

FORENSIC SCIENCE, BACHELOR OF SCIENCE (B.S.) WITH A CONCENTRATION IN FORENSIC CHEMISTRY

The forensic chemistry concentration requires an additional 27-28 credits in chemistry, calculus, forensic science and elective credits beyond the core requirements and is well-suited for students interested in graduate study or careers in the chemical analysis of forensic evidence, including the areas of drug analysis, toxicology and trace evidence analysis. Students also will be prepared for work in private analytical laboratories. Students completing the forensic chemistry concentration will be eligible for a minor in chemistry.

Student learning outcomes

Upon completing this program, students will know and know how to do the following:

- Demonstrate a basic understanding of the laws of criminal procedure and rules of evidence
- Demonstrate proper crime scene investigation and reconstruction
- Demonstrate ethical and professional duties and responsibilities of the forensic scientist
- Be able to apply basic principles and laboratory procedures of chemistry to forensic science
- Demonstrate capabilities, use and limitations of forensic laboratory techniques

Special requirements

The forensic science program requires a minimum of 120 credits including completion of the general education requirements (see more information below), 34 forensic science core program credits and 27-28 concentration-specific credits.

All of the general education foundation courses will be automatically fulfilled through this degree by taking the following required courses: UNIV 111, UNIV 112, UNIV 200 and MATH 200 (13 credits).

Students will need to take a total of 17 credits from areas of inquiry (including nine credits from breadth of knowledge). Some of these general education areas of inquiry and breadth of knowledge requirements will also be automatically fulfilled through this degree by taking the following required courses: CHEM 101 and CHEZ 101 (four credits) both satisfy breadth of knowledge for natural sciences and area of inquiry for scientific and logical reasoning; and either PHYS 201 or 207 (four to five credits) satisfies area of inquiry for scientific and logical reasoning.

In addition to these required courses, students will need to select at least three additional general education courses from the remaining areas of inquiry. Three credits are required from each of the following areas of inquiry (nine credits total): diversities in the human experience; creativity, innovation and aesthetic inquiry; and global perspectives. Two of the selected general education courses should also fulfill the breadth of knowledge requirement from the areas of humanities/fine arts and social/behavioral sciences.

Degree requirements for Forensic Science, Bachelor of Science (B.S.) with a forensic chemistry concentration

Course	Title	Hours
General education (http://bulletin.vcu.edu/undergraduate/undergraduate-study/general-education-curriculum/)		
Select 12-13 credits from general education foundations and 17-18 credits from areas of inquiry.		30
Major requirements		
• Major core requirements ¹		
BIOL 152 & BIOZ 152	Introduction to Biological Sciences II and Introduction to Biological Science Laboratory II	4
BIOZ 151	Introduction to Biological Science Laboratory I	1
CHEM 102 & CHEZ 102	General Chemistry II and General Chemistry Laboratory II	4
CHEM 301 & CHEZ 301	Organic Chemistry and Organic Chemistry Laboratory I	5
CHEM 302 & CHEZ 302	Organic Chemistry and Organic Chemistry Laboratory II	5
FRSC 300	Survey of Forensic Science	3
FRSC 309	Scientific Crime Scene Investigation	3
FRSC 365	Forensic Microscopy	3
FRSC 375	Forensic Evidence, Law and Criminal Procedure	3
FRSC 490	Professional Practices in Forensic Science	3
• Additional major requirements ¹		
FRSC electives (any 300-500 level course)		6
PHYS 202 or PHYS 208	General Physics II or University Physics II	4-5
• Concentration requirements ¹		
CHEM 309 & CHEZ 309	Quantitative Analysis and Quantitative Analysis Laboratory	5
CHEM 313 or CHEM 314	Physical Chemistry I ² or Physical Chemistry I with Math Modules	3-4
CHEM 409 & CHEZ 409	Instrumental Analysis and Instrumental Analysis Laboratory	5
CHEZ 313	Physical Chemistry Laboratory I	2
FRSC 400	Forensic Chemistry	4
FRSC 445	Forensic Toxicology and Drugs	4
MATH 201	Calculus with Analytic Geometry II	4
Ancillary requirements		
BIOL 151	Introduction to Biological Sciences I ¹	3
CHEM 101 & CHEZ 101	General Chemistry I and General Chemistry Laboratory I (both satisfy general education BOK for natural sciences and AOI for scientific and logical reasoning) ¹	4
HUMS 202	Choices in a Consumer Society	1
MATH 200	Calculus with Analytic Geometry I (satisfies general education quantitative foundations) ¹	4

PHYS 201	General Physics I (either satisfies general education BOK for natural sciences and AOI for scientific and logical reasoning) ¹	4-5
or PHYS 207	University Physics I	
STAT 210	Basic Practice of Statistics	3
Experiential fine arts ³		1-3
Foreign language through the 102 level (by course or placement)		0-6
Open electives		
Select any course.		0-11
Total Hours		120

1

Students must receive a minimum grade of C in these courses. If a course is a prerequisite for another course, a minimum grade of C must be obtained in the prerequisite course before proceeding to the subsequent course.

2

Students may take CHEM 313 if they have completed MATH 307 with a minimum grade of C.

3

Course offered by the School of the Arts

The minimum number of credit hours required for this degree is 120.

What follows is a sample plan that meets the prescribed requirements within a four-year course of study at VCU. Please contact your adviser before beginning course work toward a degree.

Note: This plan of study assumes that the student:

- Scored well enough on the VCU Mathematics Placement Test to place into MATH 200 or that the student has completed MATH 151 with a minimum grade of C (a pre- or corequisite for BIOL 151, BIOZ 151 and CHEM 101; a prerequisite for CHEM 102).
- Scored well enough on the chemistry placement exam/assessment or has successfully completed CHEM 100 with a minimum grade of B (a prerequisite for CHEM 101).

Freshman year

Fall semester		Hours
BIOL 151 & BIOZ 151	Introduction to Biological Sciences I ¹ and Introduction to Biological Science Laboratory I ¹	4
CHEM 101 & CHEZ 101	General Chemistry I ^{1,2} and General Chemistry Laboratory I (both satisfy general education BOK for natural sciences and AOI for scientific and logical reasoning) ^{1,2}	4
MATH 200	Calculus with Analytic Geometry I (satisfies general education quantitative foundations) ²	4

UNIV 111	Focused Inquiry I (satisfies general education UNIV foundations) ¹	3
Play course video for Focused Inquiry I		

Term Hours: 15

Spring semester

BIOL 152 & BIOZ 152	Introduction to Biological Sciences II and Introduction to Biological Science Laboratory II	4
CHEM 102 & CHEZ 102	General Chemistry II ^{1,2} and General Chemistry Laboratory II ^{1,2}	4
HUMS 202	Choices in a Consumer Society	1
MATH 201	Calculus with Analytic Geometry II ²	4
UNIV 112	Focused Inquiry II (satisfies general education UNIV foundations) ¹	3
Play course video for Focused Inquiry II		

Term Hours: 16

Sophomore year

Fall semester

CHEM 301 & CHEZ 301	Organic Chemistry ^{1,2} and Organic Chemistry Laboratory I ^{1,2}	5
CHEM 309 & CHEZ 309	Quantitative Analysis ² and Quantitative Analysis Laboratory ²	5
PHYS 201 or PHYS 207	General Physics I (either satisfies general education AOI for scientific and logical reasoning) ² or University Physics I ²	4-5
UNIV 200	Inquiry and the Craft of Argument (satisfies general education UNIV foundations) ¹	3

Term Hours: 17-18

Spring semester

CHEM 302 & CHEZ 302	Organic Chemistry ² and Organic Chemistry Laboratory II ²	5
FRSC 300	Survey of Forensic Science	3
PHYS 202 or PHYS 208	General Physics II ² or University Physics II ²	4-5
STAT 210	Basic Practice of Statistics	3

Term Hours: 15-16

Junior year

Fall semester

CHEM 313 or CHEM 314	Physical Chemistry I ² or Physical Chemistry I with Math Modules ²	3-4
CHEZ 313	Physical Chemistry Laboratory I ²	2
FRSC 375	Forensic Evidence, Law and Criminal Procedure	3
Foreign language 101 (or open elective)		3
FRSC elective		3

Term Hours: 14-15

Spring semester

CHEM 409 & CHEZ 409	Instrumental Analysis and Instrumental Analysis Laboratory	5
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FRSC 365	Forensic Microscopy	3
Foreign language 102 (or open elective)		3
General education course ³		3
Term Hours:		14
Senior year		
Fall semester		
FRSC 309	Scientific Crime Scene Investigation	3
FRSC 445	Forensic Toxicology and Drugs	4
FRSC 490	Professional Practices in Forensic Science	3
Experiential fine arts		1-3
FRSC elective		3
Term Hours:		14-16
Spring semester		
FRSC 400	Forensic Chemistry	4
General education course ³		3
General education course ³		3
Open electives		5
Term Hours:		15
Total Hours:		120-125

1

There is little, if any, flexibility regarding when to take these courses in order to enroll in FRSC 300 during spring semester of sophomore year.

2

There is little, if any, flexibility regarding when to take these courses in order to enroll in CHEM 409 and CHEZ 409 during spring semester of junior year. CHEM 409 and CHEZ 409 are required prerequisites for FRSC 400.

3

At least three additional general education courses are required. Three credits are required from the areas of inquiry for diversities in the human experience; creativity, innovation and aesthetic inquiry; and global perspectives. Two of the selected general education courses should also fulfill the breadth of knowledge requirement from the areas of humanities/fine arts and social/behavioral sciences.

The minimum number of credit hours required for this degree is 120.

FRSC 202. Crime and Science. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Introduces the scientific theory, concepts and practices used in any physical science by relating them to the analysis of physical evidence performed in forensic laboratories and the fundamentals of crime scene investigation, and their relationship to the criminal justice system and criminal investigations. Not applicable for credit toward the B.S. in Forensic Science.

FRSC 291. Topics in Forensic Science. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. May be repeated with different topics for a maximum of six credits. A study of selected topics in forensic science. See the Schedule of Classes for specific topics to be offered each semester and prerequisites.

FRSC 300. Survey of Forensic Science. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 151, BIOZ 151, CHEM 102, CHEZ 102 and UNIV 112, each with a minimum grade of C. Pre- or corequisites: CHEM 301 and CHEZ 301, and UNIV 200 or HONR 200. Enrollment is restricted to forensic science majors or by permission of instructor. Introduces the theory, concepts and practices used in the analysis of physical evidence performed in crime laboratories, and the fundamentals of crime scene investigation. Also introduces ethical and quality assurance issues of crucial importance in modern crime laboratories.

FRSC 309. Scientific Crime Scene Investigation. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisites: CHEM 301 and FRSC 300, each with a minimum grade of C. Enrollment is restricted to forensic science majors or by permission of the instructor. Provides scientific theory of crime scene investigation and crime scene reconstruction and basic knowledge of proper crime scene protocol and evidence processing techniques. Includes the processes for documentation, collecting and preserving physical evidence.

FRSC 310. Forensic Anthropology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: ANTH 210 or FRSC 300 with a minimum grade of C. A comprehensive overview of forensic anthropology including its development and the theory and methodology on which it is based. Crosslisted as: ANTH 310.

FRSC 325. Forensic Medicine. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: FRSC 300, CHEM 301 and CHEZ 301, each with a minimum grade of C. Enrollment restricted to forensic science majors or by permission of instructor. An investigation of topics in death scene investigations as well as autopsy findings associated with natural and unnatural deaths.

FRSC 351. Forensic Science Service-learning. 2 Hours.

Semester course; 2 lecture hours. 2 credits. May be repeated for a maximum of 4 credits. Prerequisites: FRSC 300 and at least one additional FRSC/Z course, each with a minimum grade of C. Enrollment restricted to forensic science majors or by permission of instructor. Provides an opportunity to learn about the community's schools and how to teach forensic science concepts to school-aged students. Each week, VCU students will provide hands-on lab activities in community-based programs to reinforce lessons learned through their school curricula. Reflective writing, partner assignments and a final presentation are required, in addition to 20 community partner hours. VCU students will improve their ability to explain forensic concepts to those with differing scientific backgrounds, have increased confidence when addressing audiences and deepen their understanding of civic responsibility.

FRSC 365. Forensic Microscopy. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisites: CHEM 301 and FRSC 300, each with a minimum grade of C. An in-depth course in the theory and practical application of microscopy to the examination, identification and individualization of physical evidence submitted to forensic laboratories.

FRSC 375. Forensic Evidence, Law and Criminal Procedure. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Pre- or co-requisites: FRSC 300 or FRSC 350. Open only to forensic science majors or by permission of instructor. The law of criminal procedure and rules of evidence as applied to forensic science. Topics will include scientific versus legal burdens of proof, legal terminology and trial procedure.

FRSC 385. Forensic Serology. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits.
Prerequisites: CHEM 301 and either FRSC 300 or FRSC 350, each with a minimum grade of C. Examines the application of basic chemical, biological, immunological and microscopic laboratory techniques to the examination and identification of body-fluid stains, including both presumptive and/or confirmatory identification of blood, semen, saliva, urine and feces. Applies methods that are used in forensic laboratories to identify the species of origin and includes a review of advanced methods for automated serological analysis. Laboratory exercises will supplement lectures to give students practical knowledge of the laboratory procedures.

FRSC 391. Topics in Forensic Science. 1-3 Hours.

Semester course; 1-3 lecture hours. 1-3 credits. Maximum total of 6 credits for all forensic science topics courses may be applied to the major. Prerequisites: CHEM 301 and either FRSC 300 or FRSC 350, each with a minimum grade of C. A study in selected topics in forensic science. See the Schedule of Classes for specific topics to be offered each semester and additional prerequisites.

FRSC 400. Forensic Chemistry. 4 Hours.

Semester course; 2 lecture and 4 laboratory hours. 4 credits.
Prerequisites: CHEM 409 and CHEZ 409, each with a minimum grade of C. Examines core principles and instrumentation used in forensic chemistry applications to include microchemical tests, gas chromatography, liquid chromatography, spectroscopy and mass spectrometry, with emphasis on forensic casework. These topics may include accelerants, explosives, paints, polymers and drug analysis. Students will gain experience in experimental design, operation and troubleshooting of instrumentation, as well as the analysis and interpretation of chromatographic and spectroscopic data sets.

FRSC 410. Forensic Pattern Evidence. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: FRSC 309 with a minimum grade of C. Enrollment is restricted to forensic science majors or by permission of the instructor. Covers topics in pattern evidence analysis including analysis of latent prints and impression evidence of footwear and tire treadmarks as applied to forensic casework. Covers both the theoretical and practical aspects using lectures and laboratory exercises focusing on the visualization, examination and interpretation of pattern evidence.

FRSC 412. Forensic Analysis of Firearms and Toolmarks. 3 Hours.

Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: FRSC 365 with a minimum grade of C. Enrollment is restricted to forensic science majors or by permission of the instructor. An investigation of topics in firearms and toolmark examination for forensic applications. Covers both theoretical and practical aspects using lectures and laboratory exercises.

FRSC 438. Forensic Molecular Biology. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOL 310 with a minimum grade of C. Provides an understanding of molecular biology testing methodologies as applied to analysis of forensic samples. Current topics in forensic DNA analysis will include quality assurance, DNA databanking, contemporary research and population genetics. Crosslisted as: BIOL 438.

FRSC 445. Forensic Toxicology and Drugs. 4 Hours.

Semester course; 2 lecture and 4 laboratory hours. 4 credits.
Prerequisites: CHEM 301, CHEM 302, CHEZ 301 and CHEZ 302, each with a minimum grade of C. Provides a comprehensive overview of the basic principles of drug analysis and forensic toxicology. Students will perform hands-on lab exercises in these areas. Students will learn to identify the controlled substances and toxic agents most commonly abused and/or encountered in criminal investigations, including issues of interpretation and impairment.

FRSC 490. Professional Practices in Forensic Science. 3 Hours.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CHEM 301; FRSC 300 or FRSC 350; and one additional forensic science course, each with a minimum grade of C. Enrollment restricted to seniors in forensic science with at least 85 credit hours toward the degree. An examination and evaluation of historical and current issues in the scientific analysis of physical evidence in criminal investigations. Individual and group activities relating to professional practices (ethics, quality control and testimony) of forensic scientists.

FRSC 492. Forensic Science Independent Study. 1-3 Hours.

Semester course; 1-3 independent study hours. 1-3 credits. May be repeated for a maximum of six credits. Prerequisites: CHEM 301 and FRSC 300, each with a minimum grade of C. Enrollment is restricted to forensic science majors with at least sophomore standing and a minimum GPA of 2.5. Independent studies must be research-based. A determination of the amount of credit and the written permission of both the instructor and the program director must be procured prior to registration for the course.

FRSC 493. Forensic Science Internship. 1-3 Hours.

Semester course; 1-3 field experience hours. 1-3 credits. Prerequisite: FRSC 300 with a minimum grade of C. Enrollment is restricted to forensic science majors with a minimum GPA of 2.75. An application is required in advance of admission with permission of the internship coordinator. Through placement in an approved organization, the student will obtain a broader, more practical knowledge of forensic science and its applications. Written progress and final reports are required. Graded as pass/fail.