Computational Biology & Bioinformatics Minor (ENGR)

Description
This interdisciplinary minor prepares students to understand, use, and develop advanced computational methods and tools for processing, visualizing, and analyzing biological data and for modeling biological processes. Studies in computational biology and bioinformatics involve biosciences, computer science, engineering, mathematics, and statistics. Students will be prepared for careers in biomedical, biotechnology, agricultural, pharmaceutical, and engineering fields and for related graduate studies.

College Requirements

College Admission

College Entrance Requirements
Students must have high school credit for (one unit is equal to one high school year):

1. Mathematics – 4 units: 2 of algebra, 1 of geometry, and 1 of precalculus and trigonometry
2. English – 4 units
3. Natural sciences – 3 units that must include 1 unit of physics and 1 unit of chemistry (chemistry requirement waived for students in construction management)
4. Foreign language – 2 units of a single foreign language
5. Social studies – 3 units
6. Students having a composite ACT score of 28 or greater (or equivalent SAT score) will be admitted to the College of Engineering even if they lack any one of the following: trigonometry, chemistry, or physics.
7. Students having an ACT score of 19 or less in English (or equivalent SAT score) must take ENGL 150 Writing and Inquiry or ENGL 151 Writing and Argument.

A total of 16 units is required for admission.

Students must have an ACT (enhanced) score of 24 or greater (or equivalent SAT). Students who lack entrance requirements may be admitted based on ACT scores, high school rank and credits, or may be admitted to pre-engineering status in the Exploratory and Pre-Professional Advising Center. Pre-engineering students are advised within the Exploratory and Pre-Professional Advising Center.

Students for whom English is not their language of nurture must meet the minimum English proficiency requirements of the University.

Students who lack entrance units may complete precollege training by Independent Study through the University of Nebraska–Lincoln Office of On-line and Distance Education, in summer courses, or as a part of their first or second semester course loads while in the Exploratory and Pre-Professional Advising Center or other Colleges at Nebraska.

Students should consult their advisor, their department chair, or Engineering Student Services if they have questions on current policies.

Other Admission Requirements
Students who transfer to the University of Nebraska–Lincoln from other accredited colleges or universities and wish to be admitted to the College of Engineering (COE) must meet COE freshman entrance requirements and have a minimum cumulative GPA of 2.5 and be calculus-ready.

Students not meeting either of these requirements must enroll in the Explore Center or another University college until they meet COE admission requirements. Students transferring from UNO, UNL, or UNK to the College of Engineering must be in good academic standing with their institution.

The COE accepts courses for transfer for which a C or better grade was received. Although the University of Nebraska–Lincoln accepts D grades from the University of Nebraska at Kearney and at Omaha, not all majors in the COE accept such low grades. Students must conform to the requirements of their intended major and, in any case, are strongly encouraged to repeat courses with a grade of C- or less.

All transfer students must adopt the curricular requirements of the undergraduate catalog current at the time of transfer to the COE—not that in use when they entered the University of Nebraska–Lincoln. Upon admission to Nebraska, students wishing to pursue degree programs in the COE will be classified and subject to the policies defined in the subsequent section.

Students who were previously admitted to COE and are returning to the College of Engineering must demonstrate a cumulative GPA of 2.5 in order to be readmitted to COE.

College Degree Requirements

Grade Rules

Grade Appeals
In the event of a dispute involving any college policies or grades, the student should appeal to his/her instructor and appropriate department chair or school director (in that order). If a satisfactory solution is not achieved, the student may appeal his/her case through the College Academic Appeals Committee on his/her campus.

Catalog Rule
Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted at the University of Nebraska–Lincoln. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at Nebraska in the College of Engineering. Students must complete all degree requirements from a single catalog year. The catalog which a student follows for graduation.

Requirements for Minor Offered by Department

Eighteen (18) hours (not including prerequisites) of core courses and additional courses.

Prerequisite Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 109A</td>
<td>General Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; CHEM 109L</td>
<td>and General Chemistry I Laboratory (or equivalent)</td>
<td></td>
</tr>
<tr>
<td>LIFE 120</td>
<td>Fundamentals of Biology I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; LIFE 120L</td>
<td>and Fundamentals of Biology I laboratory</td>
<td></td>
</tr>
</tbody>
</table>
MATH 106 Calculus I (or equivalent) 5
Credit Hours Subtotal: 13

Core Courses 1
CSCE 155T Computer Science I: Informatics Focus 3
CSCE 311 Data Structures and Algorithms for Informatics 3
BIOS 337 Applications of Bioinformatics 4
STAT 218 Introduction to Statistics 2 or STAT 380 Statistics and Applications 3
Credit Hours Subtotal: 13

Life Science Course 3
Select a course from either LS 1 or LS 2 choices, depending on your major. 3-4

LS 1 – For students in life science majors.
BIOS 426 Systems Biology
BIOS 427 Practical Bioinformatics Laboratory
BIOS 456 / NRES 456 Mathematical Models in Biology
BIOS 477 Bioinformatics and Molecular Evolution

LS 2
BIOC 431 / BIO 431 / CHEM 431 Biochemistry I: Structure and Metabolism
BIOC 432 / BIO 432 / CHEM 432 Biochemistry II: Metabolism and Biological Information
BIOC 434 / AGRO 434 / BIO 434 / CHEM 434 Plant Biochemistry
BIOS 418 Advanced Genetics
BIOS 420 / Molecular Genetics
MBIO 420
BIOS 425 Plant Biotechnology
BIOS 429 Phylogenetic Biology
BIOS 472 Evolution
Credit Hours Subtotal: 3-4

Computer Science/Math/Statistics/Engineering (CMSE) Course 4
Select a course from either CMSE 1 or CMSE 2 choices, depending on your major. 3

CMSE 1 – For students in computer science, math, engineering, and related majors.
CSCE 471 Computational Methods in Bioinformatics

CMSE 2
BSEN 414 Medical Imaging Systems
CHME 473 Biochemical Engineering
CHME 474 Advanced Biochemical Engineering
CSCE 413 Database Systems
CSCE 421 Foundations of Constraint Processing
CSCE 423 Design and Analysis of Algorithms
CSCE 435 Cluster and Grid Computing
CSCE 456 Parallel Programming
CSCE 472 Digital Image Processing
CSCE 474 Introduction to Data Mining
CSCE 476 Introduction to Artificial Intelligence
CSCE 478 Introduction to Machine Learning
CSCE 479 Introduction to Deep Learning
ECEN 450 Bioinformatics
MATH 439 Mathematical Biology
MATH 452 Graph Theory
STAT 412 Advanced Statistical Design
STAT 450 Introduction to Regression Analysis
Credit Hours Subtotal: 3
Total Credit Hours 19-20

1 These requirements can be replaced with equivalent courses upon approval except for BIOS 337, which cannot be replaced.
2 Students are strongly encouraged to take STAT 218 or STAT 380. However, ECEN 305 can be used to satisfy this requirement, subject to approval.
3 For life science major students, those courses listed as LS Elective 2 cannot be used for CBB requirements.
4 For students in computer science, mathematics, engineering, and related majors, those courses listed as CMSE Elective 2 cannot be used for CBB requirements.

Grade Rules
C- and D Grades
A grade of C or above is required for all courses in the minor.

Pass/No Pass
No course taken Pass/No Pass will be counted toward the minor.