



## CHEMISTRY AND PHYSICS

Associate Professor Todd Wimpfheimer, Chairperson

*Professors:* William E. Adams, Lorrie Comeford, Robert T. Wang, Richard T. Wester

*Assistant Professors:* Tracy Hodge, Christine MacTaylor, Ronald MacTaylor, Robert E. Rosenberg

*Laboratory Instructors:* Andrew Athens, Darcyll Dale

### Faculty Emeriti

*Professors:* Mary C. Cavallaro, Myles D. Glazer, Schuyler G. Slater, Joseph J. Szymanski, Edward Wall

*Assistant Professor:* Mildred Tamminen

### PROGRAMS OFFERED

- Bachelor of Arts – Chemistry**
- Bachelor of Science – Chemistry**

### Option

American Chemical Society (ACS) Approved

### Concentration

Biochemistry

### MAJORS

Chemistry  
Physics  
Secondary Education

### Programs in Chemistry

The Department of Chemistry and Physics offers the Bachelor of Arts and the Bachelor of Science degrees in Chemistry. The program provides graduates with a strong foundation in all branches of Chemistry including biochemistry, analytical, inorganic, organic and physical chemistry.

Chemistry majors are prepared to pursue careers and graduate study programs in areas such as chemistry, biochemistry, pharmaceuticals, the environment, education, medicine, dentistry and law. Chemistry majors may also pursue careers in chemical sales, marketing, business and computer applications. For these career goals, courses and minors in economics, business, management, computer science, or marketing would be appropriate.

### Bachelor of Arts

The Bachelor of Arts degree is for students who wish to develop expertise in an additional area of study. Students must elect a minor and must study a foreign language. Students are encouraged to consider a minor in Biology, Geological Sciences, Earth Science, Computer Studies, Mathematics, Secondary Education, Business, Economics, Management, or Marketing. The degree includes 40 credits hours in Chemistry and requires support courses in Mathematics, Physics, and Computer Science. A minimum number of 127 credits is required for graduation.

### Bachelor of Science

The Bachelor of Science degree provides broad preparation for students seeking employment or graduate studies. The degree includes 47 credits hours in Chemistry and requires support courses in Mathematics, Physics, and Computer Science. A minimum of 120 credits is required for graduation.

The **ACS approved option** is a more rigorous program. The curriculum has been reviewed and approved by the ACS Committee on Professional Training. Upon successful completion of this program of study and recommendation of the faculty, the student will receive a certificate from the ACS Committee on Professional Training. The degree includes 53 credits hours of

chemistry and requires support courses in Mathematics, Physics, and Computer Science. Students must complete a research project. A minimum of 120 credits is required for graduation. It requires support courses in Mathematics, Physics, and Computer Science.

The **Biochemistry Concentration** is designed for students with an interest in biochemistry and the chemical aspects of biotechnology. The degree includes 41 credits hours in Chemistry and 16 credits hours in Biology. A minimum of 120 credits is required for graduation.

### MINORS

#### Chemistry Minor

A Chemistry minor may be earned by taking 16 hours of Chemistry. Students must take one of the following pairs of courses: CHE124/125, CHE 130/131 or CHE 130/231. Students must also take CHE 212-213.

#### Physics Minor

A Physics minor may be earned by taking 16 credit hours of Physics. Students must take either PHS 211A/212A or PHS 221/222 followed by PHS 311/312 or instead of PHS 312, PHS 315 and 1 credit PHS 570.

#### Secondary Education Minor

A Secondary Education minor may be elected by students wishing to teach secondary school Chemistry. Students may pursue either the B.A. or B.S. degrees in Chemistry. Students planning to pursue the Secondary Education minor should see page 258 in the Education Department section of the catalog for requirements for admission to teacher licensure. The minor in Secondary Education requires the following courses:

1. Education Component (30 credits)
 

|          |  |              |
|----------|--|--------------|
| EDU 251  | The Secondary school-History and Thought                       | 3 credits    |
| EDU 252A | The Contemporary High School                                   | 3 credits    |
| EDU 254A | Teaching the Adolescent  | 3 credits    |
| EDU 256A | Responding to Diversity in Contemporary Secondary Schools      | 3 credits    |
| EDU 260A | Reading and Writing Strategies in Secondary Education          | 3 credits    |
| CHE 302T | Apprenticeship in Teaching Chemistry                           | 3 credits    |
| EDU 499  | The Student Teaching Practicum and Seminar for your discipline | (12 credits) |
2. Students must also take: HIS 204 U.S. History and Constitutional Government I or HIS 208 History of American Constitutions or HIS 319 Development of the American Constitution
3. Support Course
 

|         |                           |           |
|---------|---------------------------|-----------|
| PSY 252 | Adolescent Psychology     | 3 credits |
| GLS 100 | Physical Geology with Lab | 4 credits |
| BIO ___ | Biology                   | 4 credits |



Chemistry/Physics  
Salem State College  
Advisor: \_\_\_\_\_

Name: \_\_\_\_\_  
Date admitted into Major: \_\_\_\_\_  
Transfer credits: \_\_\_\_\_

**BACHELOR OF ARTS  
CHEMISTRY**

**CORE REQUIREMENTS**

**Competency-Based Skills**

- @  Basic College Math
- @  Reading Comprehension
- @  Computer Literacy

|   |     |     |                     |   |       |
|---|-----|-----|---------------------|---|-------|
| @ | ENG | 101 | Composition I       | 3 | _____ |
| @ | ENG | 102 | Composition II      | 3 | _____ |
| @ | SPC | 101 | (Speech)            | 3 | _____ |
| @ | SFL | 194 | Health and Wellness | 3 | _____ |

Physical Education Activities (1 cr. total)

|   |     |       |       |       |       |
|---|-----|-------|-------|-------|-------|
| @ | SFL | _____ | _____ | _____ | _____ |
| @ | SFL | _____ | _____ | _____ | _____ |

**Distribution Sequences (20 credits)**

|       |          |                 |                                 |       |       |
|-------|----------|-----------------|---------------------------------|-------|-------|
| _____ | _____    | (Literature I)  | 3                               | _____ |       |
| _____ | _____    | (Literature II) | 3                               | _____ |       |
| *     | PHS 211A | Physics I       | 4                               | _____ |       |
|       | or 221   |                 |                                 |       |       |
| *     | PHS 212A | Physics II      | 4                               | _____ |       |
|       | or 222   |                 |                                 |       |       |
| @     | HIS      | 101             | History of World Civilization I | 3     | _____ |
| @     | HIS      | _____           | (History II)                    | 3     | _____ |

**Distribution Electives (18-20 credits)**

Among the distribution electives, the student must earn at least 3 but no more than 9 additional semester hours in each of the three divisions.

**Humanities (Division I)**

|       |       |       |       |       |
|-------|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |

**Science/Mathematics (Division II)**

|   |     |     |                          |   |       |
|---|-----|-----|--------------------------|---|-------|
| * | MAT | 220 | Calculus I               | 4 | _____ |
| * | MAT | 221 | Calculus II              | 4 | _____ |
| * | CSC | 100 | Computers and Their Uses | 3 | _____ |

**Social Sciences (Division III)**

|       |       |       |       |       |
|-------|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |

(Note: Courses allowable as distribution electives are marked 'D' in the College Catalog or indicated by appropriate footnotes.)

**COURSES IN MAJOR (40 credits)**

**Freshman Year**

|     |     |                     |   |       |
|-----|-----|---------------------|---|-------|
| CHE | 130 | General Chemistry I | 4 | _____ |
| CHE | 212 | Organic Chemistry I | 4 | _____ |

**Sophomore Year**

|     |     |                                |   |       |
|-----|-----|--------------------------------|---|-------|
| CHE | 213 | Organic Chemistry II           | 4 | _____ |
| CHE | 231 | Quantitative General Chemistry | 4 | _____ |
| CHE | 309 | Biochemistry                   | 4 | _____ |

**Junior Year**

|     |     |                       |                              |       |       |
|-----|-----|-----------------------|------------------------------|-------|-------|
| CHE | 321 | Quantitative Analysis | 4                            | _____ |       |
| CHE | 331 | Physical Chemistry I  | 4                            | _____ |       |
| CHE | 332 | Physical Chemistry II | 4                            | _____ |       |
| **  | CHE | 441                   | Advanced Inorganic Chemistry | 3     | _____ |

**Senior Year**

|     |     |                       |   |       |
|-----|-----|-----------------------|---|-------|
| CHE | 442 | Instrumental Analysis | 4 | _____ |
| CHE | 560 | Seminar               | 1 | _____ |

**\*\*\*MINOR: \_\_\_\_\_ (15-18 credits)**

|       |       |       |       |       |
|-------|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |

**\*\*\*\*FREE ELECTIVES (minimum: 4 credits)**

|       |       |       |       |       |
|-------|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |

**FOREIGN LANGUAGE (12 CREDITS)**

|       |       |       |   |       |
|-------|-------|-------|---|-------|
| _____ | _____ | _____ | 3 | _____ |
| _____ | _____ | _____ | 3 | _____ |
| _____ | _____ | _____ | 3 | _____ |
| _____ | _____ | _____ | 3 | _____ |

@ Requirements so marked should be completed within the first 53 credits of study (i.e., before Junior status). Exceptions will be made for transfer students.  
 \* These are **required** support courses which may also be used to satisfy the indicated Distribution requirements. A student may choose to fulfill Distribution requirements with courses other than the ones listed, but these listed courses must still be taken. CSC 100 is required of students who did not pass the Computer Literacy Test and must be taken in the first semester of the Freshman year or the transfer year.  
 \*\* CHE 440 is offered during alternate years.  
 \*\*\* For a minor in mathematics or another minor, the student should consult with that Department Chair.  
 \*\*\*\* It is strongly recommended that students elect additional biology, chemistry, mathematics, physics and computer science courses.  
 Note: If a course is used to satisfy two or more requirements (for example, a support course and a distribution elective), the credits are counted in only one place. Using a course to satisfy more than one requirement does **not** reduce the credit total required for graduation.

**Total credits for graduation: 127**

Effective: 9/04



Chemistry/Physics
Salem State College
Advisor: \_\_\_\_\_

Name: \_\_\_\_\_
Date admitted into Major: \_\_\_\_\_
Transfer credits: \_\_\_\_\_

BACHELOR OF SCIENCE
CHEMISTRY

CORE REQUIREMENTS

Competency-Based Skills

- @ Basic College Math
@ Reading Comprehension
@ Computer Literacy

Table with 4 columns: Prefix, Course Number, Course Title, Credits. Includes ENG 101, ENG 102, SPC 101, SFL 194.

Physical Education Activities (1 cr. total)

Table with 4 columns: Prefix, Course Number, Course Title, Credits. Includes SFL courses.

Distribution Sequences (20 credits)

Table with 4 columns: Prefix, Course Number, Course Title, Credits. Includes Literature, Physics, and History courses.

Distribution Electives (18-20 credits)

Among the distribution electives, the student must earn at least 3 but no more than 9 additional semester hours in each of the three divisions.

Humanities (Division I)

Table with 4 columns: Prefix, Course Number, Course Title, Credits. Blank rows for student input.

Science/Mathematics (Division II)

Table with 4 columns: Prefix, Course Number, Course Title, Credits. Includes MAT 220, MAT 221, CSC 100.

Social Sciences (Division III)

Table with 4 columns: Prefix, Course Number, Course Title, Credits. Blank rows for student input.

(Note: Courses allowable as distribution electives are marked 'D' in the College Catalog or indicated by appropriate footnotes.)

COURSES IN MAJOR (47 credits)

Freshman Year

Table with 4 columns: Course Number, Course Title, Credits. Includes CHE 130, CHE 212.

Sophomore Year

Table with 4 columns: Course Number, Course Title, Credits. Includes CHE 213, CHE 231, CHE 309.

Junior Year

Table with 4 columns: Course Number, Course Title, Credits. Includes CHE 308, CHE 321, CHE 340, CHE 341, CHE 342.

Senior Year

Table with 4 columns: Course Number, Course Title, Credits. Includes CHE 422, CHE 441, CHE 442, CHE 560.

\*\*FREE ELECTIVES (minimum: 20 credits)

Table with 4 columns: Prefix, Course Number, Course Title, Credits. Blank rows for student input.

@ Requirements so marked should be completed within the first 53 credits of study...
\* These are required support courses...
\*\* It is strongly recommended that students elect a minor...
Note: If a course is used to satisfy two or more requirements...

Total credits for graduation: 120

Effective: 9/04



Chemistry/Physics  
Salem State College  
Advisor: \_\_\_\_\_

Name: \_\_\_\_\_  
Date admitted into Major: \_\_\_\_\_  
Transfer credits: \_\_\_\_\_

**BACHELOR OF SCIENCE  
CHEMISTRY  
BIOCHEMISTRY CONCENTRATION**

**CORE REQUIREMENTS**

**Competency-Based Skills**

- @  Basic College Math
- @  Reading Comprehension
- @  Computer Literacy

|   |     |     |                     |   |       |
|---|-----|-----|---------------------|---|-------|
| @ | ENG | 101 | Composition I       | 3 | _____ |
| @ | ENG | 102 | Composition II      | 3 | _____ |
| @ | SPC | 101 | (Speech)            | 3 | _____ |
| @ | SFL | 194 | Health and Wellness | 3 | _____ |

Physical Education Activities (1 cr. total)

|   |     |       |       |       |       |
|---|-----|-------|-------|-------|-------|
| @ | SFL | _____ | _____ | _____ | _____ |
| @ | SFL | _____ | _____ | _____ | _____ |

**Distribution Sequences (20 credits)**

|       |       |                 |                                 |       |       |
|-------|-------|-----------------|---------------------------------|-------|-------|
| _____ | _____ | (Literature I)  | 3                               | _____ |       |
| _____ | _____ | (Literature II) | 3                               | _____ |       |
| *     | PHS   | 211A or 221     | Physics I                       | 4     | _____ |
| *     | PHS   | 212A or 222     | Physics II                      | 4     | _____ |
| @     | HIS   | 101             | History of World Civilization I | 3     | _____ |
| @     | HIS   | _____           | (History II)                    | 3     | _____ |

**Distribution Electives (18 credits)**

Among the distribution electives, the student must earn at least 3 but no more than 9 additional semester hours in each of the three divisions.

**Humanities (Division I)**

|       |       |       |       |       |
|-------|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |

**Science/Mathematics (Division II)**

|   |     |     |                          |   |       |
|---|-----|-----|--------------------------|---|-------|
| * | MAT | 220 | Calculus I               | 4 | _____ |
| * | MAT | 221 | Calculus II              | 4 | _____ |
| * | CSC | 100 | Computers and Their Uses | 3 | _____ |

**Social Sciences (Division III)**

|       |       |       |       |       |
|-------|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |

(Note: Courses allowable as distribution electives are marked 'D' in the College Catalog or indicated by appropriate footnotes.)

**COURSES IN MAJOR (41 credits)**

**Freshman Year**

|     |     |                     |   |       |
|-----|-----|---------------------|---|-------|
| CHE | 130 | General Chemistry I | 4 | _____ |
| CHE | 212 | Organic Chemistry I | 4 | _____ |

**Sophomore Year**

|     |     |                                |   |       |
|-----|-----|--------------------------------|---|-------|
| CHE | 213 | Organic Chemistry II           | 4 | _____ |
| CHE | 231 | Quantitative General Chemistry | 4 | _____ |
| CHE | 309 | Biochemistry                   | 4 | _____ |

**Junior Year**

|     |     |   |   |       |
|-----|-----|---|---|-------|
| CHE | 321 | Quantitative Analysis                       | 4 | _____ |
| CHE | 340 | Techniques in Inorganic & Organic Synthesis | 4 | _____ |
| CHE | 341 | Physical Chemistry I                        | 4 | _____ |
| CHE | 342 | Physical Chemistry II                       | 4 | _____ |
| CHE | 422 | Instrumental Analysis                       | 4 | _____ |

**Senior Year**

|     |     |         |   |       |
|-----|-----|---------|---|-------|
| CHE | 560 | Seminar | 1 | _____ |
|-----|-----|---------|---|-------|

**SUPPORT COURSE (16 credits)**

|     |     |                       |   |       |
|-----|-----|-----------------------|---|-------|
| BIO | 132 | Introduction to Cells | 4 | _____ |
| BIO | 212 | Cell Biology          | 4 | _____ |
| BIO | 409 | Biological Chemistry  | 4 | _____ |

**and one of the following:**

|     |     |                    |       |       |
|-----|-----|--------------------|-------|-------|
| BIO | 402 | Genetics           | _____ | _____ |
| BIO | 405 | General Physiology | _____ | _____ |
| BIO | 406 | Microbiology       | _____ | _____ |
| BIO | 411 | Immunology         | 4     | _____ |

**\*\*FREE ELECTIVES (minimum: 12 credits)**

|       |       |       |       |       |
|-------|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |

@ Requirements so marked should be completed within the first 53 credits of study (i.e., before Junior status). Exceptions will be made for transfer students.  
 \* These are **required** support courses which may also be used to satisfy the indicated Distribution requirements. A student may choose to fulfill Distribution requirements with courses other than the ones listed, but these listed courses must still be taken. CSC 100 is required of students who did not pass the Computer Literacy Test and must be taken in the first semester of the Freshman year or the transfer year.  
 \*\* It is strongly recommended that students elect additional mathematics, physics, biology and computer science courses.  
 Note: If a course is used to satisfy two or more requirements (for example, a support course and a distribution elective), the credits are counted in only one place. Using a course to satisfy more than one requirement does **not** reduce the credit total required for graduation.



Chemistry/Physics  
Salem State College  
Advisor: \_\_\_\_\_

Name: \_\_\_\_\_  
Date admitted into Major: \_\_\_\_\_  
Transfer credits: \_\_\_\_\_

**BACHELOR OF SCIENCE  
CHEMISTRY  
(ACS APPROVED)**

**CORE REQUIREMENTS**

**Competency-Based Skills**

- @  Basic College Math
- @  Reading Comprehension
- @  Computer Literacy

|   |     |     |                     |   |       |
|---|-----|-----|---------------------|---|-------|
| @ | ENG | 101 | Composition I       | 3 | _____ |
| @ | ENG | 102 | Composition II      | 3 | _____ |
| @ | SPC | 101 | (Speech)            | 3 | _____ |
| @ | SFL | 194 | Health and Wellness | 3 | _____ |

Physical Education Activities (1 cr. total)

|   |     |       |       |       |       |
|---|-----|-------|-------|-------|-------|
| @ | SFL | _____ | _____ | _____ | _____ |
| @ | SFL | _____ | _____ | _____ | _____ |

**Distribution Sequences (20 credits)**

|       |       |                 |                                 |       |       |
|-------|-------|-----------------|---------------------------------|-------|-------|
| _____ | _____ | (Literature I)  | 3                               | _____ |       |
| _____ | _____ | (Literature II) | 3                               | _____ |       |
| *     | PHS   | 211A            | Physics I                       | 4     | _____ |
|       |       | or 221          |                                 |       |       |
| *     | PHS   | 212A            | Physics II                      | 4     | _____ |
|       |       | or 222          |                                 |       |       |
| @     | HIS   | 101             | History of World Civilization I | 3     | _____ |
| @     | HIS   | _____           | (History II)                    | 3     | _____ |

**Distribution Electives (18 credits)**

Among the distribution electives, the student must earn at least 3 but no more than 9 additional semester hours in each of the three divisions.

**Humanities (Division I)**

|       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |

**Science/Mathematics (Division II)**

|   |     |     |                          |   |       |
|---|-----|-----|--------------------------|---|-------|
| * | MAT | 220 | Calculus I               | 4 | _____ |
| * | MAT | 221 | Calculus II              | 4 | _____ |
| * | CSC | 100 | Computers and Their Uses | 3 | _____ |

**Social Sciences (Division III)**

|       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |

(Note: Courses allowable as distribution electives are marked 'D' in the College Catalog or indicated by appropriate footnotes.)

**COURSES IN MAJOR (53 credits)**

**Freshman Year**

|     |     |                     |   |       |
|-----|-----|---------------------|---|-------|
| CHE | 130 | General Chemistry I | 4 | _____ |
| CHE | 212 | Organic Chemistry I | 4 | _____ |

**Sophomore Year**

|     |     |                                |   |       |
|-----|-----|--------------------------------|---|-------|
| CHE | 213 | Organic Chemistry II           | 4 | _____ |
| CHE | 231 | Quantitative General Chemistry | 4 | _____ |
| CHE | 309 | Biochemistry                   | 4 | _____ |

**Junior Year**

|     |     |   |   |       |
|-----|-----|---|---|-------|
| CHE | 308 | Descriptive Inorganic Chemistry             | 3 | _____ |
| CHE | 321 | Quantitative Analysis                       | 4 | _____ |
| CHE | 340 | Techniques in Inorganic & Organic Synthesis | 4 | _____ |
| CHE | 341 | Physical Chemistry I                        | 4 | _____ |
| CHE | 342 | Physical Chemistry II                       | 4 | _____ |
| CHE | 422 | Instrumental Analysis                       | 4 | _____ |

**Senior Year**

|     |     |                              |   |       |
|-----|-----|------------------------------|---|-------|
| CHE | 441 | Advanced Inorganic Chemistry | 3 | _____ |
| CHE | 442 | Physical Organic Chemistry   | 3 | _____ |
| CHE | 560 | Seminar                      | 1 | _____ |
| CHE | 572 | Chemistry Research I         | 3 | _____ |

**SUPPORT COURSE (4 credits)**

|   |     |     |                     |   |       |
|---|-----|-----|---------------------|---|-------|
| * | PHS | 311 | General Physics III | 4 | _____ |
|---|-----|-----|---------------------|---|-------|

**\*\*FREE ELECTIVES (minimum: 12 credits)**

|       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |

@ Requirements so marked should be completed within the first 53 credits of study (i.e., before Junior status). Exceptions will be made for transfer students.  
 \* This is a **required** support course which may also be used to satisfy the indicated Distribution requirements. A student may choose to fulfill Distribution requirements with a course other than the one listed, but this listed course must still be taken. CSC 100 is required of students who did not pass the Computer Literacy Test and must be taken in the first semester of the Freshman year or the transfer year.  
 \*\* It is strongly recommended that students elect additional biology, mathematics, physics and computer science courses.  
 Note: If a course is used to satisfy two or more requirements (for example, a support course and a distribution elective), the credits are counted in only one place. Using a course to satisfy more than one requirement does **not** reduce the credit total required for graduation.



## COURSE DESCRIPTIONS

## CHEMISTRY

**CHE 120 Foundations of Chemistry I (Fall) 3 credits DII**

The basic principles of chemistry, both qualitative and quantitative are discussed. Topics include the physical properties of matter, the structure of atoms, ions and molecules, the formation and nomenclature of compounds, chemical reactions; states of matter; and solutions. Two lecture hours, one hour of discussion and one two-hour laboratory per week. Not open to Chemistry majors. This course satisfies Division II Distribution requirements for a laboratory science sequence with CHE 121 or CHE 123.

**CHE 121 Foundations of Chemistry II (Spring) 3 credits DII**

The application of chemical principles to problems in environmental chemistry, biological chemistry, and the chemistry of consumer products is discussed. Topics include acids and bases, combustion, oxidation and reduction, solution concentration, spectroscopy, heat, bond energy, and radioactivity. Two lecture hours, one hour of discussion and one two-hour laboratory per week. Not open to Chemistry majors. This course satisfies the laboratory science sequence requirement with CHE 120.

Prerequisite: CHE 120 or the equivalent.

**CHE 123 Chemistry of Art 3 credits DII**

The application of chemical principles to art is explored. Background topics including light, color, pigments, dyes, paint and materials such as glasses, polymers and ceramics will be presented. Case studies in conservation, restoration and detection of forgeries will be examined. Cannot be taken for major credits in Chemistry. This course with CHE 120 satisfies the full-year sequence in a laboratory science. Two lecture hours and one two-hour laboratory per week. (Offered in even numbered years).

Prerequisite: CHE 120 or the equivalent.

**CHE 124 General Chemistry for Life Sciences 4 credits DII**

Required of B.S. Nursing majors. A systematic survey of the metric system, physical properties, the structure of the atom, trends in the periodic table, bonding and structure, names of chemicals, typical reactions, chemical calculations, acids and bases and radioactivity. Three lecture hours and one two-hour laboratory period per week. For non-chemistry majors. This course together with CHE 121 or CHE 125 satisfies the full year sequence in laboratory science.

**CHE 125 Chemistry of Life Processes 4 credits DII**

Required of B.S. in Nursing majors. A continuation of CHE 124. A systematic survey of the classes of organic compounds and biochemicals. The classes of organic compounds are distinguished by structure, common names, I.U.P.A.C. names, reactions and their uses. General and organic chemistry are used to discuss the structure, function, and metabolism of the carbohydrates, lipids, proteins and nucleic acids. Three lecture hours and one two-hour laboratory period per week. For non-chemistry majors.

Prerequisite: CHE 121 or CHE 124 or the equivalent.

**CHE 130 General Chemistry I 4 credits DII**

This course covers descriptive and quantitative aspects of chemistry. Topics include states and properties of matter, atomic structure, chemical bonding, the mole, chemical reactions, stoichiometry, and acid-base chemistry. A proficiency in algebra is recommended. For Chemistry, Biology, and Geological Sciences students. Three lecture hours, one hour of discussion and one three-hour laboratory per week.

**CHE 131 General Chemistry II 4 credits DII**

This course is a continuation of CHE 130. Topics include, thermochemistry, equilibrium, electrochemistry, kinetics, nuclear chemistry and phase equilibria. This course emphasizes applications in environmental chemistry and is for Geological Sciences students. Three lecture hours, one hour of discussion and one three-hour laboratory per week.

Prerequisite: CHE 130.

**CHE 200 Forensic Science 3 credits DII**

A systematic survey of forensic science that covers physical evi-

dence, the branches of forensic science and the qualifications and preparation of forensic scientists. The evidence covered includes fingerprints, firearms, arson, explosives, glass, soil, paint, hair, fibers, ink and document examination, serological evidence including DNA, breath and blood alcohol and drugs. Three lecture hours per week. Cannot be taken for major credits in Chemistry.

Prerequisites: A two-semester laboratory sequence in either Chemistry or Biology.

**CHE 212 Organic Chemistry I 4 credits DII**

Introduction to chemistry of carbon compounds. Survey of the principal classes of aliphatic and aromatic compounds and their reactions. The application of the techniques of synthetic organic chemistry to the preparation and purification of simple organic compounds is taken up in the laboratory. Required of Chemistry and Biology majors. Three lecture hours, and one three-hour laboratory per week. This course, with CHE 130 satisfies the full year sequence in a laboratory science.

Prerequisite: CHE 130.

**CHE 213 Organic Chemistry II 4 credits**

This course is a continuation of CHE 212: Study of organic reactions with emphasis upon the relation between structure and reactivity. Introduction of IR and NMR theory in lecture and application in laboratory. Laboratory work includes the study of advanced preparations and techniques. Three lecture hours and one three-hour laboratory period per week.

Prerequisite: CHE 212.

**CHE 231 Quantitative General Chemistry 4 credits**

This course builds on topics covered in CHE 130, CHE 212 and CHE 213. Topics include thermochemistry, equilibrium, electrochemistry, kinetics, nuclear chemistry and phase equilibria. This course emphasizes applications in environmental chemistry, organic chemistry and biochemistry. For Chemistry and Biology students. Three lecture hours, one hour of discussion and one three-hour laboratory per week.

Prerequisites: CHE 130, CHE 212, CHE 213 and MAT 202N or higher.

**CHE 300H Chemistry in Contemporary Life (Spring) 3 credits**

Emphasis will be placed on major issues in contemporary life that deal with chemistry. The topics covered in the course will be energy crisis, environmental problems of air and water pollution, use of natural resources, pharmacology of drugs of abuse, pharmacology of therapeutic drugs and toxicology in general. A class report and a research paper are required. Three lecture hours per week. Open only to students in the Honors Program; cannot be taken for major credits in Chemistry.

Prerequisites: A year of Biology or Chemistry is recommended, but not required.

**CHE 302T Apprenticeship in Teaching Chemistry (Spring) 3 credits**

A pre-practicum field-based course which is part of the state approved program for Teacher of Chemistry (9-12). Students learn skills for teaching chemistry by performing activities under a master high school teacher. A minimum of 45 field-site hours are required. Seminars and conferences are held periodically to coordinate the field experience. Required of students seeking certification in Secondary Education Chemistry. Taken usually in the Junior Year preceding the practicum.

Prerequisite: PSY 252 and permission of Department Chairperson.

**CHE 308 Descriptive Inorganic Chemistry (Fall) 3 credits**

This course explores descriptive inorganic chemistry. The chemistry of the representative elements and the inner and outer transition elements will be studied. Topics include bonding, atomic and molecular structure, and chemical reactivity. The discovery and purification of these elements is covered as well. Special topics include organometallic chemistry and bioinorganic chemistry. Three lecture hours per week.

Prerequisite: CHE 231.

**CHE 309 Biochemistry 4 credits**

An introduction to carbohydrates, lipids, proteins and nucleic acids,



which will include metabolic pathways, the role of vitamins and detoxification mechanisms. The laboratory deals with enzyme kinetics and the solution of practical analytical problems using chromatographic, instrumental and wet chemical methods. Three lecture hours and one three-hour laboratory period per week. Prerequisite: CHE 213.

**CHE 321 Quantitative Analysis (Fall) 4 credits**

This course deals with the fundamental principles of classical analysis and electrochemistry with specific emphasis on gravimetry, titrimetry, potentiometry, voltammetry and amperometry. The laboratory work includes the use of analytical balances, glassware and electronics in order to quantitate single constituents of mixtures gravimetrically, volumetrically, complexometrically and electrochemically. The standard methods of estimation of single constituents gravimetrically, volumetrically, and complexometrically and electrochemically. Three lecture hours and two three-hour laboratory periods per week.

Prerequisite: CHE 231.

**CHE 340 Techniques in Inorganic and Organic Synthesis (Spring) 4 credits**

This laboratory course explores advanced chemical synthesis. The laboratory experiments will focus on the synthesis and characterization of inorganic and organic compounds. The purpose of the course is to build on a student's experience in the laboratory through the use of new synthesis techniques and instrumentation applications. The use of specialized glassware and instruments such as the FT-IR, FT-NMR and UV-Vis will be a main part of the course. One lecture hour and two three hour laboratory periods per week.

Prerequisite: CHE 231.

**CHE 341 Physical Chemistry I (Fall) 4 credits**

This course will cover quantum theory; molecular and atomic structure; vibrational, rotational and electronic spectroscopy, nuclear magnetic resonance spectroscopy and statistical mechanics. Three lecture hours and one three hour laboratory per week. Not open to students who have received credits for CHE 332.

Prerequisites: CHE 231, MAT 221, PHS 212 or 222.

**CHE 342 Physical Chemistry II (Spring) 4 credits**

This course will cover chemical kinetics, the laws of thermodynamics, phase equilibrium, chemical equilibrium, and electrochemistry. Three lecture hours and one three hour laboratory per week. Not open to students who have received credits for CHE 331.

Prerequisites: CHE 231, MAT 221, PHS 212 or 222.

**CHE 350 Introduction to Chemistry Research 1 credit**

This course is an introduction to research and provides qualified students with research direction and the opportunity to participate in independent work in any area of chemistry of special interest to them, provided that a Faculty Supervisor is available. Three hours of lab work per week. May be taken up to three times for credits. Open only to Junior and Senior Chemistry majors.

Prerequisites: Two years of Chemistry, consent of the Faculty Supervisor and permission of the Department Chairperson.

**CHE 420 Instrumental Analysis for Clinical Chemists (Spring) 4 credits**

This course will involve a study of the instrumentation, theoretical aspects and the application of physicochemical principles for the solution of analytical problems in the area of clinical chemistry. Ultraviolet-visible absorption spectroscopy, fluorescence and phosphorescence, nephelometry and turbidimetry, flame photometry, atomic absorption spectroscopy, ion exchange, gas, liquid, and thin layer chromatographics, specific ion potentiometry, radiochemical methods, and kinetic methods of analysis will be discussed. The laboratory will involve detailed investigation of important clinical, analytical problems utilizing the above-listed techniques. Three lecture hours, one two-hour of laboratory discussion and one two-hour laboratory period per week.

Prerequisites: CHE 321 and PHS 212A or PHS 222.

**CHE 422 Instrumental Analysis (Spring) 4 credits**

This course will involve the study of the theoretical aspects, chemical applications, and the instrumentation of the physicochemical principles that are the foundations of Instrumental Analysis. Topics covered will be the absorption, emission, and the scattering of the various forms of electromagnetic radiation; the various forms of chromatography; mass to charge ratio; and the interaction of electricity with matter. The laboratory will involve practical chemical experiments (Qualitative and Quantitative) based on some of the topics covered in lecture. Three lecture hours, and one three-hour laboratory period per week.

Prerequisites: CHE 321, CHE 341 and PHS 212A or PHS 222.

**CHE 441 Advanced Inorganic Chemistry (Spring) 3 credits**

This course builds on Descriptive Inorganic Chemistry and Physical Chemistry. Topics include concepts of acids and bases; non-aqueous solvent systems; bonding and structure; molecular symmetry; solid state chemistry; coordination chemistry with an emphasis on ligand field theory, spectroscopy, thermodynamic and kinetic aspects of coordination compounds; organometallic chemistry of mono and polynuclear metal carbonyl, alkyl and analogues. Catalysis and selected bioinorganic compounds will be covered briefly as well. Three lecture hours per week. Not open to students who have received credits for CHE 440.

Prerequisites: CHE 308, CHE 340, CHE 342.

**CHE 442 Physical Organic Chemistry (Fall) 3 credits**

This course deals with the physical basis for the reactivity of organic compounds and methods used to study reaction mechanisms. Topics to be covered include stereochemistry, structure and bonding, computational chemistry, solvation and structure-reactivity relationships. Methods used to elucidate organic reaction mechanisms will be discussed and their application to various classes of reactions will be studied. Three lecture hours per week. Not open to students who have received credits for CHE 439.

Prerequisites: CHE 341, CHE 342.

**CHE 560 Chemistry Seminar (Spring) 1 credit**

Presentation by students of current topics from chemical literature and/or the presentation of the results of individual research. The topics will be approved by Department members. A detailed written report of the student's investigation is required. One meeting per week.

Prerequisite: Senior standing as a Chemistry major or permission of the Department Chairperson.

**CHE 570 Directed Study in Chemistry 1-3 credits**

This course will consist of readings in particular areas of chemistry, under the direction of a staff member. Students wishing to register for this course must make prior arrangements with the faculty member involved. Cannot be taken for major credits in Chemistry. Open only to Junior and Senior Chemistry majors.

Prerequisite: Consent of the faculty member and permission of the Department Chairperson.

**CHE 572 Chemistry Research I 3 credits**

This course provides qualified students with research direction and the opportunity to participate in independent work in any area of chemistry of special interest to them, provided that a faculty supervisor is available. A paper and poster presentation are required at the end of the course. Open only to Junior and Senior Chemistry majors.

Prerequisites: CHE 321 and CHE 341, consent of the faculty supervisor and permission of the Department Chairperson.

**CHE 573 Chemistry Research II 3 credits**

This course builds on CHE 572, continuing with the same project or starting a new project. Students in this course will be expected to present their results in a professional setting.

Prerequisites: CHE 342 and CHE 572, consent of the faculty supervisor and the permission of the Department Chairperson.



## PHYSICAL SCIENCE, PHYSICS AND ASTRONOMY

### PHS 101 Physical Science I (Fall) 3 credits DII

Selected topics in the physical sciences (physics, chemistry, & astronomy), with emphasis on the process of scientific investigation and the development of scientific concepts, reasoning skills, and mathematical modeling. Topics include scientific representations; properties of matter, the relationship between force and motion. No previous background in science is assumed. Together with PHS 102 or PH 107 this course satisfies the full-year sequence in laboratory science. Two lecture hours, and one two-hour lab per week. Not open to students who have received credits for PHS 105.

### PHS 102 Physical Science II (Spring) 3 credits DII

Continuation of PHS 101. This course examines additional topics in physical science, with emphasis on the process of scientific investigation and the development of scientific concepts, reasoning skills, and mathematical modeling. Topics may include electricity, and magnetism; atomic and chemical structure; the properties of light; and observational astronomy. Two lecture hours, and one two-hour laboratory per week. Not open to students who have received credits for PHS 106.

Prerequisite: PHS 101 or PHS 105.

### PHS 107 The Physics of Music and Voice 4 credits DII

Introductions to the fundamental concepts and techniques of acoustics, particularly as applied to the performing arts. Topics will include a description of waves and wave motion; frequency and pitch; interference, standing, waves, and resonance; intensity levels and loudness. The course will also explore the fundamentals of musical instruments, including stringed instruments, woodwinds, and percussion. Three lecture hours and one two-hour laboratory period per week.

Prerequisite: PHS 101, Physical Science I.

Together with PHS 101 (Physical Science I) this course satisfies the Laboratory Sequence in Physical Science.

### PHS 205 Digital Circuit Design 4 credits DII

Introduction to D.C. circuit analysis and digital logic design. Topics include: D.C. circuit analysis, fundamental building blocks of modern computers (binary number system, Boolean algebra, logic gates, logic circuits), counters and registers, integrated circuit logic, methods of analog-to-digital and digital-to-analog conversions, computer organization (CPU and main memory, read-only memory, cache storage, buses, serial and parallel communication), and secondary storage media such as magnetic and optical disks. Four lecture hours per week.

Co-requisite: MAT 202N or equivalent.

### PHS 207 Astronomy 3 credits DII

Introduction to topics in modern astronomy. Topics may include the origin and evolution of the solar system; the search for extra-solar planets; the lives and deaths of stars; the structure of the galaxy; modern theories of cosmology; and the search for extraterrestrial life. Emphasis on the latest results in research astronomy, from the perspective of the enthusiastic novice. Required periodic visual observations and visits to the Collins Observatory will supplement lectures. Three lecture hours per week.

Prerequisite: MAT 202N or permission of the Department Chairperson.

### PHS 211A College Physics I (Fall) 4 credits DII

An introduction to principles of classical mechanics, with emphasis on development of problem-solving skills. Topics include the relationship between force and motion, the conservation of energy and momentum, rotational motion, and simple harmonic motion. Algebra, geometry and elementary trigonometry are used freely. Three lecture hours, one discussion period and one three-hour laboratory period per week. Emphasizes biological science applications. Not open to students who have received credits for PHS 211. Prerequisite: MAT 202N or equivalent.

### PHS 212A College Physics II (Spring) 4 credits DII

Continuation of PHS 211. This course examines additional topics in classical physics, including fluid dynamics; thermal properties of matter; the laws of thermodynamics; principles of electricity and magnetism; D.C. circuits; electromagnetic induction. A strong emphasis on problem solving skills, in which algebra, geometry and

elementary trigonometry are used freely. Three lecture hours, one discussion period and one three-hour laboratory period per week. Emphasizes biological science applications. Not open to students who have received credits for PHS 212.

Prerequisite: MAT 202N or equivalent and PHS 211A.

### PHS 221 General Physics I with Calculus (Fall) 4 credits DII

Calculus-based survey of selected topics in classical mechanics, including kinematics and Newtonian mechanics, one- and two-dimensional collisions; energy conservation; rotational motion and angular momentum; harmonic motion and oscillations. Recommended for Chemistry majors. Three lecture hours, one mandatory discussion hour, and one three-hour laboratory period per week. Cannot be taken for credits with PHS 211A. Not open to students who have received credits for PHS 213.

Prerequisite: MAT 202N or equivalent.

Co-requisite: MAT 220.

### PHS 222 General Physics II with Calculus (Spring) 4 credits DII

Continuation of PHS 221. Calculus-based survey of selected topics in classical electrodynamics and geometric optics, including electric fields & Gauss'; Law, electric potential; D.C. circuits, magnetic fields, electromagnetic induction; the electromagnetic field, reflection and refraction of light. Recommended for Chemistry majors. Cannot be taken for credits with PHS 212 or PHS 212A. Not open to students who have received credits for PHS 214.

Prerequisites: PHS 221 or PHS 213 and MAT 220.

Co-requisite: MAT 221.

### PHS 311 General Physics III (Fall) 4 credits

This course examines topics in electromagnetism and wave motion, including properties of waves; geometric optics; interference and diffraction of light; the electromagnetic spectrum and wave-particle duality. Selected topics in modern physics will be introduced as time permits. Three lecture hours, one discussion period, and one three-hour laboratory period per week.

Prerequisite: PHS 212A or PHS 212 or PHS 214.

### PHS 312 Modern Physics (Spring) 4 credits

Introduction to the major developments in physics during the 20<sup>th</sup> Century. Topics include blackbody radiation and Planck's constant; the photoelectric effect, development of quantum theory, the structure of matter, particle physics and cosmology. Three lecture hours, one discussion period, and one three-hour laboratory per week.

Prerequisites: PHS 311 and MAT 221.

### PHS 315 Introduction to Radiation Physics (Spring) 3 credits

This course examines problems in radiation physics, including nuclear structure; radioactive decay and activity; uses of radioactivity, the interaction of radiation with matter, radiation detection and measurement; radiation dosimetry, biological applications and hazards of radioactivity. Intended for Nuclear Medicine Technologists. Three lecture hours per week. Prerequisites: PHS 211A/212A, or PHS 221/222.

### PHS 570 Directed Study in Physics Variable credits

This course will consist of readings in particular areas of physics, under the direction of a staff member. Students wishing to register for this course must make prior arrangements with the faculty members involved.

Prerequisite: Consent of faculty member and permission of Department Chairperson.

### PHS 571 Special Problems in Physics Variable credits

This course provides research direction and participation in any area of physics of interest to the student and for which a faculty specialist is available for supervision. Open only to students who have completed at least three semesters of college physics. Requires the approval of the supervising faculty member. Students must make prior arrangements with the faculty member. Demands on faculty time and laboratory equipment will necessarily limit the openings in this course. A paper will be required at the end of the course.

Prerequisite: Consent of faculty member and permission of Department Chairperson.