

# DEPARTMENT OF NATURAL SCIENCE

*Chair: Van. W. Daniel, III*

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The Department of Natural Science offers Bachelor of Arts and Bachelor of Science degrees in natural science with majors in biology, chemistry, environmental science and medical technology/clinical laboratory science. It offers minors in biology, chemistry and physics. Courses are taught in astronomy, biology, chemistry, environmental science, geology, geography, and physics.

Pre-professional studies are available for students seeking careers in dentistry, forestry, medicine, nursing, pharmacy, physical therapy, and veterinary medicine.

Advanced placement and credit by examination may be awarded in accordance with college-wide policies. Outstanding students may be graduated with honors after meeting the criteria set by College-wide policy. For all majors in the department, a grade point average of 2.00 or higher is required in all courses for the major attempted at UVa-Wise.

Students may meet the degree requirements and design individual curricula to emphasize preparation for graduate school, professional schools, government, or private employment.

## **BACHELOR OF ARTS OR BACHELOR OF SCIENCE IN NATURAL SCIENCE / BIOLOGY MAJOR**

I. For all baccalaureate degrees in biology, requirements include:

A. Required biology courses:

		<i>semester hours</i>
BIOL 103/113*	Principles of Biology and Lab	4
BIOL 104/114*	Introduction to Biological Diversity and Lab	4

*\*These courses must be taken in sequence before students may take any other courses for a degree in biology.*

BIOL 210	Topics in Cell Biology	3
BIOL 215	Laboratory Methods in Biology	2
BIOL 220	Ecology and Evolutionary	

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	Processes	3
BIOL 225	Biostatistics	2
BIOL 360	Molecular Genetics	4
BIOL 498/499	Senior Seminar I/II	2

### B. Related Courses:

	CHEM 101/111 College Chemistry 1 and Lab	4
	CHEM 102/112 College Chemistry 2 and Lab	4
	MATH 204 Calculus I	4

**SUBTOTAL** **36**

C. All biology majors will be required to demonstrate satisfactory performance on a comprehensive examination prescribed by the department.

### II. For the Bachelor of Arts degree, biology majors also complete:

Additional biology courses (with or without labs) at the 300-level or above (BIOL 375, BIOL 380, BIOL 493 and BIOL 494 cannot satisfy this requirement) 6+

One of the following courses: 4-5

	CHEM 301/308 Organic Chemistry and Lab	
	CHEM 321 Quantitative Analytical Chemistry	
	PHYS 101/211 General Physics I and Lab	

A sequence of courses in a foreign language terminating in a course numbered 202 3-12

**SUBTOTAL** **13-23**

**TOTAL, BACHELOR OF ARTS** **49-59**

### III. All biology majors must take the following courses for a Bachelor of Science in Biology:

	BIOL 103/113 Principles of Biology*	4
	BIOL 104/114 Introduction to Biological Diversity*	4

\*These two courses must be taken in sequence before students may take any other courses for a degree in biology.

	BIOL 201 Topics in Cell Biology	3
	BIOL 215 Laboratory Methods in Biology	2
	BIOL 220 Ecology and Evolutionary Processes	3
	BIOL 225 Biostatistics	2
	BIOL 360 Molecular Genetics	4
	BIOL 398/399 Preparing for Life as a Scientist I/II	1/1
	BIOL 498/499 Senior Seminar I/II	1/1

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One course from each of the following three groups (at least one of the three must have a lab):

10-12

### GROUP I

- BIOL 302 Cellular Communications (3)
- BIOL 305 Animal Physiology (4)
- BIOL 308 Plant Cell Function (4)

### GROUP II

- BIOL 312 Microbiology (4)
- BIOL 315 Biomechanics (3)
- BIOL 318 Developmental Biology (4)

### GROUP III

- BIOL 322 Symbiosis (3)
- BIOL 325 Advanced Ecology (4)
- BIOL 328 Conservation Biology (3)

At least two electives from any course listed below or a course listed above that is not being used to meet the group requirement:

6

### ELECTIVES

- BIOL 331 Invertebrate Zoology
- BIOL 332 Vertebrate Zoology
- BIOL 335 Local Flora
- BIOL 336 Evolutionary Morphology of Plants
- BIOL 337 Anatomy
- BIOL 338 Parasitology
- BIOL 352 Immunology/Serology
- BIOL 353 Environmental Microbiology
- BIOL 360 Molecular Genetics
- BIOL 372 Biochemistry
- BIOL 373 Analytical Biochemistry
- BIOL 400 Virology
- BIOL 405 Mycology
- BIOL 410 Limnology
- BIOL 415 Neurobiology
- BIOL 420 Microbial Diversity
- BIOL 425 Regulation of Transcription

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BIOL 430	Toxicology
BIOL 458	Medicinal Plants
BIOL 460	Paleobotany

<b>SUBTOTAL</b>	<b>40-42</b>
<b>TOTAL, BACHELOR OF SCIENCE</b>	<b>63-65</b>

### MINOR IN BIOLOGY

A minor in biology consists of 22 semester hours with at least 14 hours in courses numbered 300 or above. Required courses are: BIOL 360: Molecular Genetics and BIOL 498-499: Senior Seminar. An average of 2.0 in all biology courses is required.

### RESEARCH HONORS IN BIOLOGY

The Biology Program is pleased to award graduation with honors to students who distinguish themselves in research. To earn honors, students must submit a contract for research in biology and fulfill all requirements of the contract to the satisfaction of the program and the Honors Committee at The University of Virginia's College at Wise.

### TEACHER LICENSURE IN BIOLOGY

Licensure to teach biology may be obtained by completing the requirements for either the Bachelor of Arts or the Bachelor of Science degrees, in addition to the professional education requirements for secondary school certification as outlined on page 123-124. Students should consult the Director of Teacher Education for specific requirements.

### TEACHER LICENSURE IN EARTH SCIENCE

Licensure to teach with an endorsement in earth science may be obtained by earning an endorsement in another science discipline and completing at least 18 semester hours in earth sciences in each of the following areas: geology, oceanography, meteorology, and astronomy.

### BACHELOR OF ARTS IN NATURAL SCIENCE CHEMISTRY MAJOR

The requirements for the Bachelor of Arts in Natural Science with a major in chemistry include:

		<i>semester hours</i>
CHEM 101/111	College Chemistry 1 and Lab	4
CHEM 102/112	College Chemistry 2 and Lab	4

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CHEM 301/308	Organic Chemistry 1 and Lab	5
CHEM 302/309	Organic Chemistry 2 and Lab	5
CHEM 311	Inorganic Chemistry	3
CHEM 321	Quantitative Analysis	5
CHEM 331	Introduction to Physical Chemistry	4
CHEM 498-499	Chemistry Seminar 1 and 2	2
Chemistry elective or biology elective with laboratory		3-4
MATH 204	Calculus I	4
MATH 205	Calculus II	4
MATH 208	Introduction to Probability and Statistics	4
PHYS 101/211	Introduction to Physics 1 and Lab	4
PHYS 102/212	Introduction to Physics 2 and Lab	4
<b>TOTAL SEMESTER HOURS</b>		<b>55-56</b>

## BACHELOR OF SCIENCE IN NATURAL SCIENCE CHEMISTRY MAJOR

*Coordinator: Van W. Daniel, III*

The requirements for the Bachelor of Science in Natural Science with a major in chemistry include:

		<i>semester hours</i>
CHEM 101/111	College Chemistry 1 and Lab	4
CHEM 102/112	College Chemistry 2 and Lab	4
CHEM 301/308	Organic Chemistry 1 and Lab	5
CHEM 302/309	Organic Chemistry 2 and Lab	5
CHEM 311	Inorganic Chemistry	3
CHEM 321	Quantitative Analytical Chemistry	5
CHEM 322	Instrumental Methods of Analysis	5
CHEM 333	Physical Chemistry 1	5
CHEM 334	Physical Chemistry 2	5
CHEM 498-499	Chemistry Seminar 1 and 2	2
BIOL 372	Biochemistry, <i>or</i>	3
Additional chemistry course (3 hours)		
MATH 204, 205, 306	Calculus I, II, and III	12
A course in probability and statistics or computer science selected from the following:		3-4
MATH 208	Elementary Probability and Statistics	
MATH 325	Probability and Statistics	
COSC 190	Fundamentals of Computer Programming or other approved programming course	
PHYS 311/211	College Physics 1 and Lab	5
PHYS 312/212	College Physics 2 and Lab	5

**TOTAL SEMESTER HOURS**

71-72

**MINOR IN CHEMISTRY**

A minor in chemistry includes CHEM 301/308: Organic Chemistry 1 and laboratory; CHEM 321: Quantitative Analytical Chemistry; and either CHEM 331: Introduction to Physical Chemistry or CHEM 333: Physical Chemistry 1. Substitutions are allowed with permission of the Department Chair.

**TEACHER LICENSURE IN CHEMISTRY**

Teacher Licensure in Chemistry may be obtained by completing either the Bachelor of Arts or Bachelor of Science Degree in Natural Science with a Major in Chemistry and also completing the professional education requirements for secondary school licensure as outlined on page 123-124. Students should consult the Director of Teacher Education for specific requirements.

**BACHELOR OF SCIENCE IN NATURAL SCIENCE  
ENVIRONMENTAL SCIENCE MAJOR**

The curriculum for the Bachelor of Science major in Environmental Science consists of the courses listed below.

	<i>semester hours</i>
<b>Biology:</b>	
BIOL 103/113	Principles of Biology and Lab 4
BIOL 104/114	Introduction to Biological Diversity and Lab 4
BIOL 220	Ecology and Evolutionary Processes 3
BIOL 225	Biostatistics 2
BIOL 325	Advanced Ecology <b>or</b> 4
BIOL 328	Conservation Biology 3
BIOL 335	Local Flora 2
BIOL 336	Evolutionary Morphology of Plants 4
BIOL 353	Environmental Microbiology 4
<b>Chemistry:</b>	
CHEM 101/111	College Chemistry 1 and Lab 4
CHEM 102/112	College Chemistry 2 and Lab 4
CHEM 321	Quantitative Analysis 5
CHEM 326 <i>or</i> 301/308 <i>or</i> 322	Environmental Chemistry, <i>or</i> Organic Chemistry and Lab, <i>or</i> Instrumental Analysis 4 or 5
<b>Environmental Science:</b>	
ENVR 201	Environmental Health 3

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ENVR 204	Introduction to Oceanography	3
ENVR 301	Land Restoration	4
ENVR 498/499	Environmental Science Seminar 1 and 2	4
Geology:		
GEOL 101	Physical Geology	4
GEOL 102	Historical Geology	4
Physics:		
PHYS 101/211	Introduction to Physics 1 and Lab	4
Mathematics:		
MATH 204	Calculus I	4
Economics:		
ECON 105	Economic Principles, <i>or</i>	
ECON 205	Microeconomic Principles	3
Communications:		
COMM 340	Business and Professional Communication	3
<b>TOTAL SEMESTER HOURS</b>		<b>79-81</b>

## **BACHELOR OF SCIENCE IN NATURAL SCIENCE MEDICAL TECHNOLOGY/CLINICAL LABORATORY SCIENCE MAJOR**

*Coordinator: Stanley C. Kunigelis*

The curriculum of this degree program consists of three years of academic work at UVa-Wise followed by a 12-month period of specialized training in medical technology/clinical laboratory science at a cooperating school of medical technology/clinical laboratory science accredited by the Committee on Allied Health Education and Accreditation (CAHEA).

UVa-Wise has affiliation agreements with schools of medical technology/clinical laboratory science at the Carilion Roanoke Memorial Hospital, Roanoke, Virginia, and Rockingham Memorial Hospital, Harrisonburg, Virginia.

Admission to the schools of medical technology/clinical laboratory science is open to students in the medical technology/clinical laboratory science degree program who have completed at least 92 semester hours. It is also open to those who hold, or will hold before admission, a baccalaureate degree in biology or chemistry with courses in organic chemistry, quantitative analysis, microbiology and immunology. Students apply for admission at the end of the sophomore year.

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Acceptance is competitive. The minimum grade point average for acceptance is 2.0 with 2.5 in biology, chemistry and mathematics.

Acceptance is based on grades, experience, references, and an interview.

Students enrolled in a school of medical technology/clinical laboratory science must register for two semesters at UVA-Wise, take BIOL 441-442, and pay full tuition. In general, the cost of a medical technology/clinical laboratory science school is about the same as three semesters of college. Special scholarships for medical technology/clinical laboratory science students are listed under Financial Aid.

After successful completion of the program, a student will be able to take examinations for certification including those given by the Board of Registry of Medical Technologists of the American Society of Clinical Pathologists and the National Certification Agency for Medical Laboratory Personnel.

Medical technology/clinical laboratory science students must meet all the degree requirements of UVA-Wise. A student must have a total of 92 semester hours of academic credit before clinical training.

Courses must include the following:

		<i>semester hours</i>
BIOL 103/113	Principles of Biology and Lab	4
BIOL 104/114	Introduction to Biological Diversity and Lab	4
BIOL 210	Topics in Cell Biology	3
BIOL 215	Laboratory Methods in Biology	2
BIOL 351	Microbiology	4
BIOL 352	Immunology and Serology	4
BIOL 374	Animal Physiology	5
CHEM 101/111	College Chemistry 1 and Lab	4
CHEM 102/112	College Chemistry 2 and Lab	4
CHEM 301/308	Organic Chemistry 1 and Lab	5
	<i>One selection from the following:</i>	5
CHEM 302/309	Organic Chemistry 2 and Lab, <i>or</i>	
CHEM 321	Quantitative Analysis	
MATH 103	Pre-calculus	3
MATH 208	Elementary Probability and Statistics	4
PHYS 101/211	Introduction to Physics 1 and Lab	4

### TOTAL SEMESTER HOURS

55

Courses listed above may also be counted toward a baccalaureate degree with a major in biology. Students who have taken two semesters of foreign language as electives should be able to complete a Bachelor of

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Arts degree in biology during a fourth year at UVa-Wise if they do not enter clinical training at a medical technology/clinical laboratory science school. (*Note: BIOL 338: Parasitology is strongly recommended.*)

## MINOR IN PHYSICS

A minor in physics includes PHYS 311-312, College Physics 1-2; PHYS 211-212, General Physics Lab 1-2; and at least eight additional semester hours in physics courses numbered 300 or above. ASTR 301, Intermediate Astronomy, may be included in the eight additional hours.

## PRE-PROFESSIONAL STUDIES

### PRE-ENGINEERING

*Faculty Contact: Megan E. Henry*

The University of Virginia and The University of Virginia's College at Wise are in the process of developing a 3-2 engineering program. Qualified students planning a career in engineering may complete three years of course work in Wise and finish their studies in Charlottesville. Successful students may earn a bachelor's degree from UVa-Wise and a master's degree in engineering from U.Va. Suggested curricula will depend both on the undergraduate major chosen and the intended graduate engineering program. All students must complete general education and major requirements. Students should consult with their advisors for individualized course planning. Students must apply to U.Va.'s school of engineering; admission is not guaranteed.

Courses required for most engineering programs include the following:

		<i>semester hours</i>
CHEM 101/111	College Chemistry 1 and Lab	4
CHEM 102/112	College Chemistry 2 and Lab	4
COSC 320	C/C++ Programming	3
MATH 204	Calculus I	4
MATH 205	Calculus II	4
MATH 208	Elementary Probability and Statistics	4
MATH 306	Calculus III	4
MATH 311	Ordinary Differential Equations	3
MATH 313	Linear Algebra	3
PHYS 211/212	General Physics Lab 1 & 2	2
PHYS 311/312	College Physics 1 & 2	8

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### PRE-FORESTRY

*Faculty Contact: Craig Van Boskirk*

Students planning a career in forestry may complete two years of pre-forestry course work at UVa-Wise. A suggested curriculum is listed below but students should consult requirements of schools at which they plan to complete their degrees. For transfer to Virginia Polytechnic Institute and State University, application should be made by February 1 prior to the summer or fall a student plans to enter.

<i>FRESHMAN YEAR</i>		<i>semester hours</i>
BIOL 103/113	Principles of Biology and Lab	4
BIOL 104/114	Introduction to Biological Diversity and Lab	4
CHEM 101/111	College Chemistry 1 and Lab	4
CHEM 102/112	College Chemistry 2 and Lab	4
ENGL 101-102	Composition	6
MATH 103	Pre-calculus	3
MATH 204	Calculus I	4
ELECTIVES		6
<b>TOTAL SEMESTER HOURS</b>		<b>35</b>

<i>SOPHOMORE YEAR</i>		<i>semester hours</i>
ECON 205	Microeconomic Principles	3
ECON 206	Macroeconomic Principles	3
GEOL 101	Physical Geology	4
MATH 205	Calculus II	4
MATH 313	Introduction to Linear Algebra	3
PHYS 101	Introduction to Physics 1 and Lab	4
COMM 100	Public Speaking	3
ELECTIVES		9
<b>TOTAL SEMESTER HOURS</b>		<b>33</b>

### PRE-MEDICINE, PRE-DENTISTRY, PRE-VETERINARY MEDICINE

*Faculty Contact: Margie Tucker*

The minimum requirement for admission to most schools of medicine is 90 semester hours of academic courses, although completion of the curriculum leading to a baccalaureate degree is encouraged. Courses in general chemistry, organic chemistry, biology, physics and English are

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required but concentration in the sciences is not essential. Medicine is concerned with a variety of social and community problems and a broad cultural background is considered desirable.

Pre-medical studies for each student should be planned in keeping with individual interests. Development of an efficient method of study and habit of reasoning is more important than the selection of subjects. Requirements may be met with the programs leading to baccalaureate degrees in natural sciences, social sciences or humanities. Students interested in becoming physicians, veterinarians or dentists should contact Dr. Tucker as early as possible for specific advice on preparatory programs, required courses and examinations, and application procedures for professional schools.

## PRE-PHARMACY

*Faculty Contact: Van W. Daniel, III*

The first two years of six-year programs leading to Bachelor of Science or Doctorate in Pharmacy degrees may be taken at UVa-Wise. A plan of study appropriate for students planning to transfer to the School of Pharmacy of the Medical College of Virginia is listed below. Students interested in other schools should consult specific requirements of those schools and be advised that admission to schools of pharmacy is competitive.

		<i>semester hours</i>
BIOL 103/113	Principles of Biology and Lab	4
BIOL 104/114	Introduction to Biological Diversity and Lab	4
CHEM 101/111	College Chemistry 1 and Lab	4
CHEM 102/112	College Chemistry 2 and Lab	4
CHEM 301/308	Organic Chemistry 1 and Lab	5
CHEM 302/309	Organic Chemistry 2 and Lab	5
ECON 205	Microeconomic Principles	3
ENGL 101-102	Composition	6
MATH	Elective	3
MATH 204	Calculus I	4
MATH 208	Elementary Probability and Statistics	4
PHYS 101/211	Introduction to Physics 1 and Lab	4
PHYS 102/212	Introduction to Physics 2 and Lab	4
COMM 100	Public Speaking	3
ELECTIVES	(not to include natural sciences, business or physical education)	12
<b>TOTAL SEMESTER HOURS</b>		<b>71</b>

## PRE-PHYSICAL THERAPY

*Faculty Contact: Robin Woodard*

Traditionally, physical therapy programs have required at least two years of preparation which may be completed at UVa-Wise, and two years at a professional school, to complete a bachelor's degree in physical therapy. A recent trend, exemplified by the Medical College of Virginia (MCV), requires three years of preparation and three years of professional school work, resulting in a master's degree in physical therapy. The suggested three year plan of study listed below is designed for the MCV program. Students should consult schools to which they plan to apply for specific requirements, and be advised that admission to physical therapy programs is highly competitive.

		<i>semester hours</i>
BIOL 103/113	Principles of Biology and Lab	4
BIOL 104/114	Introduction to Biological Diversity and Lab	4
BIOL 374	Animal Physiology	5
CHEM 101/111	College Chemistry 1 and Lab	4
CHEM 102/112	College Chemistry 2 and Lab	4
ENGL 101-102	Composition	6
MATH 103	Pre-calculus, <i>or</i>	3-4
MATH 204	Calculus I	
MATH 208	Elementary Probability and Statistics	4
Physical Education	activity course(s)	2
PHYS 101/211	Introduction to Physics 1 and Lab	4
PHYS 102/212	Introduction to Physics 2 and Lab	4
PSYC 110	Introduction to Psychology	3
HUMANITIES ELECTIVES		6
PSYCHOLOGY ELECTIVE		3
SOCIAL SCIENCE ELECTIVES		6
GENERAL ELECTIVES		29-30

### TOTAL SEMESTER HOURS

**93-95**

Students are encouraged to select general electives from the following categories: computer science, embryology, histology, human anatomy, kinesiology, physiology, foreign languages, and courses in physical education which deal with an analytical approach to human movement or motor learning.

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### COURSES IN ASTRONOMY

#### **ASTR 101: Introduction to Astronomy (3)**

*Pre- or corequisite: MATH 101 and the ability to make measurements with a metric ruler.*

A survey course to introduce students to the solar system and to stellar and galactic astronomy. Three class hours.

#### **ASTR 194, 195: Special Topics in Astronomy (1-3, 1-3)**

*Prerequisite: Permission of instructor*

An introductory level special topics course.

#### **ASTR 301: Intermediate Astronomy (4)**

*Prerequisite: ASTR 101*

An intermediate level course focusing on planetary evolution/geology, as well as stellar and galactic evolution. The course will introduce advanced observational techniques. A laboratory will support lecture material through observational projects requiring data collection and reduction.

### COURSES IN BIOLOGY

#### **BIOL 103: Principles of Biology (3)**

*Pre- or corequisite: MATH 101 or higher, ENGL 101 or higher, or permission of instructor*

An introduction to the biochemical, cellular, genetic, ecological, and evolutionary principles fundamental to all of biology. Three lecture hours.

#### **BIOL 104: Introduction to Biological Diversity (3)**

*Pre-requisite: BIOL 103/113, or permission of instructor*

An introduction to the diversity of living organisms with an emphasis on their interrelationships and the ways in which they have solved problems common to all life forms, past and present. Three lecture hours.

#### **BIOL 113: Principles of Biology Laboratory (1)**

*Corequisite: Concurrent enrollment in BIOL 103, or permission of instructor*

An introduction to the laboratory methods and techniques necessary to understand the fundamental principles of biology. This course meets alternate weeks and includes one lecture hour and two laboratory hours.

#### **BIOL 114: Introduction to Biological Diversity Laboratory (1)**

*Pre-requisite: BIOL 103/113, concurrent enrollment in BIOL 104, or permission of instructor*

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An introduction to the diversity of living organisms with an emphasis on the diagnostic characteristics of major groups of organisms and evolutionary patterns visible throughout these groups. Three laboratory hours.

### **BIOL 160: Human Biology (3)**

This course is designed specifically for non-majors and focuses on the biological principles of the human body from an anatomical, physiological, and ecosociological perspective. This course does not apply to any major or minor within the natural sciences. To count toward the general education laboratory science credit, you must concurrently enroll in BIOL 161. Three lecture hours.

### **BIOL 161: Human Biology Laboratory (1)**

*Co-requisite: Concurrent enrollment in BIOL 160*

A laboratory study correlated to the human organism. This course does not apply to any major or minor within the natural sciences. To count toward the general education laboratory science credit, you must enroll in BIOL 160. Three laboratory hours.

### **BIOL 180: Biodiversity and Conservation (3)**

An introduction to biological diversity, including the impact of organisms on our daily lives as well as issues pertaining to the conservation of biodiversity. This course does not apply to any major or minor in the natural sciences. To count toward the general education laboratory science credit, you must concurrently enroll in BIOL 181. Three lecture hours.

### **BIOL 181: Biodiversity and Conservation Laboratory (1)**

*Co-requisites: Concurrent enrollment in BIOL 180*

Students are given exposure to representatives of the various groups of organisms discussed in BIOL 180 as well as other lecture topics that can be appropriately considered in the context of a laboratory setting (e.g., anatomy, genetics, etc.). Three laboratory hours.

### **BIOL 210: Topics in Cell Biology (3)**

*Prerequisites: BIOL 104/114 , or permission of instructor*

A bridging course that expands upon fundamental concepts of cell structure and function introduced in BIOL 103 and provides the background necessary for a range of courses at the 300 level. Three lecture hours.

### **BIOL 215: Laboratory Methods in Biology (2)**

*Prerequisites: BIOL 104/114; or permission of instructor*

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This course is designed to give students hands-on experience with a wide range of basic laboratory techniques. Topics to be covered include microscopy, electrophoresis, chromatography, molecular biology and immunochemistry. Six laboratory hours.

### **BIOL 220: Ecology and Evolutionary Processes (3)**

*Prerequisites: BIOL 104/114 or permission of instructor*

An introduction to systematic biology, population genetics, evolutionary theory, physiological and population ecology, and ecosystem structure and function. Three lecture hours.

### **BIOL 225: Biostatistics (2)**

*Prerequisites: BIOL 104/114, or permission of instructor*

An introduction to biostatistical concepts and methods commonly encountered in biology. The course will cover basic descriptive statistics as well as experimental design and techniques for testing hypotheses (e.g. analysis of variance/covariance, regression analysis, and nonparametric statistics). Three lecture or laboratory hours.

### **BIOL 244: Scanning Electron Microscopy: Theoretical Aspects (1)**

*Prerequisites: BIOL 103/113 and BIOL 104/114*

The SEM offers a resolution that is several thousand times greater than visible light microscopy, making it particularly useful for elucidating surface structure. The theory underlying operation of the microscope, specimen preparation, and research applications are addressed. One lecture and two laboratory hours for one half semester.

### **BIOL 245: Scanning Electron Microscopy: Practical Concepts (1)**

*Prerequisite: BIOL 244*

A practical course in the use of the SEM, designed to prepare students to use the instrument in other courses or in research projects.

### **BIOL 260: The Human Brain (3)**

*Prerequisites: 8 hours of introductory biology*

A survey of basic neuroanatomy and neurophysiology will provide the necessary background to discuss higher mental functions such as learning, memory, emotions, motor control, language, sleep and arousal. Pathological states such as Parkinson's disease, Alzheimer's disease, and Multiple Sclerosis will be explored. (Dual listing with PSYC 260).

### **BIOL 275: An Introduction to Marine Biology (3)**

*Prerequisites: 8 hours of introductory biology*

This course is designed for all students, regardless of intended major.

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Twelve field days are required in Florida to generate data for a research-based, 7-page term-paper, due one week before the end of the first summer session. Using boat- and shoreline-based collection methods, this course will survey the diversity of life along marine shorelines, intertidal and subtidal zones. The importance of coastal communities as nurseries for both pelagic and benthic species of the ocean will be emphasized. Food, lodging, transportation, and lab fees are in addition to tuition. Students who have completed BIOL 375 may not take this course.

### **BIOL 280: Man and His Environment (3)**

Examination of human evolution with emphasis on effects of human populations on the natural world. Three class hours.

### **BIOL 302: Cellular Communications (3)**

*Prerequisite: BIOL 210*

A study of the basic mechanisms used by all cells to monitor and respond appropriately to their environment. Topics to be covered include cell adhesion molecules and cell trafficking, hormones and ligand-receptor interactions, signal transduction, transport across cell membranes and trafficking of intracellular components. Three lecture hours.

### **BIOL 305: Animal Physiology (4)**

*Prerequisite: BIOL 210, 215*

A study of physiological principles of humans. Human organ systems are studied with respect to their role in homeostasis. Laboratory experiments demonstrate underlying principles using computerized data acquisition. Three lecture and three laboratory hours.

### **BIOL 308: Plant Cell Function (4)**

*Prerequisites: BIOL 210, BIOL 215*

A course dealing with structural, biochemical and physiological characteristics of cell function in photosynthetic organisms. Special emphasis will be placed on cell walls, nutrient metabolism, photosynthesis, growth regulation, and totipotency. The laboratory portion of the class will stress the practical manipulation of plant cell function. Three lecture and three laboratory hours.

### **BIOL 312: Microbiology (4)**

*Prerequisites: BIOL 103/113, BIOL 104/114; BIOL 210 strongly recommended*

An introduction to morphological and physiological characteristics of bacteria, fungi, viruses and rickettsia. Special emphasis on medically important microbes, disease production, disease treatment, and disease transmission. Six class and laboratory hours.

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### **BIOL 315: Biomechanics (3)**

*Prerequisite:* BIOL 220

An introduction to the biomechanics underlying animal locomotion in aquatic, aerial, and terrestrial systems. The study of form and how it can be used to understand adaptations in various environments will be covered, including insights into fossil specimens. Three lecture hours.

### **BIOL 318: Developmental Biology (4)**

*Prerequisites:* BIOL 210, BIOL 215

The development of a fertilized ovum will be followed through the zygote, embryo, and fetal stages with particular attention to germ layer differentiation into specialized tissues. The regulation of development will be emphasized. The laboratory will follow the developmental stages of organisms using histological methods.

### **BIOL 322: Symbiosis (3)**

*Prerequisite:* BIOL 220

A course that introduces the diversity of interactions that occur among prokaryotes, fungi, protists, plants and animals in various combinations. The interactions considered will cover the spectrum from obligate mutualism to obligate parasitism. Three lecture hours.

### **BIOL 325: Advanced Ecology (4)**

*Prerequisites:* BIOL 220, BIOL 225

An examination of current topics in ecology with an emphasis on physiological, behavioral, and evolutionary ecology. The laboratory will integrate common field techniques with experimental design. Three lecture and three laboratory hours.

### **BIOL 328: Conservation Biology (3)**

*Prerequisite:* BIOL 220

An introduction to the theoretical and applied aspects of the preservation of biological diversity. The emphasis will be on the ecological and evolutionary background to species and habitat conservation, current threats to biodiversity, and evaluation of conservation efforts. Three lecture hours.

### **BIOL 331: Invertebrate Zoology (4)**

*Prerequisites:* BIOL 103/113 and BIOL 104/114, or equivalent

A taxonomic survey of the invertebrate phyla emphasizing diversity, and key anatomical, physiological, embryological and ecological features. Three lecture and three laboratory hours.

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### **BIOL 332: Vertebrate Zoology (4)**

*Prerequisite: Eight hours of introductory biology or permission of instructor*

A survey of the evolution and natural history of the vertebrates. Six class, laboratory, or field hours.

### **BIOL 335: Local Flora (2)**

An introduction to the systematic study of vascular plants native to the area. Offered each fall semester during the first half of the semester. Six laboratory and class hours.

### **BIOL 336: Evolutionary Morphology of Plants (4)**

*Prerequisite: BIOL 335*

The first half of the semester will be a comparative morphological study of the major extant plant groups with focus on those structures that distinguish the groups into evolutionary lineages. The second half will be a systematic study of the morphological features of members of our local flora and the system by which they have been taxonomically arranged.

### **BIOL 337: Anatomy (4)**

*Prerequisites: BIOL 103/113 and BIOL 104/114 or equivalent*

A comparative study of fine and gross anatomy of mammals with emphasis on human morphology. Laboratory requires extensive dissections including a human cadaver, supplemented with computerized tutorials. Students prepare a presentation on the functional anatomy of an assigned region of a human cadaver. Three lecture hours and three laboratory hours.

### **BIOL 338: Parasitology (4)**

*Prerequisites: BIOL 103/113 and BIOL 104/114 or their equivalent. A course in invertebrate zoology is strongly recommended*

A survey of the animal kingdom, paying special attention to pathogenic species. Life cycles are examined to emphasize the intimate relationship between parasite, host, and intermediate host. Etiology, morbidity, mortality and treatment of human parasitic infections are discussed. Three lecture hours and three laboratory hours.

### **BIOL 352: Immunology and Serology (4)**

*Prerequisite: BIOL 210, BIOL 215, BIOL 360*

Basic principles of antigen-antibody reactions and their application to disease diagnosis. Six class and laboratory hours.

### **BIOL 353: Environmental Microbiology (4)**

*Prerequisites: BIOL 103/113, BIOL 104/114, CHEM 101/111, CHEM 102/112*

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An introduction to microbiology, biochemistry and bacterial physiology of concern to environmental science. Focuses on interrelationships between microorganisms and the environment, particularly aquatic systems, and the role of microorganisms in environmental degradation and in bioremediation of contaminated soil and water. Six class and laboratory hours. (NOTE: BIOL 312 and BIOL/ENV SCI 353 may not both be used to meet graduation requirements.)

### **BIOL 360: Molecular Genetics (4)**

*Prerequisite: BIOL 210, BIOL 215*

An introductory course dealing with the laws of heredity, chemical basis of heredity, gene structure and function, population genetics, and the genetics of humans. Six class and laboratory hours.

### **BIOL 372: Biochemistry (3)**

*Prerequisite: CHEM 301-302 or permission of instructor*

Topics in biochemistry, with emphasis on metabolic synthesis and degradation pathways. Three class hours. Offered alternate years. (Dual listing with CHEM 372)

### **BIOL 373: Analytical Biochemistry (2)**

*Prerequisite: BIOL 372 or permission of instructor*

A laboratory course dealing with modern methods of identification and quantitation of biologically active compounds with emphasis on theory, operation, and application of instruments. Six laboratory hours. (Dual listing with CHEM 373)

### **BIOL 375: Advanced Marine Biology (4)**

*Prerequisites: BIOL 275 or BIOL 331*

Includes 10-12 field days in Florida surveying the diversity of life along marine shorelines, intertidal and subtidal zones using boat and shore-based collection methods. Lectures emphasize marine and coastal diversity and the importance of coastal communities as nurseries for pelagic and benthic species. Students prepare illustrated, taxonomically correct catalogs of species collected, and using data from field work and thorough literature review, prepare a major research paper, due one week before the end of Summer Session I. Food, lodging, transportation and laboratory fees are in addition to tuition.

### **BIOL 380: Natural History of the Appalachians (3)**

*Prerequisite: Eight hours of biology or permission of instructor*

An introductory study of the geology, climate, soil, flora and fauna of the Appalachian range, with emphasis on Virginia. Three hours lecture, plus local field trips.

**BIOL 387, 388: Cooperative Education Project 1 (1-6, 1-6)**

Students can obtain information from the Department Chair.

**BIOL 398, 399: Preparing for Life as a Scientist I/II (1, 1)**

*Prerequisites: BIOL 104/114*

The objectives of this course are to provide biology majors with information on pre- and post-graduate opportunities, and prepare them for graduate and professional studies related to biology. The course will make extensive use of technology to prepare students for this aspect of professional life.

**BIOL 400: Virology (3)**

*Prerequisite: BIOL 360*

A study of the basic structure and function of viruses. Emphasis will be placed on mechanisms for cell invasion, viral replication, and pathogenesis. Three lecture hours.

**BIOL 405: Mycology (3)**

*Prerequisites: BIOL 215, BIOL 220*

This course will take a phylogenetic view of fungal diversity and consider the significance of fungi to humans. Three lecture hours.

**BIOL 410: Limnology (4)**

*Prerequisites: BIOL 220, BIOL 225; or permission of instructor*

A study of the biological, chemical, and physical factors influencing freshwater life. The laboratory will emphasize limnological techniques, biological productivity and communities, pollution, and lake and stream morphometry. Three lecture and three laboratory hours.

**BIOL 415: Neurobiology (3)**

*Prerequisites: BIOL 210, BIOL 215;*

From primitive neural nets to layer V pyramidal cells of the cerebral cortex, neural language links sensory input with motor output, coordinating homeostatic functions. Neural language will be looked at from first principles. Basic neuroanatomy and neurophysiology will be studied at the molecular and cellular levels, paying attention to genetically-based pathologies. Topics studied will include bioelectricity, ion channels, sensory transduction, neurohumors, synaptic transmission and integration, and neural plasticity.

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### **BIOL 420: Microbial Diversity (3)**

*Prerequisites: BIOL 220, BIOL 312*

A course dealing with the biology and economic significance of microscopic organisms from all three domains of life. Three lecture hours.

### **BIOL 425: Regulation of Transcription (3)**

*Prerequisites: BIOL 302, BIOL 360*

A discussion of the role transcription factors play in determining the fate of a cell. Topics to be covered include a detailed look at the process of transcription, transcription factors, the physical relationship between DNA and transcription factors, and the role of transcription factors in development. Three lecture hours.

### **BIOL 430: Principles of Toxicology (3)**

*Prerequisites: BIOL 103, CHEM 102; CHEM 301 highly recommended*

An introduction to the concepts and principles of toxicology as they apply to humans and environmental health. The course discusses the fate and behavior of chemicals in the environment and the effects of pollutants on ecosystems. It defines the principles underlying the interactions of environmental chemicals with the biological systems, emphasizing chemical distribution, cellular penetration, biotransformation and elimination. Special attention to the genetic basis of toxicity by environmental agents will be given. In addition, monitoring exposure, toxicity testing, and risk assessment are discussed.

### **BIOL 441-442: Clinical Training (32)**

Required of all students in the Bachelor of Science in Medical Technology/Clinical Laboratory Science Program. Clinical training at a CAHEA-accredited (Committee on Allied Health Education and Accreditation) school of medical technology/clinical laboratory science. A twelve-month course of study involving lecture and clinical experience. Subjects include clinical chemistry and instrumentation, microbiology, hematology, immunochemistry, immunology and serology, coagulation, genetics, urinalysis, and nuclear medicine.

### **BIOL 458: Medicinal Plants (3)**

*Prerequisites: BIOL 210, CHEM 301*

A course dealing with the sources, biochemistry, and pharmacology of plant-derived drugs, including 'herbal' medicines. Three lecture hours.

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### **BIOL 460: Paleobotany (3)**

*Prerequisite:* BIOL 336

An evolutionary history of the plants examining morphology, phylogeny, ecology and distributions, of both living and extinct groups drawn from the evidence of the fossil record. Three lecture hours.

### **BIOL 487, 488: Cooperative Education Project 2 (1-6, 1-6)**

Students can obtain information from the Department Chair.

### **BIOL 490: Biology Professional Internship (1)**

*Prerequisites:* BIOL 220/225; or permission of instructor

The professional internship provides students with an opportunity to work with and learn from professionals in an off-campus setting. Individuals participating in the internship must submit a contract clearly stating the expectations of the student, the off-campus mentor, and a sponsoring biology professor. Copies of the contract may be obtained in the Natural Sciences office. A minimum of 150 hours of work is required for one credit hour. The professional internship does NOT include shadowing experiences.

### **BIOL 493: Biology Laboratory Internship (1)**

*Prerequisites:* BIOL 103/113, BIOL 104/114

Three hours of work per week in laboratory preparation and instruction for biology laboratories taught at UVa Wise, under the direction of a faculty/staff member. Goals are to foster independent work habits and responsibility in a laboratory setting for majors in biology or related fields.

### **BIOL 495, 496: Special Topics in Biology (1-3, 1-3)**

*Prerequisite:* Permission of instructor

This course allows advanced students to pursue a biological subject not normally covered in a regularly scheduled class. Topics generally represent special fields of study or currently expanding areas of research. This course is only an addition to and not a substitution for any portion of the major requirement in biology.

### **BIOL 497: Independent Study (1-3)**

*Pre- or co-requisites:* BIOL 215, BIOL 225

This course provides intensive instruction in the use of laboratory and/or field equipment for students interested in pursuing careers in biology. This course is designed both for those who plan to undertake honors research in their third/fourth years as well as those who want some practical research experience. Various methodological approaches (both

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current and historical) will be used in a process of scientific investigation. This course is only an addition to and not a substitution for any portion of the major requirement in biology. Copies of the contract for Independent Study may be obtained in the Natural Science office.

### **BIOL 498, 499: Senior Seminar (1, 1)**

*Prerequisites: Senior status*

The presentation and discussion of problems of current interest by faculty, visiting speakers, and students. Students are responsible for materials presented and are subject to examination.

## COURSES IN CHEMISTRY

### **CHEM 100: Principles of Chemistry (3)**

Selected topics from descriptive and theoretical chemical literature. No previous knowledge of chemistry assumed. Not open to students who have successfully completed CHEM 101 or 102. (Satisfies no departmental degree requirements.) Three class hours per week.

### **CHEM 101-102: College Chemistry 1-2 (3, 3)**

*Prerequisite for CHEM 101: MATH 101 or equivalent placement; CHEM 102: CHEM 101.*

Basic facts and principles of chemistry. Properties and uses of the more important metallic and non-metallic elements. Three class hours.

### **CHEM 110: Principles of Chemistry Laboratory (1)**

*Pre- or corequisite: CHEM 100*

Laboratory component of CHEM 100. Two laboratory hours per week.

### **CHEM 111-112: College Chemistry Laboratory 1-2 (1, 1)**

*Pre- or corequisite for CHEM 111: CHEM 101*

*Pre- or corequisite for CHEM 112: CHEM 102*

Laboratory components of CHEM 101, 102: College Chemistry. One lecture hour and two laboratory hours. Meets alternate weeks.

### **CHEM 194, 195: Special Topics (1-3, 1-3)**

*Prerequisite: Permission of instructor*

### **CHEM 255: Chemistry in Our Daily Lives: Consumer and Environmental Chemistry (3)**

*Prerequisites: CHEM 100, ENGL 102, or permission of instructor*

Examination of the inorganic and organic chemicals that affect our daily

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lives (food, clothing, health, cleanliness, transportation, air and water, appearance and agriculture). (Satisfies no departmental degree requirement..) Three class hours.

### **CHEM 256: Chemistry in Our Daily Lives Laboratory (1)**

*Pre- or Corequisite: CHEM 255*

Laboratory experiments to support lecture material in CHEM 255. Two laboratory hours per week.

### **CHEM 301-302: Organic Chemistry 1-2 (3, 3)**

*Prerequisite for CHEM 301: CHEM 102, 112; CHEM 302: CHEM 301, 308*

An introduction to the theoretical, synthetic, industrial, and biological aspects of the chemistry of carbon compounds. Three class hours.

### **CHEM 308-309: Organic Chemistry Laboratory 1-2 (2, 2)**

*Pre- or corequisite for CHEM 308: CHEM 301 / CHEM 309: CHEM 301, 302*

The laboratory component of CHEM 301, 302: Organic Chemistry 1-2. One lecture hour and three laboratory hours per week.

### **CHEM 311: Inorganic Chemistry (3)**

*Prerequisite: CHEM 102, 112*

A systematic study of the elements and their inorganic compounds, transitional-metal complexes, theories of bonding and geometries of compounds, periodic relationships and the structure of the atom. Three class hours per week.

### **CHEM 321: Quantitative Analytical Chemistry (5)**

*Prerequisite: CHEM 102, 112*

A study of principles and methods used in the separation and quantitative determination of elements and compounds. Laboratory work consists of gravimetric, volumetric, and instrumental determinations illustrating the principal types of quantitative analysis. Three class hours, six laboratory hours.

### **CHEM 322: Instrumental Methods of Analysis (5)**

*Prerequisite: CHEM 321*

A continuation of quantitative analytical chemistry to include utilization of modern analytical instrumentation for chemical analysis in organic and inorganic chemistry. Emphasis on absorption spectroscopy, gas and liquid chromatography, electrical methods, and non-aqueous studies. Three class hours, six laboratory hours.

### **CHEM 326: Environmental Chemistry (4)**

*Prerequisites: CHEM 321*

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Fundamental aspects of inorganic and organic chemistry relating to air, water, and soil/land/pollution, its prevention and amelioration. Three class hours, three laboratory hours. Offered alternate years.

### **CHEM 331: Introduction to Physical Chemistry (4)**

*Prerequisite:* CHEM 102/112, MATH 204

A survey of the principles of physical chemistry with emphasis on thermodynamics, electrochemistry, solutions, and equilibrium. Credit may not be claimed for this course if credit is claimed for CHEM 333, 334. Three class hours, one three-hour laboratory.

### **CHEM 333-334: Physical Chemistry 1-2 (5, 5)**

*Prerequisite:* CHEM 102, 112 and one semester of calculus

A survey of theoretical chemistry based on kinetic theory, the laws of thermodynamics, and quantum mechanics. Topics include thermodynamics, thermochemistry, chemical equilibrium, solutions, reaction kinetics, electrochemistry, wave mechanics, and molecular structure. Three class hours, four laboratory hours. Offered alternate years.

### **CHEM 341: Biophysical Chemistry (3)**

*Prerequisite:* CHEM 102, 302, or permission of instructor

An introductory course using physical chemical methods to study macromolecules. Includes the physical and chemical properties of macromolecules, the structure and function of enzymes and proteins, and an introduction to enzyme kinetics. Three class hours.

### **CHEM 350: History of Chemistry (3)**

The history of the development of chemistry as a science. An examination of the principal concepts and how they came into being. Three class hours.

### **CHEM 360: Polymer Chemistry (3)**

*Prerequisites:* CHEM 302

An introduction to polymer chemistry including polymer structure and architecture, mechanism and kinetics of polymerization, and the physical characterization of polymers. Three class hours.

### **CHEM 372: Biochemistry (3)**

*Prerequisite:* Organic Chemistry or permission of instructor

Topics in biochemistry, with emphasis on metabolic synthesis and degradation pathways. Three class hours. Offered alternate years. (Dual listing with BIOL 372)

**CHEM 373: Analytical Biochemistry (2)**

*Prerequisite: BIOL 372 or permission of instructor*

A laboratory course dealing with modern methods of identification and quantitation of biologically active compounds with emphasis on theory, operation, and application of instruments. Six laboratory hours. (Dual listing with BIOL 373)

**CHEM 375: Bioorganic Chemistry (3)**

*Prerequisite: CHEM 302*

An examination of biological phenomena from the perspective of organic chemistry. Three lecture hours.

**CHEM 387, 388: Cooperative Education Project 1 (1-6, 1-6)**

Students can obtain information from the Department Chair.

**CHEM 403: Advanced Organic Chemistry (3)**

*Prerequisites: CHEM 301/308 and CHEM 302/309*

An examination of the relationship between structure and reactivity of organic molecules.

**CHEM 487, 488: Cooperative Education Project 2 (1-6, 1-6)**

Students can obtain information from the Department Chair.

**CHEM 491, 492: Chemistry Research 1, 2 (3, 3)**

*Prerequisite: Permission of instructor*

An original investigation under the direction of a member of the staff. Nine laboratory hours.

**CHEM 493, 494: Chemistry Laboratory Internship 1, 2 (1, 1)**

*Prerequisite: Permission of instructor*

Three hours of work in laboratory preparation for chemistry laboratories under the direction of the faculty member teaching those laboratories. Goals are to foster independent work habits and responsibility in a laboratory setting for majors in chemistry or related fields.

**CHEM 495, 496: Special Topics in Chemistry (1-3, 1-3)**

*Prerequisite: Permission of instructor*

Pursuit of some subject which is not normally covered in a regularly scheduled class. (May be used in the B.A. degree program to satisfy area requirements in analytical, organic, inorganic, or physical chemistry courses, if agreed upon in advance and in writing by the instructor and the department chairman.)

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### **CHEM 497: Independent Study (1-3)**

### **CHEM 498-499: Chemistry Seminar 1, 2 (1, 1)**

*Prerequisite: Juniors or senior status*

Discussion of current research and literature.

## COURSES IN ENVIRONMENTAL SCIENCE

### **ENVR 201: Environmental Health (3)**

*Prerequisite: Eight hours of chemistry and/or biology (with laboratories) or permission of instructor*

Characterize the physical, chemical and biological factors in the environment that can potentially affect human health. Define the impact of humans on the environment, and the impact of the environment on humans. Discuss the practice and limitations of assessing, controlling, correcting and preventing those environmental agents that adversely affect human health. Emerging environmental health topics such as global change and environmental degradation in the developing countries are also evaluated.

### **ENVR 204: Introduction to Oceanography (3)**

*Prerequisites: GEOL 101 or BIOL 103/113 or BIOL 104/114*

Designed to acquaint students with the earth's oceans and ocean basins, the course will emphasize an interdisciplinary approach focusing on the following: geologic development of the ocean basins and margins; chemistry of ocean waters; physics of water circulation; ocean/atmospheric interactions; and marine biology. Human impact on the oceans. Students are expected to gain a basic knowledge of various ocean environments and ocean dynamics and the interplay of oceans and other earth systems.

### **ENVR 301: Land Restoration (4)**

*Prerequisites: BIOL 381, pre- or corequisite: CHEM 321*

Basic principles of soils and plant materials involved in restoring productivity to drastically disturbed lands. Chemistry of soils emphasized. Three hours lecture, three hours laboratory or field work per week. Offered alternate years.

### **ENVR 326: Environmental Chemistry (4)**

*Prerequisites: CHEM 321*

Fundamental aspects of inorganic and organic chemistry relating to air, water, and soil/land/pollution, its prevention and amelioration. Four class hours. Three class and three laboratory hour. Offered alternate years.

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### **ENVR 387, 388: Cooperative Education Project 1 (1-6, 1-6)**

Students can obtain information from the Department Chair.

### **ENVR 487, 488: Cooperative Education Project 2 (1-6, 1-6)**

Students can obtain information from the Department Chair.

### **ENVR 495, 496: Special Topics in Environmental Science (1-6, 1-6)**

*Prerequisite: Permission of instructor*

### **ENVR 497: Independent Study (1-3)**

### **ENVR 498-499: Environmental Science Seminar 1, 2 (2, 2)**

*Prerequisite: Junior or senior status or permission of instructor*

Discussion of environmental issues and problems and their possible solutions by students, staff and outside speakers. Emphasis for part of each year will be on economics, ethics, and law.

## COURSES IN GEOGRAPHY

### **GEOG 201: Introduction to Physical Geography (3)**

The major physical elements of the natural environment, such as land forms, weather and climate, natural vegetation and soils.

### **GEOG 202: Introduction to Cultural Geography (3)**

A regional survey of human or cultural geography of the world with emphasis on the Old World. May not be used to satisfy the general education science requirement.

## COURSES IN GEOLOGY

### **GEOL 101: Physical Geology (4)**

*Prerequisite: Ability to make measurements with a ruler in both English and metric units.*

An introductory study of minerals, rocks, land forms, and the internal structure of the earth, and the processes by which these develop. Three hours lecture, three hours laboratory.

### **GEOL 102: Historical Geology (4)**

*Prerequisite: GEOL 101*

A chronological survey of the development of planet earth as revealed through evidence from rocks and fossils, and interpreted in light of modern theories of plate tectonics. Two hours lecture, one hour laboratory per week and four all-day field trips per semester.

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### GEOL 495, 496: Special Topics in Geology (1-3, 1-3)

## COURSES IN PHYSICS

### **PHYS 101: Introduction to Physics 1 (3)**

*Pre- or corequisite: MATH 101 or 103*

An introductory level college physics course using mathematics through algebra and trigonometry. Topics covered include kinematics and Newton's laws with vectors, energy and momentum conservation, rotational motion, harmonic motion, and thermodynamics. Three lecture hours per week.

### **PHYS 102: Introduction to Physics 2 (3)**

*Prerequisite: PHYS 101*

A continuation of Principles of Physics 1. Topics include electrostatics, circuits, electric and magnetic fields, geometric optic, quantum mechanics, atomic structure and nuclear physics. Three lecture hours per week.

### **PHYS 211: General Physics Lab 1 (1)**

*Pre- or corequisite: PHYS 101 or PHYS 311;*

An introductory laboratory course in physics. Experiments are intended to support lecture material in PHYS 101 and PHYS 311. Includes general laboratory procedures and methods of data analysis. Two hours of laboratory work per week.

### **PHYS 212: General Physics Lab 2 (1)**

*Prerequisite: PHYS 211; pre- or corequisite: PHYS 102 or PHYS 312*

A continuation of General Physics Lab 1. Experiments are intended to support lecture material in PHYS 102 and PHYS 312. Two hours of laboratory work per week.

### **PHYS 301: Electronics (4)**

*Prerequisite: MATH 204*

Analog and digital electronics for scientific applications. Topics include DC circuits, AC circuits, amplifiers, logic gates, analog to digital conversion, and digital to analog conversion. Three lecture hours and three laboratory hours.

### **PHYS 311: College Physics 1 (4)**

*Pre- or corequisite: MATH 204*

An introductory level, calculus-based physics course. Topics covered include kinematics and Newton's laws with vector calculus, energy and

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momentum conservation, rotational motion, harmonic motion, and thermodynamics. Four lecture hours per week.

### **PHYS 312: College Physics 2 (4)**

*Prerequisite: PHYS 311; Pre- or corequisite: MATH 205*

A continuation of College Physics 1. Topics covered include electrostatics, circuits, electric and magnetic fields, geometric optics, quantum mechanics, atomic structure and nuclear physics. Three lecture hours per week.

### **PHYS 321: Modern Physics (3)**

*Prerequisite: PHYS 312*

Twentieth century developments in physics. Topics include special relativity, introductory quantum theory, the particle theory of light, the wave nature of electrons, and atomic structure. Three lecture hours per week.

### **PHYS 323: Experimental Modern Physics (1)**

*Prerequisite: PHYS 312; pre- or corequisite: PHYS 321*

A laboratory class with experiments relating to important 20th century developments in physics. Lab experiments may include measuring the speed of light; measuring Planck's constant using a photoelectric effect device; measuring critical properties of superconductors; performing experiments observing EMR (electron spin resonance) and NMR (nuclear spin resonance); and detecting alpha, beta and gamma particles resulting from nuclear decay. Three laboratory hours.

### **PHYS 421: Quantum Physics (3)**

*Prerequisite: PHYS 321*

Non-relativistic quantum mechanics. Topics include an introduction to wave mechanics; mathematical tools of quantum mechanics; and the application of quantum mechanics to spin 1/2 systems, the one-dimensional harmonic oscillator and the hydrogen atom.

### **PHYS 495, 496: Special Topics in Physics (1-3, 1-3)**

*Prerequisite: Permission of instructor*

Pursuit of some subject which is not normally covered in a regularly scheduled class. May be taken once or twice for one, two, or three semester hours of credit per semester.

### **PHYS 497: Independent Study (1-3)**

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### COURSES IN SCIENCE

#### **SCIE 301: Science Methods 1 (3)**

Introduction to science education, with a focus on physical science. Course will focus on concepts of physics and chemistry needed to understand objects encountered in everyday life. Topics include the laws of motion, thermodynamics, waves, electricity, magnetism, selected material from modern physics, and the basics of chemical bonding. (*SCIE 301 will not satisfy the general education requirement nor count toward a major or minor within the Department of Natural Science.*)

#### **SCIE 302: Science Methods 2 (3)**

Introduction to science education, with a focus on earth and life sciences. The course will examine our natural world and its place in the solar system. Topics covered will include the solar system, oceanography, geology and a study of the earth's life forms and its various environments. (*SCIE 302 will not satisfy the general education requirement nor count toward a major or minor within the Department of Natural Science.*)