable Calculus II and Differential Equations	3		
SME 401 Science Laboratories for Secondary Schools	4		
An approved elective in Chemistry or Physics	3		























