

B.S. Chemical Engineering – Biotechnology Concentration

Fall Semester

Spring Semester

First Year

 APMA 1110 Single Variable Calculus II^(a)

CHEM 1410 General Chemistry I

CHEM 1411 General Chemistry I: Lab

ENGR 1010 Engineering Foundations I

HSS Elective

APMA 2120 Multivariable Calculus III

CHEM 1420 General Chemistry II

CHEM 1421 General Chemistry II: Lab

PHYS 1425 Gen. Physics I: Mechanics, Thermo.

PHYS 1429 Gen. Physics I: Workshop

CS 111X Intro. to Programming

ENGR 1020 Engineering Foundations II

Second Year

APMA 2130 Differential Equations

CHE 2215 Material & Energy Balances

CHE 2246 Intro. to Biotechnology

CHEM 2410 Organic Chemistry I

 Physics II & Laboratory^(b)

APMA 3110 Applied Probability & Statistics

CHE 2202 Thermodynamics

CHE 2216 Modeling & Simulation in ChE

CHEM 2420 Organic Chemistry II

STS 2600 Engineering Ethics

Third Year

CHE 3316 Chemical Thermo. & Staged Ops.

CHE 3321 Transport Processes I

 Physical Chemistry^(c)

CHEM 2411 Organic Chemistry Lab

HSS Elective

CHE 3318 Chemical Reaction Engineering

CHE 3322 Transport Processes II

CHE 3398 Chemical Engineering Lab I

CHE 3347 Biochemical Engineering

HSS Elective

Fourth Year

CHE 4474 Process Syn., Modeling & Control

CHE 4475 Intro. to Process Safety

CHE 4491 Chemical Engineering Lab II

CHE 4448 Bioseparation Engineering

STS 4500 STS & Engineering Practice

Unrestricted Elective

CHE 4476 Chemical Engineering Design

CHE 4456 Bioprocess & Bioproduct Engineering

STS 4600 STS & Engineering Practice

Unrestricted Elective

Unrestricted Elective

^(a) **Calculus:** Students starting with APMA1090 can succeed in chemical engineering and graduate on time. Please consult your academic advisor for guidance.

^(b) **Physics II & Laboratory:** Chosen from either ECE 2200 (4 credits) or both PHYS 2415 (3 credits, lecture) and PHYS 2419 (1 credit, laboratory)

^(c) **Physical Chemistry:** Chosen from CHE 4561 (Topic: Physical Chemistry for Engineers), CHEM 3410, or CHEM 3610

Note: The information contained in this document is for informational purposes only. The Undergraduate Record represents the official repository for academic program requirements: <http://records.ureg.virginia.edu/>

Pre- and co-requisites for CHE courses, chemistry courses, and minimum grade requirements

| Course | Pre-requisites | Co-requisites |
|----------|--|---|
| CHE 2202 | | APMA 2120 |
| CHE 2215 | CHEM 1410 or CHEM 1810; APMA 1110 | |
| CHE 2216 | CS 111X; CHE 2215 | APMA 2130 |
| CHE 2246 | CHEM 1410 or CHEM 1810 | |
| CHE 3316 | CHE 2202; CHE 2215 | |
| CHE 3318 | CHE 2216; CHE 3316 | CHE 3322 |
| CHE 3321 | APMA 2130; CHE 2215; CHE 2216 | |
| CHE 3322 | CHE 2216; CHE 3316; CHE 3321 | |
| CHE 3347 | CHE 2246 or BME 2315 or MAE 3420; CHE 3321 or MAE 3210 or BME 3240 or Instructor Permission | CHE 3318; CHE 3322 or MAE 3140 or BME 3240 |
| CHE 3398 | CHE 2215; CHE 3316; CHE 3321 | CHE 3322 |
| CHE 4417 | CHEM 1420 or CHEM 1810; APMA 2130; an introductory course in cell and molecular biology or Instructor Permission | |
| CHE 4442 | Instructor Permission | |
| CHE 4445 | CHE 3321 or MAE 3210 or BME 3240; CHE 3322 or MAE 3140 or BME 3240 | |
| CHE 4448 | CHE 3322 or BME 3240 or MAE 3140 or Instructor Permission | |
| CHE 4449 | | CHE 3321 or BME 3240 or MAE 3140 or Permission |
| CHE 4450 | CHE 2202 or MAE 2100 or MSE 3050; CHEM 1410 or CHEM 1810 | |
| CHE 4452 | CS 111X; APMA 2120; APMA 2130; APMA 3110; CHE 2216 or BME 2315 or MAE 3420 | |
| CHE 4456 | 4th year or higher CHE or BME standing or Instructor Permission | |
| CHE 4474 | CHE 3318; CHE 3322 | CHE 4475 |
| CHE 4475 | CHE 3318; CHE 3322 | CHE 4474 |
| CHE 4476 | CHE 2216; CHE 3318; CHE 3322; CHE 4474; CHE 4475 | |
| CHE 4491 | CHE 3318; CHE 3322; CHE 3398 | |

Minimum Grade Requirements for CHE Prerequisite Courses

A grade of C or CR is the standard required in core CHE courses that are prerequisites for other CHE courses. Students cannot have more than one passing grade of less than C or CR in core CHE prerequisite courses to enroll in any subsequent CHE courses. Students with more than one grade below C and/or CR in more than one core CHE prerequisite course (CHE 2202, 2215, 2216, 3316, 3318, 3321, 3322, 3398, 4474, and 4475) will have to retake the prerequisite(s) and receive a grade of CR or C or higher before taking any subsequent CHE courses. This policy applies to students pursuing either the B.S. degree or the minor in chemical engineering.

Chemistry Course Requirements

Note: The Department of Chemistry maintains their own minimum grade requirements: <https://chemistry.as.virginia.edu/policies>

- General Chemistry: ChE students take CHEM 1410 (3 hr), CHEM 1411 (1 hr), CHEM 1420 (3 hr), and CHEM 1421 (1 hr). Students with AP Chemistry credit still must take the CHEM 1411 and CHEM 1421 labs.
- Organic Chemistry: ChE students take CHEM 2410 (3 hr) and CHEM 2420 (3 hr) and the laboratory CHEM 2411 (3 hr). Note that CHEM 2411 can also be taken concurrently with CHEM 2410 during the third semester.
- 1800 Series Chemistry: Students taking the 1800 series chemistry course sequence satisfy all the chemical engineering general chemistry and organic chemistry requirements (listed above) by taking:
 - CHEM 1810 Principles of Chemical Structures (3 hr); CHEM 1811 Principles of Chemical Structures Lab (2 hr);
 - CHEM 1820 Principles of Organic Chemistry (3 hr); CHEM 1821 Principles of Org Chem Lab (3 hr);
 - CHEM 2810 Principles of Organic & Bioorganic Chemistry (3 hr); Selected CHEM course* (3 hr)

*Chosen from: CHEM 2820 (Principles of Chemical Thermodynamics and Kinetics), CHEM 4090 (Analytical Chemistry), CHEM 4320 (Inorganic Chemistry), CHEM 4440 (Biochemistry for Pre-Health), CHEM 4410 (Biological Chemistry I), or another CHEM 4xxx or 5xxx course with approval by the CHE Program

Please Note: The 1800 series chemistry sequence is an 'all or nothing' replacement of the 1400 series chemistry requirements. Students should complete the sequence they start and should not switch sequences during their program of study.

- Physical Chemistry: ChE students should take CHE 4561 (Topic: Physical Chemistry for Engineers) (3 hr). CHEM 3410 Physical Chemistry - Quantum Theory (3 hr), cross-listed as CHEM 3610, also satisfies this requirement.