
SCHOOL OF SCIENCES

School Dean: Dr. J. Clancy Leahy

Sciences Resource Manager: Ms. Justis

Biology Program Faculty: Dr. Benson, Dr. Cowden, Dr. Freier, Dr. Houghton, Dr. Jablonski, Dr. Leahy, Ms. Olah, Dr. Schupp

Biomedical Sciences Faculty: Dr. Freier, Dr. Jablonski, Dr. Leahy, Dr. Reeve

Chemistry Program Faculty: Dr. Gannicott, Dr. Payne, Dr. Reeve, Dr. Sumerlin

Claytor Nature Study Center: Dr. Corney, Director

Computer Science Program Faculty: Dr. Briggs, Dr. Lobb, Mr. Purdy, Dr. Ribler, Dr. Roussos

Environmental Science Program Faculty: Dr. Gannicott, Dr. Houghton, Dr. Perault, Dr. Pike, Dr. Shahady

Mathematics Program Faculty: Ms. Bruno, Dr. Coco, Dr. Hatfield, Dr. Lobb, Dr. Peterson, Ms. Smotrel

Physics and Engineering Faculty: Dr. Goff, Dr. Sigler

Psychology Program Faculty: Dr. Baird, Dr. Corodimas, Dr. Dreznick, Dr. Jackson, Dr. Pittas, Dr. Southall, Dr. Werner

The School of Sciences provides curricular and co-curricular activities for students interested in graduate study and careers in the physical and life sciences, mathematics, and computer science. The School also prepares students for advanced study in a health science such as medicine, dentistry, or veterinary medicine. Through the Center for Environmental Education and activities at the College's Claytor Nature Study Center, students, faculty, and staff are involved in initiatives that have a positive impact on the quality of the environment of the College and the community.

APPLIED PHYSICAL SCIENCE MAJOR

The applied physical science major is designed to provide solid preparation for technical employment or for graduate study in certain interdisciplinary programs such as materials science or textile science. The major will not necessarily prepare students for graduate study in physics or chemistry; it will prepare prospective secondary teachers to teach physics and chemistry and will provide a suitable path for local students who want to complete a four-year technical degree but who cannot leave local employment to do so.

The mission of the program is to provide:

1. An introduction to the history, thought, and techniques, which distinguish physics as a discipline central to the sciences (through support of the College General Education Program);
2. Physics curricula which thoroughly ground participating students in the core competencies expected of physics graduates; and
3. Physics curricula that stress the ability to read, calculate, write, and speak effectively about specific physics topics.

Students completing the B.S. major in applied physical science will:

1. Demonstrate conceptual knowledge in the core physics and chemistry courses outlined below;
2. Demonstrate competence in the application of the methods, techniques, and equipment used in the physical and chemical laboratories;

3. Demonstrate knowledge of research methodology in the physical sciences, including the use of appropriate research literature;
4. Demonstrate competence to apply basic concepts to solve both physics and chemistry problems, including those which require mathematics through differential equations; and
5. Obtain information on a general or specialized topic within the physical science disciplines and communicate that information both orally and in writing.

			Hours
CHEM	103-104	Fundamentals of Chemistry	6
CHEM	105L-106L	Fundamentals of Chemistry Lab	2
CHEM	410-411	Physical Chemistry	6
CHEM	412L	Physical Chemistry Lab	2
CHEM or PHYS	300+	Electives	6
MATH	103-104	Calculus I-II	6
MATH	211	Calculus III	3
MATH	301	Differential Equations	3
PHYS	211	Physics III	4
PHYS	309	Classical Mechanics	4
PHYS	312	Electromagnetic Theory	4
PHYS	333	Computational Physics	4
One of the following sequences:			8
PHYS	141-142	College Physics	
PHYS	161-162	Physics I-II	
One of the following:			2
PHYS		Research Project or laboratory-based internship	
CHEM		Research Project or laboratory-based internship	—
<i>Total Hours Required</i>			<u>60</u>

BIOLOGY MAJOR

The science of biology is a process of inquiry, using experimentation and observation to gain understanding of living systems and their interactions with nature. The purpose of the biology major is to acquire knowledge of the basics in the discipline, and, through a modern curriculum, prepare students for careers in the biological sciences. The biology major provides broad preparation appropriate for health-related careers, professional or graduate schools, government or industry, or teacher preparation. The curriculum is designed to ensure that students learn about animals, plants, and microorganisms at the molecular, cellular, organismal, and population levels of analysis. Courses are taught in a variety of styles including lecture, small group collaboration, and hands-on approaches that often involve a range of resources, including computer software, the World Wide Web, and field experiences.

A strong emphasis is placed on developing critical thinking and sound scientific reasoning skills. As part of the student's capstone experience, he/she will work with a faculty member on an independent project, typically a collaborative research project or an internship. Student interns gain practical work-related experience through affiliations with local laboratories, hospitals, physical therapy and veterinary clinics, industries, and government agencies responsible for natural resources.

It is strongly recommended that the student select MATH 103 (Calculus I) as the General Education math requirement. Most health-related careers require additional courses as prerequisites. Each student will need to meet with his/her advisor on a regular basis to ensure that the appropriate courses are being selected.

Biology courses required:		Hours
BIOL 111-111L	Organisms, Ecology, Evolution and Lab	4
BIOL 112-112L	Cells: Genetic and Molecular Perspectives and Lab	4
BIOL 205	Plant Biology	4
BIOL 321	General Ecology	4
BIOL 323	Genetics	4
BIOL 430	Molecular Cell Biology	4
BIOL 480	Case Studies in Biology	3
BIOL 490	Biology Seminar	1
One of the following:		3
BIOL 240	Introduction to Biological Research	
BIOL 399	Internship in Biology	
BIOL 440	Individual Research	
Allied science and math courses required:		
CHEM 103-104	Fundamentals of Chemistry	6
CHEM 105L-106L	Fundamentals of Chemistry Lab	2
CHEM 251-253L	Organic Chemistry I and Lab	4
MATH 222	Introductory Statistics	3
Fourteen hours (four hours maximum ENVS) from:		14
BIOL 210	Animal Biology	
BIOL 233	Tropical Biology	
BIOL 300+	300-level biology courses not selected above	
BIOM 300+	300-level biomedical sciences courses except BIOM 301	
CHEM 252-254L*	Organic Chemistry II and Lab	
CHEM 320	Introductory Biochemistry	
ENVS 300-Level	Environmental Science Courses except 399 and 440	

Total hours required

60

* (CHEM 252-254L is also required for most graduate/professional-level programs.)

BIOMEDICAL SCIENCE MAJOR

Biomedical science is an interdisciplinary program that includes courses in biology, chemistry, and physics. The core courses provide a foundation in each of the sciences, allowing students to develop broad-based knowledge and skills from classroom and laboratory experiences. These courses may serve as prerequisites for admission to professional schools in the health area (medical, dental, veterinary, physical therapy, optometry, chiropractic, physician assistant, pharmacy, etc.). With appropriately chosen electives, this program will also prepare students for graduate study in a variety of fields, including genetics and molecular biology, or employment in the rapidly growing biotechnology industry.

A broad-based technical background, such as that offered by the biomedical science major, coupled with a business minor or an M.B.A. will provide students with an attractive background for employment in the administrative division of many health-related industries.

Since admission to graduate and professional programs in the health sciences is highly competitive, students will work closely with their academic advisors to ensure that all admission prerequisites are met and courses are properly sequenced. Biomedical science majors are required to conduct a research project as a capstone experience, and they must maintain excellent academic standing. To be eligible to continue in the biomedical science major beyond the sophomore year, students must have completed nineteen hours in the core (four lab science courses and MATH 103) with a 3.0 average in the core courses and a 2.75 overall QPA. Submission of a formal application for progression to the junior year of the major is also required. The application form may be obtained from the biomedical science program coordinator. Pre-physical therapy students are strongly encouraged to choose BIOL 332 and 333 as electives and to seek a minor in sports medicine.

Biomedical science courses required:		Hours
BIOL	111-111L Organisms, Ecology, and Evolution	4
BIOL	112-112L Cells: Genetics and Molecular Perspectives	4
BIOM	301 Biomedical Science Seminar	1
CHEM	103-104 Fundamentals of Chemistry	8
CHEM	105L-106L Fundamentals of Chemistry Lab	
CHEM	251-252 Organic Chemistry	8
CHEM	253L-254L Organic Chemistry Lab	
MATH	103 Calculus I	3
PHYS	161-162 Physics I & II	8
or	141-142 College Physics	8
Capstone course:		
BIOM	421 Research Project	3
Sixteen hours from:		16
BIOL	323 Genetics	
BIOL	332 Vertebrate Anatomy	
BIOL	333 Vertebrate Physiology	
BIOL	345 Animal Behavior	
BIOL	356 Neurobiology	

BIOL	424	Microbiology	
BIOL	430	Molecular Cell Biology	
BIOM	354	Immunology	
BIOM	380	Special Topics in Biomedical Science	
CHEM	320	Biochemistry	
HP	270	Nutrition	
MATH	222	Statistics	
PSYC	241 or 308	Developmental Psychology or Abnormal Psychology	
PHIL	317	Ethical Issues in Medicine	
BIOM	399	Internship in a Health Profession	
PSYC	315	Drugs and Behavior	
		<i>Total hours required</i>	<u>55</u>

CHEMISTRY MAJOR

The Chemistry Program offers two degree options. The B.A. is primarily designed for students intending to work in chemical laboratories following graduation, for students planning to teach who need an endorsement in chemistry, and for pre-professional (pre-medical, pre-dental, pre-veterinary, pre-pharmacy) students. The B.S. is a more rigorous course of study designed for students wishing to continue their study of chemistry at the graduate level.

Students who intend to major in chemistry and students who intend to prepare for medical, dental, veterinary, or pharmacy school are urged to *select Fundamentals of Chemistry* in their first year.

The courses listed with a hyphen are two-semester courses; they are not counted toward the major unless both semesters are completed. Satisfactory completion of the first semester of a two-semester course is a prerequisite for admission into the second semester. Both class and lab for sequences 103 and 105L, 104 and 106L, 251 and 253L, 252 and 254L must be taken or dropped simultaneously. The only exception made is for a student who previously passed one of them and is repeating the other.

CHEMISTRY MAJOR – Bachelor of Sciences

		Hours	
CHEM	103-104	Fundamentals of Chemistry	6
CHEM	105L-106L	Fundamentals of Chemistry Lab	2
CHEM	201	Analytical Chemistry I	5
CHEM	251-252	Organic Chemistry	6
CHEM	253L-254L	Organic Chemistry Lab	2
CHEM	360	Analytical Chemistry II	5
CHEM		Another chemistry course numbered 200 or above	3
CHEM	410-411	Physical Chemistry	6
CHEM	412L	Physical Chemistry Lab	2
CHEM	441	Chemistry Seminar	3
CHEM	442	Chemical Research	3
MATH	103-104	Calculus I-II	6
MATH	211	Calculus III	3
PHYS	161-162	Physics I & II	<u>8</u>
		<i>Total Hours Required</i>	60

CHEMISTRY MAJOR – Bachelor of Arts

CHEM	103-104	Fundamentals of Chemistry	6
CHEM	105L-106L	Fundamentals of Chemistry Lab	2
CHEM	201	Analytical Chemistry I	5
CHEM	251-252	Organic Chemistry	6

CHEM	253L-254L	Organic Chemistry Lab	2
CHEM	360	Analytical Chemistry II	5
CHEM		Another chemistry course numbered 200 or above	3
CHEM	441	Chemistry Seminar	3
MATH	103	Calculus I	3
PHYS	161-162	Physics I & II	<u>8</u>
		<i>Total Hours Required</i>	43

COMPUTER SCIENCE MAJOR

The computer science curriculum is designed to provide students with the broad range of core competencies required of all computer professionals, as well as the opportunity to acquire an understanding of selected advanced topics in computer science.

C S	141-142	Introduction to Computer Science and Structured Programming	8
C S	241-242	Data Structures and Abstraction	8
C S	271	Assembly Language and Architecture	4
C S	322	Programming Languages	3
C S	360	Operating Systems	3
MATH	231	Mathematics of Computer Science	3
C S		Courses numbered 300 and above	12
C S	451,452	Senior Project	<u>4</u>
		<i>Total Hours Required</i>	45

Recommended electives:

Students interested in pursuing careers as information system managers for businesses should take C S 370, *Database Management*, and C S 335, *Computer Networks*, as well as C S electives tailored to their individual interests. A minor in business is strongly recommended. At a minimum, business courses should include ACCT 201-202, *Principles of Accounting*, and MGMT 260, *Principles of Management*.

Students considering graduate study and/or careers as system developers should also take *Principles of Digital Systems, Algorithms*, and other C S electives tailored to their individual interests. They are strongly encouraged to minor in mathematics. Courses in mathematics should include calculus, differential equations, linear algebra, and probability. PHYS 161-162, *Physics I & II*, is also strongly recommended.

ENGINEERING PROGRAM

DUAL-DEGREE PROGRAM WITH OLD DOMINION UNIVERSITY

Under special agreement with Old Dominion University (ODU), a student may earn a B.S. from Lynchburg College and a degree in engineering from ODU in a total of five years. Dual-degree candidates enroll at Lynchburg College for the first three years and transfer to the School of Engineering at ODU for approximately two years.

Students must complete prescribed courses, including General Education requirements, with an average grade of B or higher during the first three years at Lynchburg College, before they can transfer to ODU.

Upon completing specified courses and meeting total hour requirements, the student is awarded the bachelor of science degree from Lynchburg College, usually at the end of the fourth year. At the conclusion of the fifth year, or when all requirements for a degree in engineering have been fulfilled, the appropriate degree

is awarded from ODU: bachelor of science in civil, electrical, or mechanical engineering.

DUAL-DEGREE PROGRAM WITH THE UNIVERSITY OF VIRGINIA

Under special arrangement with the University of Virginia (UVA), a student may also earn a B.S. from Lynchburg College and a master of engineering degree from UVA in five years. Dual-degree candidates enroll at Lynchburg College for the first three years and transfer as conditionally-admitted graduate students to the School of Engineering and Applied Science at UVA for the final two years.

After completing the first three years, including all General Education requirements, with an overall quality point average of 3.3 or higher, the student transfers to UVA. Upon completion of specified courses and the total hour requirement, the student is awarded the B.S. from Lynchburg College, usually at the end of the fourth year. At the conclusion of the fifth year, when all requirements have been met, the student earns a master of engineering in either nuclear engineering or engineering physics. With some additional study, the student may earn a master of science degree in either field. See the dean of the School of Sciences for more detailed information on this program.

Prescribed courses to be taken at Lynchburg College include the following:

	Hours
CHEM 103-104 Fundamentals of Chemistry	6
CHEM 105L-106L Fundamentals of Chemistry Laboratory	2
MATH 103-104 Calculus I and II	6
MATH 211 Calculus III	3
MATH 301 Differential Equations	3
MATH 307 Linear Algebra	3
PHYS 161-162 Physics I & II	8
PHYS 211 Physics III	4
PHYS 312 Electromagnetic Theory	<u>4</u>
<i>Total hours required</i>	39

Courses in drawing, engineering graphics, and mechanics are recommended.

ENVIRONMENTAL SCIENCE MAJOR

Environmental science has emerged in recent years as an interdisciplinary field, bringing together a variety of traditional disciplines that focus on an understanding of our environment and the elements which influence it. A distinctive feature of the major at Lynchburg College is that most of the diverse elements of the discipline are presented in an environmental context and are taught within the program rather than as a collection of unrelated courses scattered throughout other programs, as is the case in many university curricula. The curriculum is designed help the student develop an awareness of the physical and biological factors at work in the environment and ways in which cultural and political forces impinge on the quality of the environment. Additionally, the student is required to engage in a research project that integrates training into an analysis of an environmental problem.

Sites for study in Central Virginia include diverse natural resources in the area such as streams, national forests, and a lake adjacent to the campus. Students also utilize industrial and farming enterprises and government facilities to study problems related to natural resource use and modification. Special resources include GIS and remote sensing software, a digitizer, an online weather station, and a wide variety of environmental sampling equipment. Of particular importance is the Claytor Nature Study Center 470-acre tract in nearby Bedford County, which provides students unique opportunities to observe and work at lakes, ponds, wetlands, and many other areas including more than a mile of the Big Otter River.

Recent graduates have found employment with government agencies, commercial environmental laboratories, and environmental consulting firms. Many graduates have started their own businesses, while others have continued their training in graduate school.

It is strongly recommended that MATH 103 (*Calculus I*) be selected for the General Education math requirement. In addition to the courses listed below, it is strongly recommended that the student also choose courses in economics and political science. Consult the advisor for the current appropriate courses to select.

		Hours
Courses Required for the Major:		
BIOL 321	Ecology	4
CHEM 103/105L	Fundamentals of Chemistry and Lab	4
ENVS 101/101L	Earth and Environmental Science I and Lab	4
ENVS 102/102L	Earth and Environmental Science II and Lab	4
ENVS 380	Geographic Information Systems (GIS)	4
ENVS 490	Environmental Sciences Seminar	1
MATH 103	Calculus I	3
MATH 222	Introductory Statistics	3
And one of the following:		4
CHEM 104/106L	Fundamentals of Chemistry and Lab	
CHEM 206	Environmental Chemistry	
And one of the following:		3
ENVS 240	Introduction to Environmental Research	
ENVS 399	Internship in Environmental Science	
ENVS 440	Environmental Research	
And 16 hours of the following:		16
ENVS 320	Conservation Biology	
ENVS 325	Landscape Ecology	
ENVS 331	Hydrology	
ENVS 333	Physical Oceanography	
ENVS 336	Physical Geology	
ENVS 337	Historical Geology	
ENVS 340	Remote Sensing	
ENVS 345	Meteorology	
ENVS 350	Environmental Law and Policy	
ENVS 355	Environmental Impact Assessment	
ENVS 375	Freshwater Ecology	
Electives Available for the Major:		10
BIOL 205	Plant Biology	
BIOL 210	Animal Biology	
BIOL	Any 300+ Biology Courses (excluding 399 and 440)	
CHEM 206	Environmental Chemistry (if CHEM 104/106L is taken)	
CHEM 251/253L	Organic Chemistry and Lab	
ENVS	Any additional 300+ Environmental Science Courses	
PHYS 141 or 161	College Physics or Physics I	
<i>Total Hours Required</i>		<u>60</u>

MATHEMATICS MAJOR

The Mathematics Program seeks to support the College mission by maintaining a strong commitment to the importance of the liberal arts. Since four of the seven original liberal arts (arithmetic, geometry, astronomy, and logic) were mathematical in nature, mathematics has always played an important role in the study of the liberal arts. When properly presented, a mathematics course encompasses the principles of a liberal arts education using logic, numerical concepts, algebraic and geometric principles, mathematical modeling, and sequential development.

Courses in mathematics are offered for the non-major as well as for the student who plans to major in mathematics. The curriculum is designed to serve the interests and needs of several groups of students, particularly:

1. Those who seek a major in mathematics as background for graduate school or employment (bachelor of science or bachelor of arts degree);
2. Those who intend to apply mathematics in other disciplines such as the physical sciences, the life sciences, or business and industry;
3. Prospective teachers of mathematics at the elementary or secondary school levels;
4. Those who seek fulfillment of a degree requirement;
5. Those who seek fulfillment of a teaching certificate requirement; and
6. Those who enjoy the stimulation and satisfaction derived from the study of mathematics.

Freshmen who have an interest in mathematics as a major usually take MATH 103-104; however, appropriate advanced placement is possible.

A mathematics major requires:			Hours
C S	131	Fundamentals of Programming in Basic	3
MATH	103-104	Calculus I and II	6
MATH	211	Calculus III	3
MATH	260	Mathematical Reasoning and Proof	3
MATH	301	Differential Equations	3
MATH	307	Linear Algebra	3
MATH	405	Abstract Algebra	3
MATH	407	Advanced Calculus	3
MATH	451	Senior Project Course	3
MATH		Other courses numbered 300 or above	<u>9</u>
		<i>Total Hours Required</i>	39

PSYCHOLOGY MAJOR

Studies in the liberal arts provide the context in which psychology programs are conducted. The following are guiding principles for programs in psychology:

1. To provide the student with a well-rounded foundation based upon a theoretical and conceptual understanding of psychology as a science;
2. To introduce the student to the various research methodologies and techniques used within the discipline to gain an understanding of behavior;
3. To prepare the student for further graduate study in psychology and related disciplines;
4. To prepare the student for careers in psychology and related areas.

To meet these educational goals the major must include the following:

PSYC 103-104	General Psychology	6
PSYC 105L-106L	General Psychology Lab	2
PSYC 274	Statistics for Psychologists	4
PSYC 275	Research Methodology	4
One of the following:		4
PSYC 311	Sensory Processes and Perception	
PSYC 355	Physiological Psychology	
One of the following:		4
PSYC 305	Human Memory and Information Processing	
PSYC 312	Learning and Motivation	
Two of the following:		6
PSYC 308	Abnormal Behavior	
PSYC 212	Behavior Modification	
PSYC 392	Tests and Measurements	
Two of the following:		6
PSYC 302	Social Psychology	
PSYC 306	Theories and Personality	
PSYC 401	History and Systems	
	<i>Total Hours Required</i>	<u>36</u>

Students are encouraged to take other electives available in the program to best meet individual goals. Students wishing to pursue doctoral studies in psychology are encouraged to consider one or more of the following: (1) PSYC 399 *Internship*, (2) PSYC 370 *Independent Study*, or (3) *Honors in Psychology*.

BIOLOGY MINOR

A minor in biology requires:		Hours
BIOL 111-111L	Organisms, Ecology, Evolution and Lab	4
BIOL 112-112L	Cells: Genetic and Molecular Perspectives and Lab	4
Ten hours chosen from:		10
BIOL	courses excluding BIOL 240, 399, 440, 480, 490	—
	<i>Total Hours Required</i>	<u>18</u>

The student must work closely with an advisor in the program to select courses appropriate for his/ her goals and interests.

CHEMISTRY MINOR

A minor in chemistry requires:		Hours
CHEM 103-104	Fundamentals of Chemistry	4
CHEM 105L-106L	Fundamentals of Chemistry Laboratory	2
Twelve hours chosen from:		12
CHEM	courses excluding CHEM 127, 200, 399, 441, 442	—
		<u>18</u>

COMPUTER SCIENCE MINOR

A minor in computer science requires:		Hours
C S	141-142 Introduction to Computer Science and Structured	

	Programming	8
C S	200 and above (excluding C S 399)	<u>9</u>
	<i>Total Hours Required</i>	17

COMPUTER SCIENCE APPLICATIONS MINOR

A minor in computer science application requires:		Hours
C S	131 Fundamentals of Programming in Basic	3
C S	220 Business Computer Programming and File Systems	4
C S	200 and above (excluding C S 399)	<u>10</u>
	<i>Total Hours Required</i>	17

ENVIRONMENTAL SCIENCE MINOR

For a minor in environmental science, a minimum of eighteen semester hours from ENVS courses (which must include ENVS 101/101L-102/102L) is required. The student should work closely with a program advisor to select courses appropriate for his/her goals and interests. Course selections are open with the exceptions of ENVS 240, 399, and 440.

MATHEMATICS MINOR

The minor in mathematics requires:		Hours
MATH	103-104 Calculus I and II	6
MATH	211 Calculus III	3
MATH	307 Linear Algebra	3
MATH	Other courses numbered 300 or above	<u>6</u>
	<i>Total Hours Required</i>	18

PSYCHOLOGY MINOR

The minor in psychology requires:		
PSYC	103-104 General Psychology	6
PSYC	105L-106L General Psychology Laboratory	2
PSYC	275-275L Research Methodology and Lab	4
PSYC	Other Courses Numbered 200 and above	<u>6</u>
	<i>Total Hours Required</i>	18

The prerequisite for PSYC 275 does not count in the minor total. The prerequisite for PSYC 275 is PSYC 274, MATH 222, SOCI 370, or BUAD 241.