# Department of Biology

# Bioinformatics

## I. Introduction

Bioinformatics major in SUSTC keeps pace with this fast-growing field in biology, and the curriculum covers equal amount of course works in biology, mathematics, and computer science. Students will develop skills across these disciplines to manipulate the wealth of data emerging from new omics technologies (e.g. next generation sequencing for genomics and mass spectrometry for proteomics).

## II. Objectives

Graduates from the Bioinformatics programs will have demonstrated:

a. A broad understanding of biology.

b. An ability to design bioinformatics algorithms and write bioinformatics programs/scripts.

c. An ability to develop hypotheses and to design simulations/experiments, models, and/or calculations to address these hypotheses.

d. The problem solving, analytical, and communication skills.

e. An ability to read, evaluates, interpret, and apply numerical and general scientific information.

f. An ability to read, write, and communicate in English.

**Careers –** Students of bioinformatics major graduates have excellent background for employment in industry, government, and academics.

## III. Period of Study and Degree Requirement

**Time length:** 4 years

**Degree conferred:** Bachelor of Science

**The minimum credit requirement for graduation:** 150.5 credits

## IV. Discipline

Bioinformatics

## V. Main Courses

For details please refer to General Education Required Courses, Major Required Courses (Table 1), Major Elective Courses (Table 2).

## VI. Practice-Based Courses

See Table 3

## VII. Course Structure and Credit Requirements

General Education (GE) Required Courses: 66.5 credits;

General Education (GE) Elective Courses: 10 credits;

Major Foundational Courses: 17 credits;

Major Core Courses: 20 credits;

Major Elective Courses: 27 credits;

Graduation Thesis/Projects, Research Projects: 10 credits;

The minimum credit requirement for graduation: 150.5 credits.

## VIII. Course Arrangement

### Table 1: Major Required Course (Foundational and Core Courses)

| Course Code | Course Name | Credits | Lab Credits | Hours/week | Terms | Advised term to take the course | Instruction language | Prerequisite | Dept. |
|---|---|---|---|---|---|---|---|---|---|
| BIO104 | General Biology Laboratory | 2 | 2 | 4 | Spr. | 1/Spr. | CH/EN | | BIO |
| BIO201 | Biochemistry（Macromolecules） | 3 | | 3 | Fall | 2/Fall | CH/EN | | BIO |
| CS203 | Data structures and algorithm analysis | 3 | 1 | 4 | Fall | 2/Fall | | | CS |
| BIO202 | Biochemistry（Metabolism） | 3 | | 3 | Spr. | 2/Spr. | CH/EN | BIO102 BIO201 | BIO |
| MA204 | Probability and Mathematical Statistics | 3 | | 3 | Spr. | 2/Spr. | | | MATH |
| BIO320 | Molecular Biology | 3 | | 3 | Spr. | 2/Spr. | CH/EN | | BIO |
| Total | | 17 | 3 | 20 | | | | | |
| BIO206 | Cell Biology | 4 | | 4 | Fall | 3/Fall | CH/EN | | BIO |
| BIO301 | Genetics | 3 | | 3 | Fall | 3/Fall | CH/EN | | BIO |
| BIO309 | Computational Biology | 3 | 1 | 4 | Fall | 3/Fall | CH/EN | | BIO |
| CS303 | Artificial intelligence | 3 | 1 | 4 | Fall | 3/Fall | | GE105 CS203 | CS |
| BIO304 | Systems Biology | 3 | | 3 | Spr. | 3/Spr. | CH/EN | GE103 BIO102 BIO201 BIO206 (or MA202) | BIO |
| BIO306 | Bioinformatics | 4 | 2 | 6 | Spr. | 3/Spr. | CH/EN | BIO309 | BIO |
| Total | | 20 | 4 | 24 | | | | | BIO |
| BIO480* | Projects of Science and Technology Innovation | 2 | 2 | 4 | | | | | BIO |
| BIO490 | Thesis | 8 | 8 | 16 | | | | | BIO |

## Table 2: Major Elective Courses

| Course Code | Course Name | Credits | Lab Credits | Hours /week | Terms | Instruction language | Prerequisite | Dept. |
|---|---|---|---|---|---|---|---|---|
| **Elective Courses in Computer Science** | | | | | | | | |
| GE201 | Introduction to Computer Science | 2 | | 2 | 1/Fall | CH/EN | | |
| **Elective Courses in Math** | | | | | | | | |
| MA108 | Program Design and Database | 3 | 1 | 4 | 2/Fall | | | MATH |
| MA201b | Ordinary Differential Equations（B） | 4 | | 4 | 2/Fall | CH/EN | GE101 GE102 GE103 MA104b (or MA101a MA102 GE103 MA104b) | MATH |
| MA206 | Mathematical Modelling | 3 | | 3 | 2/Spr. | | GE101 GE102 GE103 (0r MA101a MA102 GE103) | MATH |
| MA307 | Numerical Analysis | 3 | | 3 | 3/Fall | | GE101 GE102 GE103 MA104b (or MA101a MA102 GE103 MA104b) | MATH |
| **Elective Courses in Biomedical Engineering** | | | | | | | | |
| BIO106 | Introductory to Biomedical Engineering | 2 | | 2 | 1/Spr. | | | BME |
| **Elective Courses in Biology** | | | | | | | | |
| BIO211 | Basic Synthetic Biology and Laboratory | 2 | 1 | 3 | 1/Smr. | CH/EN | BIO102 | BIO |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BIO207 | Plant Physiology | 3 | | 3 | 2/Fall | CH/EN | BIO102 | BIO |
| BIO209 | Plant Physiology Laboratory | 2 | 2 | 4 | 2/Fall | CH/EN | BIO207 | BIO |
| BIO203 | Microbiology | 3 | | 3 | 2/Fall | CH/EN | | BIO |
| BIO205 | Microbiology Laboratory（BIO203） | 2 | 2 | 4 | 2/Fall | CH/EN | BIO102<br>BIO104<br>BIO203 | BIO |
| BIO222 | Biochemistry and Molecular Biology Laboratory | 2 | 2 | 4 | 2/Spr. | CH/EN | BIO102<br>BIO201<br>BIO203<br>BIO202 | BIO |
| BIO308 | Frontier in Life Sciences Seminar and Journal Club | 2 | | 2 | 2/Spr. | CH/EN | | BIO |
| BIO303 | Genetics Laboratory | 2 | 2 | 4 | 3/Fall | CH/EN | BIO301 | BIO |
| BIO331 | Protein Structure and Function | 3 | 1 | 4 | 3/Fall | CH/EN | BIO201 | BIO |
| BIO305 | Model Organism and Developmental Biology | 3 | | 3 | 3/Fall | CH/EN | BIO102 | BIO |
| BIO307 | Model organism and Developmental Biology Laboratory | 1 | 1 | 2 | 3/Fall | CH/EN | BIO305 | BIO |
| BIO311 | Animal Physiology | 3 | | 3 | 3/Fall | CH/EN | BIO103<br>BIO201<br>BIO202 | BIO |
| BIO313 | Animal Physiology Laboratory | 2 | 2 | 4 | 3/Fall | CH/EN | BIO104<br>BIO311 | BIO |
| BIO323 | Advanced Cell Biology（BIO206） | 2 | | 2 | 3/Spr. | CH/EN | BIO206 | BIO |
| BO208 | Cell Biology Laboratory | 2 | 2 | 4 | 3/Spr. | CH/EN | BIO102<br>BIO201<br>BIO203<br>BIO206 | BIO |
| BIO302 | Modern Biotechnology | 3 | 1 | 4 | 3/Spr. | CH/EN | BIO104<br>BIO201<br>BIO204<br>BIO206<br>BIO301 | BIO |
| BIO310 | Neurobiology | 3 | | 3 | 3/Spr. | CH/EN | BIO102<br>BIO201<br>BIO202<br>BIO206<br>BIO305 | BIO |
| BIO332 | Stem Cell and Regenerative Medicine | 2 | | 2 | 3/Spr. | CH/EN | BIO305 | BIO |
| BIO327 | Molecular Cell Biology Laboratory | 1 | 1 | 2 | 3/Smr. | CH/EN | BIO102<br>BIO201<br>BIO203<br>BIO204 | BIO |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | BIO206<br>BIO208 | |
| BIO330 | Biomolecular Crystallography（BIO331） | 2 | 1 | 3 | 3/Smr. | CH/EN | BIO331 | BIO |
| BIO334 | Advanced Techniques in Biological Microscopy | 2 | | 2 | 3/Smr. | CH/EN | | BIO |
| BIO401 | Genetic Engineering | 3 | | 3 | 4/Fall | CH/EN | BIO201<br>BIO202<br>BIO203<br>BIO206<br>BIO301 | BIO |
| BIO411 | Dynamical Systems Simulation in Biology | 3 | | 3 | 4/Fall | CH/EN | BIO102<br>BIO206<br>BIO201<br>GE101<br>GE102<br>GE103b | BIO |
| BIO405 | Immunology | 3 | | 3 | 4/Fall | CH/EN | BIO201<br>BIO202<br>BIO203<br>BIO206<br>BIO301 | BIO |
| Total | | 73 | 19 | 92 | | | | |
| A minimum of 27 credits MUST be taken to fulfill Major Requirements. | | | | | | | | |

## Table 3: Overview of Practice-Based Courses

| Course Code | Course Name | Credits | Lab Credits | Hours /week | Terms | Instruction language | Prerequisite | Dept. |
|---|---|---|---|---|---|---|---|---|
| BIO104 | General Biology Laboratory | 2 | 2 | 4 | Spr. | CH/EN | | BIO |
| BIO211 | Basic Synthetic Biology and Laboratory | 2 | 1 | 3 | Smr. | CH/EN | BIO102 | BIO |
| BIO209 | Plant Physiology Laboratory | 2 | 2 | 4 | Fall | CH/EN | BIO207 | BIO |
| BIO205 | Microbiology Laboratory（BIO203） | 2 | 2 | 4 | Fall | CH/EN | BIO102<br>BIO104<br>BIO203 | BIO |
| BIO204 | Biochemistry and Molecular Biology Laboratory | 2 | 2 | 4 | Spr. | CH/EN | BIO102<br>BIO201<br>BIO203<br>BIO202 | BIO |
| CS203 | Data structures and algorithm analysis | 3 | 1 | 4 | Fall | CH/EN | | BIO |
| BIO303 | Genetics Laboratory | 2 | 2 | 4 | Fall | CH/EN | BIO301 | BIO |
| BIO307 | Model organism and Developmental Biology Laboratory | 1 | 1 | 2 | Fall | CH/EN | BIO305 | BIO |
| BIO309 | Computational Biology | 3 | 1 | 4 | Fall | CH/EN | | BIO |
| BIO331 | Protein Structure and Function | 3 | 1 | 4 | Fall | CH/EN | BIO201 | BIO |
| BIO313 | Animal Physiology Laboratory（BIO311） | 2 | 2 | 4 | Fall | CH/EN | BIO104<br>BIO311 | BIO |
| BO208 | Cell Biology Laboratory | 2 | 2 | 4 | Spr. | CH/EN | BIO102<br>BIO201<br>BIO203<br>BIO206 | BIO |
| BIO302 | Modern Biotechnology | 3 | 1 | 4 | Spr. | CH/EN | BIO104<br>BIO201<br>BIO204<br>BIO206<br>BIO301 | BIO |
| BIO306 | Bioinformatics | 4 | 2 | 6 | Spr. | CH/EN | BIO309 | BIO |
| BIO327 | Molecular Cell Biology Laboratory | 1 | 1 | 2 | Smr. | CH/EN | BIO102<br>BIO201<br>BIO203<br>BIO206<br>BIO208<br>BIO204 | BIO |
| BIO330 | Biomolecular Crystallography | 2 | 1 | 3 | Smr. | CH/EN | BIO331 | BIO |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | （BIO331） | | | | | | | |
| BIO480 | Projects of Science and Technology Innovation | 2 | 2 | 4 | | | | |
| BIO490 | Thesis | 8 | 8 | 16 | | | | |
| **Total** | | 46 | 34 | 80 | | | | |

## Table 4: Overview of Course Hours and Credits

| **Course Category** | **Total Course Hours** | **Total Credits** | **The Minimum Credit Requirement** |
|---|---|---|---|
| General Education (GE) Required Courses | 1168 | 66.5 | 66.5 |
| General Education (GE) Elective Courses | 3144 | 182.5 | 10 |
| Major Foundational Courses | 320 | 17 | 17 |
| Major Core Courses | 384 | 20 | 20 |
| Major Elective Courses | 1520 | 74 | 27 |
| Graduation Thesis/Projects, Research Projects | 416 | 10 | 10 |
| Total | 6952 | 370 | 150.5 |