# BS IN BIOLOGICAL SCIENCE (CLINICAL LABORATORY SCIENCES)

**Units required for Major: 73-85, includes units of study in chosen concentration (see below).**
**Total units required for BS: 120**

## Program Description

The curriculum in Clinical Laboratory Sciences meets the undergraduate coursework requirements of the State of California for eligibility to take a Clinical Laboratory Scientist (CSL) licensure examination. Eligibility to take a licensure examination also requires a one year (CLS) internship training program at a state approved clinical laboratory. Completion of BS degree requirements in the Clinical Laboratory Sciences concentration does not guarantee admission to a CLS internship training program. Information on admission criteria and application procedures for the various CLS internship training programs throughout the state is available through the California Association for Medical Laboratory Technology (CAMLT) at their website (http://www.camlt.org/cls/). Information about state and out-of-state programs can be found at NAACLS.org.

## Program Requirements

| Code | Title | Units |
|---|---|---|
| **Required Lower Division Core Courses (37-41 Units)** | | |
| BIO 1 | Biodiversity, Evolution and Ecology [1] | 5 |
| BIO 2 | Cells, Molecules and Genes | 5 |
| CHEM 1A | General Chemistry I [1] | 5 |
| CHEM 1B | General Chemistry II | 5 |
| Select one of the following: | | 3 - 6 |
| CHEM 20 | Organic Chemistry Lecture--Brief Course [2] | |
| CHEM 24 & CHEM 124 | Organic Chemistry Lecture I<br>Organic Chemistry Lecture II | |
| Select one of the following: | | 3 - 4 |
| MATH 26A | Calculus I for the Social and Life Sciences | |
| MATH 30 | Calculus I | |
| PHYS 5A | General Physics: Mechanics, Heat, Sound | 4 |
| PHYS 5B | General Physics: Light, Electricity and Magnetism, Modern Physics | 4 |
| STAT 1 | Introduction to Statistics [1] | 3 |
| **Required Upper Division Core Courses (7 Units)** | | |
| BIO 100 | Introduction to Scientific Analysis | 3 |
| BIO 184 | General Genetics | 4 |
| **Concentration (29-37 Units)** | | |
| Select from the following concentrations: | | 29 - 37 |
| General Biology | | |
| Biomedical Sciences | | |
| Cell and Molecular Biology | | |
| Clinical Laboratory Sciences | | |
| Ecology, Evolution, and Conservation | | |
| Forensic Biology | | |
| Microbiology | | |
| **Total Units** | | **73-85** |

[1] Course also satisfies General Education (GE)/Graduation Requirement.
[2] CHEM 24 and CHEM 124 may be taken in lieu of CHEM 20. (CHEM 124 is not counted toward the 36 upper division unit requirement in the major except in the Biomedical Sciences Concentration.)

**Notes:**

- Pre-Health Professional students should take the Chemistry and Math requirements as stated in the Pre-Health Professional Program section of this catalog.
- With approval, up to six units of upper division coursework from related fields may be applied as electives in the major.

Concentration in Clinical Laboratory Sciences (34 units)

| Code | Title | Units |
|---|---|---|
| **Required courses (34 Units)** | | |
| BIO 121 | Molecular Cell Biology | 3 |
| BIO 124 | Clinical Hematology | 3 |
| BIO 131 | Systemic Physiology | 4 |
| BIO 139 | General Microbiology | 4 |
| BIO 144 | Pathogenic Bacteriology | 4 |
| BIO 149A | Immunology | 3 |
| BIO 152 | Human Parasitology | 3 |
| CHEM 31 | Quantitative Analysis | 4 |
| CHEM 161 | General Biochemistry [1] | 3 |
| CHEM 162 | General Biochemistry Laboratory [2] | 3 |
| **Total Units** | | **34** |

[1] CHEM 160A and CHEM 160B may be taken in lieu of CHEM 161. Only three units of the package may be counted toward the upper division requirement.
[2] CHEM 162 can be included in the 36 upper division unit requirement for this concentration.

**Note:** A minor in Chemistry may be attained if either CHEM 20L or CHEM 25 is taken.

- No more than 3 units from the following combined can be applied to the Biological Sciences upper division major requirement. No more than 2 units from BIO 195 and BIO 197 series courses will count toward the degree requirement.

| Code | Title | Units |
|---|---|---|
| BIO 195 | Biological Internship | 1 - 2 |
| BIO 197A | Laboratory Teaching Assistant | 1 - 2 |
| BIO 197B | Laboratory Techniques | 1 - 2 |

| | | |
|---|---|---|
| BIO 197C | Co-curricular Activities in Biology | 1 - 2 |
| BIO 199A | Introductory Undergraduate Research | 1 - 2 |
| BIO 199B | Directed Readings | 1 - 2 |

# General Education Requirements [1]

| Code | Title | Units |
|---|---|---|
| **Area A: Basic Subjects (9 Units)** | | |
| A1 - Oral Communication | | 3 |
| A2 - Written Communication | | 3 |
| A3 - Critical Thinking | | 3 |
| **Area B: Physical Universe and Its Life Forms** | | |
| B1 - Physical Science [2] | | 0 |
| B2 - Life Forms [2] | | 0 |
| B3 - Lab (Note: Lab experience to be taken with one of the following: B1, B2 or B5) [2] | | 0 |
| B4 - Math Concepts [2] | | 0 |
| B5 - Additional Course (Any B to reach 12 units) - Take upper-division course to complete Area & upper division requirements. [2] | | 0 |
| **Area C: Arts and Humanities (12 Units)** | | |
| C1 - Arts | | 3 |
| C2 - Humanities | | 3 |
| C1/C2 - Area C Course | | 3 |
| C1/C2 - Area C Course - Take upper-division course to complete Area & upper division requirements. | | 3 |
| **Area D: The Individual and Society (9 Units)** | | |
| Area D Course | | 3 |
| Area D Course | | 3 |
| Area D Course - Take upper-division course to complete Area & upper division requirements. | | 3 |
| **Area E: Understanding Personal Development (3 Units)** | | |
| Area E Course | | 3 |
| **Area F: Ethnic Studies (3 Units)** | | |
| Area F Course | | 3 |
| **Total Units** | | **36** |

[1] To help you complete your degree in a timely manner and not take more units than absolutely necessary, there are ways to use single courses to meet more than one requirement (overlap). For further information, please visit the General Education page (https://catalog.csus.edu/colleges/academic-affairs/general-education/).
**Note:** There is no way to list all possible overlaps so please consult with a professional advisor. The Academic Advising Center can be visited online (http://www.csus.edu/acad), by phone (916) 278-1000, or email (advising@csus.edu).

[2] Required in Major; also satisfies GE.

# Graduation Requirements [1]

| Code | Title | Units |
|---|---|---|
| **Graduation Requirements (required by CSU) (9 Units)** | | |
| American Institutions: U.S. History | | 3 |
| American Institutions: U.S. Constitution & CA Government | | 3 |
| Writing Intensive (WI) | | 3 |
| **Graduation Requirements (required by Sacramento State) (12 Units)** | | |
| English Composition II | | 3 |
| Race and Ethnicity in American Society (RE) | | 3 |
| Foreign Language Proficiency Requirement [2] | | 6 |

[1] To help you complete your degree in a timely manner and not take more units than absolutely necessary, there are ways to use single courses to meet more than one requirement (overlap). For further information, please visit the General Education page (https://catalog.csus.edu/colleges/academic-affairs/general-education/).
**Note:** There is no way to list all possible overlaps so please consult with a professional advisor. The Academic Advising Center can be visited online (http://www.csus.edu/acad), by phone (916) 278-1000, or email (advising@csus.edu).

[2] If not satisfied before entering Sacramento State, it may be satisfied in General Education Area C2 (Humanities). "C- or better required." The alternative methods for satisfying the Foreign Language Proficiency Requirement are described here: https://www.csus.edu/college/arts-letters/world-languages-literatures/foreign-language-requirement.html (https://www.csus.edu/college/arts-letters/world-languages-literatures/foreign-language-requirement.html)

*The following roadmaps are sample planning resources. Please consult your academic advisor and Academic Catalog for graduation requirements as you develop your individualized academic plan.*

## Biological Science (Clinical Laboratory Sciences), BS: 4-Year Roadmap

| Course | Title | Units |
|---|---|---|
| **Year 1** | | |
| **First Semester** | | |
| STAT 1 | Introduction to Statistics | 3 |
| GE Area 1A - English Composition [2] | | 3 |
| GE Area 3B - Humanities [2] | | 3 |
| GE Area 6 - Ethnic Studies [2] | | 3 |
| GR American Institutions (US History) [2] | | 3 |
| | **Units** | **15** |
| **Second Semester** | | |
| CHEM 1A | General Chemistry I | 5 |
| MATH 26A or MATH 30 | Calculus I for the Social and Life Sciences [3] or Calculus I | 3 - 4 |
| GE Area 1B - Critical Thinking [2] | | 3 |
| GE Area 1C - Oral Communication [2] | | 3 |
| | **Units** | **14-15** |
| **Year 2** | | |
| **First Semester** | | |
| BIO 1 | Biodiversity, Evolution and Ecology | 5 |
| CHEM 1B | General Chemistry II | 5 |
| GE Area 3A - Arts [2] | | 3 |
| GR American Institutions (GOVT) [2] | | 3 |
| | **Units** | **16** |
| **Second Semester** | | |
| BIO 2 | Cells, Molecules and Genes | 5 |
| CHEM 31 | Quantitative Analysis | 4 |
| PHYS 5A | General Physics: Mechanics, Heat, Sound | 4 |
| Second Semester Composition [2] | | 3 |
| | **Units** | **16** |

| | | |
|---|---|---|
| **Year 3** | | |
| **First Semester** | | |
| BIO 100 | Introduction to Scientific Analysis | 3 |
| BIO 184 | General Genetics | 4 |
| CHEM 20<br>or CHEM 24<br>or CHEM 124 | Organic Chemistry Lecture--Brief Course [3]<br>or Organic Chemistry Lecture I<br>or Organic Chemistry Lecture II | 3 |
| PHYS 5B | General Physics: Light, Electricity and Magnetism, Modern Physics | 4 |
| Foreign Language Semester 1 [2] | | 4 |
| | **Units** | **18** |
| **Second Semester** | | |
| BIO 121 | Molecular Cell Biology | 3 |
| BIO 139 | General Microbiology | 4 |
| CHEM 161 | General Biochemistry | 3 |
| Foreign Language Semester 2 [2] | | 4 |
| | **Units** | **14** |
| **Year 4** | | |
| **First Semester** | | |
| BIO 144 | Pathogenic Bacteriology | 4 |
| BIO 149A | Immunology | 3 |
| CHEM 162 | General Biochemistry Laboratory | 3 |
| Upper Division GE Area 4 - Social & Behavioral Sciences + Writing Intensive [2] | | 3 |
| Elective of Choice | | 3 |
| | **Units** | **16** |
| **Second Semester** | | |
| BIO 124 | Clinical Hematology | 3 |
| BIO 131 | Systemic Physiology | 4 |
| BIO 152 | Human Parasitology | 3 |
| Upper Division GE Area 3 - Arts or Humanities [2] | | 3 |
| | **Units** | **13** |
| | **Total Units** | **122-123** |

## Biological Science (Clinical Laboratory Sciences), BS: 2-Year Roadmap

| Course | Title | Units |
|---|---|---|
| **Year 1** | | |
| **First Semester** | | |
| BIO 100 | Introduction to Scientific Analysis | 3 |
| BIO 184 | General Genetics | 4 |
| Foreign Language Semester 1 [2] | | 4 |
| GR American Institutions (US History) [2] | | 3 |
| | **Units** | **14** |
| **Second Semester** | | |
| BIO 121 | Molecular Cell Biology | 3 |
| BIO 139 | General Microbiology | 4 |
| CHEM 161 | General Biochemistry | 3 |
| Foreign Language Semester 2 [2] | | 4 |
| | **Units** | **14** |
| **Year 2** | | |
| **First Semester** | | |
| BIO 144 | Pathogenic Bacteriology | 4 |
| BIO 149A | Immunology | 3 |
| CHEM 162 | General Biochemistry Laboratory | 3 |
| Upper Division GE Area 4 - Social & Behavioral Sciences + Writing Intensive [2] | | 3 |
| Elective of Choice | | 3 |
| | **Units** | **16** |
| **Second Semester** | | |
| BIO 124 | Clinical Hematology | 3 |
| BIO 131 | Systemic Physiology | 4 |
| BIO 152 | Human Parasitology | 3 |
| GR American Institutions (GOVT) [2] | | 3 |
| Upper Division GE Area 3 - Arts or Humanities [2] | | 3 |
| | **Units** | **16** |
| | **Total Units** | **60** |

1. Any course not completed in the first semester should be taken in the second or a later semester.
2. Please see General Education/Graduation Requirement **course options (https://www.csus.edu/academic-affairs/curriculum-%20workflow/_internal/_documents/program-road-maps/als_2yr/art_transfer-%20roadmap-2024-25.pdf)**.
3. Please see an academic advisor for elective options.