Kean University/Wenzhou-Kean University

**Minor in Bioinformatics**

***Descriptive Summary***

This 18-24 credit minor will introduce students majoring in Biology, Computer Science or Information Technology to the theory, methods, and applications of Bioinformatics by combining course work in biology and computer science. The topics covered in core courses provide an introduction to analysis of big data in health, ecology and evolution, research database management, computational analysis of DNA and proteins, computer modeling of biological molecules and processes, analysis of evolutionary patterns, and applications in biomedical and biotech areas such as epidemiology, genetic counseling or gene therapy. Computer Science or IT students in this minor will be required to complete two fundamental General Biology courses and one course on Genetics, since it is an important course for biotech applications. Required courses for Biology students are selected to provide essential training in computer programming and databases increasing students' chances to find a career in biotech industry.

***Student Learning Outcomes***

Upon completion of the program, students will be able to:

- Summarize the applications of Bioinformatics
- Apply bioinformatical methods to solve both fundamental and health-related biological problems in areas such as:
    - DNA duplication, transcription, translation and protein synthesis
    - Metabolism and photosynthesis
    - Genetics
    - Evolutionary biology and diversity of biological organisms
- Use scientific method of inquiry in Bioinformatics effectively, including:
    - Identifying relevant research questions
    - Formulating testable hypotheses from these research questions
    - Using computational approaches appropriate to address these questions
    - Critically assessing experimental results
    - Communicating results in the form of posters, presentations and reports
- Design and analyze Bioinformatics data sets, using the following skills:
    - Coding and using information systems for Bioinformatics
    - Using data structures required to appropriately process large data sets
    - Creating databases for data storage and retrieval
    - Mapping workflows for projects
- Learn to locate, process, and mange Bioinformatics databases using:
    - Publicly available online databases (e.g. NCBI, GenBank, PDB, etc.)
    - Data frames in Microsoft Excel
    - R for graphical assessment and downstream analyses

- Practice using bioinformatical software to answer research questions in biology. Software includes but not limited to:
    - Quality control software (e.g. FASTQC)
    - Visualization software (e.g. IGV)
    - Alignment Software and programs (e.g. MEGA)
    - Downstream comparative analyses (e.g. BioConductor)
    - Bioinformatic specific coding structure (e.g. BioPython)

This minor introduces students majoring in Biology, Computer Science or Information Technology to the theory, methods, and applications of bioinformatics and computational biology. The topics covered provide a strong introduction to:

- computer analysis of big data in health, genetics, ecology and evolution;
- research database management;
- computational analysis of DNA and proteins;
- computer modeling of biological molecules and processes;
- analysis of evolutionary patterns;
- applications in biomedical and biotech areas, e.g.
    - epidemiology
    - genetic counseling
    - gene therapy

**For more information** contact:

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2) Dr. Yunqi (Chloe) Zhao- yuzhao@kean.edu;

## Minor in Bioinformatics: for students majoring in Biology – 23-24 credits

*Students are required to complete the following GE course before choosing the Minor in Bioinformatics:*

| Course | Credit | Semester to be taken | Grade received |
|---|---|---|---|
| MATH 1054 Pre-Calculus | 3 | | |

## REQUIRED CORE COURSES (6 credits):

| Course | Credit | Semester to be taken | Grade received |
|---|---|---|---|
| BIO 2910 Essentials of Bioinformatics | 3 | | |
| BIO 3835 Biostatistics | 3 | | |

## ADDITIONAL REQUIRED COURSES (17-18 credits):

| Course | Credit | Semester to be taken | Grade received |
|---|---|---|---|
| CPS 1231 Fundamentals of computer science | 4 | | |
| MATH 2110 Discrete structures (*pre-req for CPS 2232/2240*) | 3 | | |
| CPS 2231 Computer Organization & Programming | 4 | | |
| CPS 2240 IT Data Structures (or CPS 2232 Data Structures) | 3-4 | | |
| **Select one of the following courses:**<br>TECH 3740 Database System Concepts and Applications<br>TECH 3750 Health Information Technology<br>CPS 3740 Database management systems | 3 | | |

## Optional courses – do not count towards the minor, but are of interest for students minoring in bioinformatics:

| Course | Credit | Semester to be taken | Grade received |
|---|---|---|---|
| BIO496X or CPS488X, Independent Study, Bioinformatics topic – selected with advisement | 1-3 | | |
| TECH 4750 Health Informatics | 3 | | |

## Minor in Bioinformatics: for students majoring in Computer Science, or Information Technology – 18 credits

*Students are required to complete the following GE course before choosing the Minor in Bioinformatics:*

| Course | Credit | Semester to be taken | Grade received |
|---|---|---|---|
| MATH 1054 Pre-Calculus | 3 | | |

## REQUIRED CORE COURSES (6 credits):

| Course | Credit | Semester to be taken | Grade received |
|---|---|---|---|
| BIO 2910 Essentials of Bioinformatics | 3 | | |
| BIO 3835 Biostatistics | 3 | | |

## ADDITIONAL REQUIRED COURSES (12 credits):

| Course | Credit | Semester to be taken | Grade received |
|---|---|---|---|
| BIO 1300 General Biology I | 4 | | |
| BIO 1400 General Biology II | 4 | | |
| BIO 3709 Genetics | 4 | | |

## Optional courses – do not count towards the minor, but are of interest for students minoring in bioinformatics:

| Course | Credit | Semester to be taken | Grade received |
|---|---|---|---|
| BIO496X or CPS488X, Independent Study, Bioinformatics topic – selected with advisement | 1-3 | | |
| TECH 4750 Health Informatics | 3 | | |

**Office of the Registrar** **KEAN UNIVERSITY**

**Name: _____**

**ID#: _____**

**MINOR in: _____**

**Semester Hours Required: _____**

**Required Courses**

| Department & Number | Course Title | Semester Hours | Grade or Projected Semester |
|---|---|---|---|
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |

**Elective Courses:**

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

**MINOR PROGRAM APPROVED BY: _____**

**(Department Advisor's Signature)**