**Major Curriculum Modification Proposal**

**Bachelor of Science**

**in**

**Biomedical Informatics**

Anticipated Effective Date: Spring 2020

**(Last Modified: 3/6/19)**

New York City College of Technology, CUNY

CURRICULUM MODIFICATION PROPOSAL

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New York City College of Technology, CUNY

CURRICULUM MODIFICATION PROPOSAL FORM

This form is used for all curriculum modification proposals. See the [Proposal Classification Chart](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-09-Proposal_Classification_Chart.pdf) for information about what types of modifications are major or minor. Completed proposals should be emailed to the Curriculum Committee chair.

|  |  |
| --- | --- |
| **Title of Proposal** | **Biomedical Informatics Program Curriculum Changes** |
| **Date** | **September 28, 2018** |
| **Major or Minor** | **Major** |
| **Proposer’s Name** | **Prof. Joanne Weinreb and the BIB Program Committee** |
| **Department** | **Biological Sciences Department** |
| **Date of Departmental Meeting in which proposal was approved** | **October 4, 2018** |
| **Department Chair Name** | **Prof. Andleeb Zameer** |
| **Department Chair Signature and Date** | **SIGN.png 10/8/18** |
| **Academic Dean Name** | **Dean Justin Vazquez-Poritz** |
| **Academic Dean Signature and Date** | **Picture 1 10/8/18** |
| **Brief Description of Proposal**  (Describe the modifications contained within this proposal in a succinct summary. More detailed content will be provided in the proposal body. | **We are proposing major changes to the Biomedical Informatics program. Modifications include changes to the list of required program-specific core courses and the list of upper level specialization electives; the number of credits for some courses; prerequisites for one course; the establishment of six new courses and revising the content of one course to address gaps in the modified sequence of courses; and update the internship course to streamline students’ culminating experience.** |
| **Brief Rationale for Proposal**  (Provide a concise summary of why this proposed change is important to the department. More detailed content will be provided in the proposal body). | **These modifications will strengthen the core curriculum and rationalize the sequence of courses in line with program objectives. New and revised courses should give students a firmer foundation for advanced study. The current Internship course will be reorganized to explicitly include, as one of the options, advanced research experience with program faculty, thereby addressing current issues and adding needed flexibility. Modifying the prerequisites for one course and changing the credit count for two courses should bring them in line with their respective course learning outcomes and syllabi.** |
| **Proposal History** | **New submission** |

Please include all appropriate documentation as indicated in the Curriculum Modification Checklist.

For each new course, please also complete the New Course Proposal and submit in this document.

Please submit this document as a single .doc or .rtf format. If some documents are unable to be converted to .doc, then please provide all documents archived into a single .zip file.

**ALL PROPOSAL CHECK LIST**

|  |  |
| --- | --- |
| Completed CURRICULUM MODIFICATION FORM including: |  |
| * Brief description of proposal | x |
| * Rationale for proposal | x |
| * Date of department meeting approving the modification | x |
| * Chair’s Signature | x |
| * Dean’s Signature | x |
| Evidence of consultation with affected departments  List of the programs that use this course as required or elective, and courses that use this as a prerequisite. | x |
| Documentation of Advisory Commission views (if applicable). |  |
| Completed [Chancellor’s Report Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-09-Chancellor_Report_Quick_Reference_Guide1.doc). | x |

**EXISTING PROGRAM MODIFICATION PROPOSALS**

|  |  |
| --- | --- |
| Documentation indicating core curriculum requirements have been met for new programs/options or program changes. |  |
| Detailed rationale for each modification (this includes minor modifications) |  |

**Brief Description of Proposal**

This document describes a proposal by the Biological Science Department for major changes to the Biomedical Informatics program (BIB). The primary purpose of these modifications is to further strengthen the curriculum by establishing a more comprehensive set of required core courses in line with the program’s learning objectives and with academic expectations set by the field. With this proposal, the Department aims to accomplish the following: establish core courses to reflect to the broad nature of the field of biomedical informatics; offer a list of elective courses that advance learning in chosen specializations; create new courses and revise existing courses to fill curricular gaps; integrate recently introduced courses offered by the department into the program; build on faculty research strengths; and provide students with greater flexibility in the required culminating internship/research course.

Specifically, the proposed changes to the Biomedical Informatics Curriculum include the following modifications:

* Consolidate the selection of tracks concentrating instead on the establishment of a global core curriculum for the major;
* Revision of the list of electives to reflect possible specializations within the field;
* Add a sequence of two new Biomedical Data Analytics courses to reflect new directions and technologies associated with translational sciences; (BIO3450 and BIO4450)
* Creation of one new course in Molecular Evolution and Phylogenetics (as an upper level elective); (BIO4250)
* Creation of one new course in Artificial Intelligence and the Brain (as a general education elective class). This class can also be taken as a Life and Physical Sciences pathways course. (BIO1020)
* Modification of the scope and description of the Internship/Research in Biomedical Informatics course BIO4900 (formerly MED3910) to encompass advanced research work with program faculty; This includes the addition of two classes BIO4910 and BIO4920 which are parts 1 and 2 of a 5 credit Independent Research Study.
* Necessary changes to the following courses to reflect their roles in the new core curriculum:
  + Bioinformatics I (BIO 3350) – modification of prerequisites
  + Programming for Biologists (BIO2110) – modification of prerequisites
  + Colloquium (BIO 4050) – modification of course description, scope and prerequisites
  + Computational Genomics (BIO 3354 now BIO 4150) – increase in the number of credits by creating a necessary lab component and change of course number
  + Molecular Modeling of Biological Molecules (BIO 3356 now BIO 4350) – increase in the number of credits by creating a necessary lab component and change of course number

**Rationale for Proposal**

There have been progressive changes made to the Biomedical Informatics Program curriculum in recent years, primarily in the Bioinformatics path. This proposal aims to incorporate some of the concepts from Medical Informatics into Bioinformatics as translational science and introduce the students to current analytic techniques being used to analyze this data. To this end we will be offering a common core of required courses and building the opportunity for specialization via an upper level electives requirement.

* The **Program-Specific Required Core** for the Biomedical Informatics program is built upon the technical/computational competencies and knowledge base.
* The **Upper Level Specialization Electives** contain courses that reflect the diverse applications of Biomedical Informatics, including advanced areas of Bioinformatics, as well as the translational applications that continue to emerge between the two fields.

This curricular design echoes the evolution of other programs in Biomedical Informatics and related fields in computational biology. For instance, in the Biomedical Informatics program at Stanford,[[1]](#footnote-1) students are trained broadly to expose them to the commonalities in computational approach while also allowing for the opportunity for more directed training towards a particular subfield of interest. Solid training in the molecular sciences and in fundamental methodologies of informatics should prepare our students in a diverse array of careers and further study.

Operationally, while the core of required courses will be stable for the foreseeable future, the upper level elective course list will see more flux as new courses are introduced that both respond to the changing trends of the field and reflect faculty research interests. By establishing this framework, the Department provides stability to the program curriculum while still allowing for flexibility when the need arises, and when new BIB-associated scientists join our faculty roster in the future to bring in their own research interests. Moreover, by removing the subdivisions in the curriculum student advisement should be greatly simplified.

The two major sections of the new BIB curriculum are discussed below.

1. Program-Specific Required Core Courses

Recently, the department has introduced new courses that adhere to the program learning outcomes and that broaden student competencies, specifically (a) a Genetics course (BIO 2450) which provides a foundation for molecular and clinical informatics; (b) a programming course (BIO 2110) which addresses workforce expectations in the field; (c) an introductory evolution course (BIO 2250) which affirms the central role of evolution in the biological sciences and particularly in bioinformatics; (d) and a Colloquium course (BIO 4050) which exposes students to experts from outside the college who are in the cutting edge of biomedical informatics research and industry. These courses have been successfully launched in the last academic year. We seek to capitalize on these essential courses in reorienting the curriculum to integrate our course roster into our students’ curricular experience.

The core competencies for Biomedical Informatics includes the following components:

* A strong foundation in the basic sciences, including Biology and Chemistry, which is fulfilled by the **General Education** requirements;
* Comprehensive computation technologies that serve as the tool box for informatics, including programming, database systems, and statistics, which are addressed by the **Computation Courses**;
* Advanced courses in molecular sciences, found in **Upper Level Biomolecular Sciences**, that include Genetics and Molecular & Cell Biology;
* Advanced courses in Biomedical Informatics, including Bioinformatics and Biomedical Data Analytics, found in **Biomedical Informatics Core Courses**;
* A culminating experience for students with real-world applications of biomedical informatics, fulfilled by the **Internship/Research in Biomedical Informatics** requirement.

The core competencies described above include a “depth of informatics method” that is deemed necessary to navigate the field.[[2]](#footnote-2) Moreover, a deliberate exposure to a broad experience in both the molecular and health informatics domains (as embodied in the Biomedical Informatics Core Courses) follows recommendations for an integrative and interdisciplinary approach at the earliest possible opportunity in a student’s education.[[3]](#footnote-3)

1. Specialization Courses

The courses included in this section reflect the diverse applications of biomedical informatics in biomedical and health sciences, both in research and in professional domains. These include advanced courses in structural biology, genomics, biomedical data analytics, and phylogenetics. Coincidentally, these courses reflect current department faculty strengths and interests.

The Department envisions this list of specialization courses to expand in the coming years. With this proposed framework for advanced courses, our BIB-associated faculty will be encouraged to propose new courses that utilize their expertise and respond to market needs. New faculty hires could bring fresh ideas into the program and the list of courses can grow organically.

The over-all curriculum adheres to a consensus of core competencies for the field, specifically in the computational, biological, statistical and mathematical, and biomedical informatics skill categories.[[4]](#footnote-4) While we are no longer offering individual tracks, the students are being given the opportunity to explore the two fields sufficiently. Within the core of the program we will be covering the skills that are essential to any student looking to enter the biomedical informatics fields. The students will still have the ability to choose to take the specific medical informatics courses as General Education Elective classes and as free electives. Additionally, they can explore their future career options by choosing between the Specialization course.

We feel that this will help both streamline advising as well as help the students find internships. Some initial feedback we have gotten from students was that they wished to explore both concentrations further before being asked to make a choice between tracks. For the students looking to find an internship, having all the combined informatics skill will open up their opportunities to more positions.

We cannot guarantee that all students will always secure outside internships since there is an application process in which they are evaluated and chosen by other institutions. To help those students we are tackling this with a two-part Independent Study. The purpose of the first part will be to teach the student to do a comprehensive literature review of the subject of their research and write the proposal and introduction portions of their research project. The second part will be actually conducting the research, analyzing the results and writing the rest of the paper. This research project whether done externally as an internship, or internally as a two-part independent research study with a faculty member, will be the capstone experience of a research focused program.

The detailed course and credit distributions of the proposed curriculum are outlined below. A course diagram is also attached to give a sense of the course sequence vis-à-vis prerequisites.

**PROPOSED BIOMEDICAL INFORMATICS CURRICULUM**

The curriculum reflects City Tech’s General Education requirements:

|  |  |
| --- | --- |
| **General Education Common Core** | **42 credits** |
| **Required BIB Core** | **62 credits** |
| **BIB Specialization courses** | **11-12 credits** |
| **Suggested Electives** | **4-5 credits** |
| **TOTAL** | **120 credits** |

**General Education (62 credits total)**

|  |  |  |
| --- | --- | --- |
| **Required Common Core (12 credits)** | | |
| English Composition 1 | ENG 1101 | 3 |
| English Composition 2 | ENG 1121 | 3 |
| Quantitative Reasoning | Any | 3 |
| Life & Physical Sciences | Any | 3 |
| **Flexible Common Core (18 credits)** | | |
| World Cultures & Global Issues | Any | 3 |
| US Experiences in its Diversity | Any | 3 |
| Creative Expression | Any | 3 |
| Individual and Society | Any | 3 |
| Scientific World | Any | 3 |
| Additional Flex Core Course | Any | 3 |
| **College Option (12 credits)** | | |
| Speech/Oral Communication | Any | 3 |
| Interdisciplinary Course | Any | 3 |
| Additional LA Course I | Any | 3 |
| Additional LA Course II | Any | 3 |

**Program-Specific Courses (78 credits total)**

**A. Required Core BIB Courses**

|  |  |  |
| --- | --- | --- |
| **Biomolecular Sciences Courses (24 credits)** | | |
| BIO 1101 | Biology I | 4 |
| BIO 1201 or BIO 1201ID | Biology II (ID section recommended) | 4 |
| CHEM 1110 | General Chemistry I | 4 |
| CHEM 1210 | General Chemistry II | 4 |
| BIO 2450 | Genetics | 4 |
| BIO 3620 | Molecular and Cell Biology | 4 |
| **Computation Courses (20 credits)** | | |
| CST 1101 | Problem Solving with Computer Programming | 3 |
| CST 1201 | Programming Fundamentals | 3 |
| CST 1204 | Database Systems Fundamentals | 3 |
| BIO 2110 | Programming for Biologists | 4 |
| MAT 1475 | Calculus I | 4 |
| MAT 1372 | Statistics with Probability | 3 |
| **Biomedical Informatics Core Courses (13 credits)** | | |
| BIO 3350 | Bioinformatics I | 4 |
| BIO 3352 | Bioinformatics II | 4 |
| BIO 3450 | Biomedical Data Analytics I | 4 |
| BIO 4050 | Colloquium | 1 |
| **Internship/Research in Biomedical Informatics (5 credits)** | | |
| BIO 4900  OR  BIO 4910  AND  BIO 4920 | Internship/Research in Biomedical Informatics  Independent Research Study; Information Literacy  Independent Research Study; Guided Research | 5  2  3 |

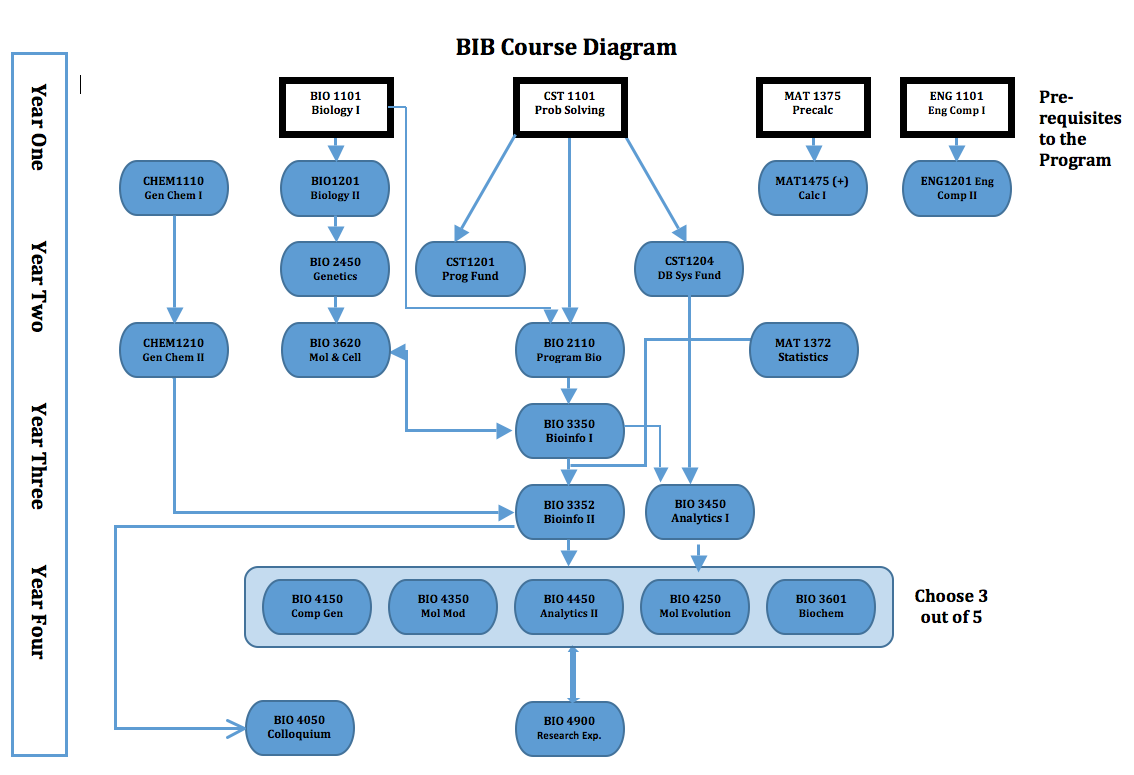
**B. BIB Specialization Courses**

|  |  |  |
| --- | --- | --- |
| **Biomedical Informatics Specialization Courses (choose at least 3 courses)** | | |
| BIO 4150 | Computational Genomics | 4 |
| BIO 4350 | Molecular Modeling of Biological Molecules | 4 |
| BIO 4450 | Biomedical Data Analytics II | 4 |
| BIO 3601 | Biochemistry | 4 |
| BIO 4250 | Molecular Evolution & Phylogenetics | 3 |

**C. Suggested Courses For Free Electives**

|  |  |  |
| --- | --- | --- |
| **Suggested Courses for Free Electives to bring the total credits up to 120** | | |
| BIO 1020 | Artificial Intelligence and the Brain | 3 |
| BIO 2250 | Evolution | 3 |
| BIO 2311 | Anatomy & Physiology I | 4 |
| BIO 2312 | Anatomy & Physiology II | 4 |
| BIO 3302 | Microbiology | 4 |
| CST 2309 | Web Programming I | 3 |
| CST 2409 | Web Programming II | 3 |
| CST 3504 | Database Design | 3 |
| CHEM 2223 | Organic Chemistry I | 5 |
| CHEM 2323 | Organic Chemistry II | 5 |
| HSA 3510 | Health Services Management 1 | 3 |
| MAT 1575 | Calculus II | 4 |
| MAT 2440 | Discrete Structures and Algorithms I | 3 |
| MAT 2540 | Discrete Structures and Algorithms II | 3 |
| MED 2400 | Medical Informatics Fundamentals | 3 |
| MED 4229 | Healthcare Databases | 3 |
| PHYS 1441 | General Physics I: Calculus Based | 5 |
| PHYS 1442 | General Physics II: Calculus Based | 5 |
| PHIL 2203 or PHIL2203ID | Health Care Ethics | 3 |

It should be noted that the revised curriculum can also accommodate all **Pre-Med and Pre-Health requirements** for those interested in pursuing advanced professional health degrees *without* exceeding the 120 credit requirement if the correct Gen Ed courses and electives are chosen. The proposed changes should also streamline Pre-Med advisement.

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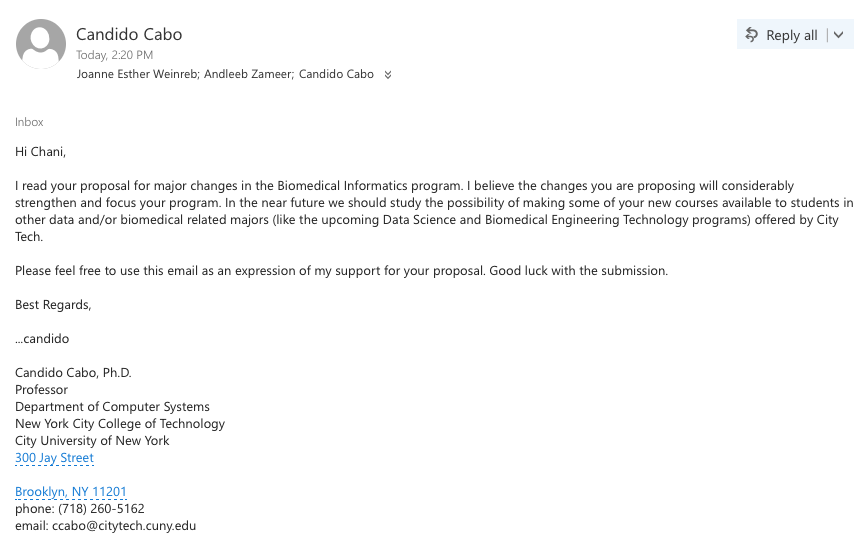
**Department Approval**

Proposal was approved at the biological sciences department meeting on October 4,2018. Minutes from the meeting are available upon request.

**Consultation with Affected Departments**

There are currently 4 courses within the Biomedical Informatics program that are being offered in other departments. MED2400 and MED4229 are elective courses within the new Big Data degree offered by the CST department. These courses are not being modified. The modification to BIO3350 is just modifying a pre-requisite of BIO 3620 to be either a pre or co-requisite.

Below is a letter from Professor Candido who is from the Computer Science department and who is involved in both the Biomedical Engineering and Technology program and the Data Science programs.



**Programmatic Learning Outcomes**

**General Education Learning Outcomes**

1. Employ scientific reasoning and logical thinking.
2. Communicate in diverse settings and groups, using written, oral, and visual means.
3. Demonstrate an understanding of professional and ethical responsibility.
4. Acquire tools for lifelong learning – how to learn, how they learn, knowledge of resources.

**Discipline-Specific Learning Outcomes1**

1. Acquire competency in general biological sciences.
2. Employ knowledge of the fundamentals of computer programming and databases.
3. Use quantitative reasoning to apply statistical methods and mathematical modeling in the analysis of biomedical datasets.
4. Demonstrate the ability to apply the process of science to develop problem-solving strategies, including hypothesis generation, evaluation of results, and formulation of potential applications.
5. Demonstrate the ability to effectively communicate complex biomedical concepts within and across disciplinary boundaries.
6. Apply fundamental biomedical informatics principles and methods within an area of practice.

Brownell, S. E., Freeman, S., Wenderoth, M. P., & Crowe, A. J. (2014). BioCore Guide: A Tool for Interpreting the Core Concepts of Vision and Change for Biology Majors. *CBE Life Sciences Education*, *13*(2), 200–211. http://doi.org/10.1187/cbe.13-12-0233

Mapping Learning Outcomes and Concepts to Courses

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course** | **a** | **b** | **c** | **d** | **f** | **g** | **h** | **i** | **j** |
| BIO1101 | x |  | x | x | x |  | x |  |  |
| BIO1201 | x |  | x | x | x |  | x |  |  |
| BIO2110 | x | x | x | x |  | x | x |  | x |
| BIO2250 | x | x | x | x | x |  | x |  |  |
| BIO2450 | x | x | x | x | x |  | x |  |  |
| BIO3620 | x | x | x | x | x | x | x |  | x |
| BIO3450 | x | x | x | x |  | x | x |  | x |
| BIO3350 | x | x | x | x | x | x | x |  | x |
| BIO3352 | x | x | x | x | x | x | x |  | x |
| BIO3601 | x |  | x | x | x |  | x |  |  |
| BIO4050 | x | x | x | x | x |  | x | x | x |
| BIO4150 | x | x | x | x | x | x | x |  | x |
| BIO4250 | x | x | x | x | x |  | x |  | x |
| BIO4350 | x | x | x | x | x | x | x |  | x |
| BIO4450 | x | x | x | x | x | x | x |  | x |
| BIO4900 | x | x | x | x | x |  | x | x | x |
| CHEM1110 | x |  |  | x | x |  | x |  |  |
| CHEM1210 | x |  |  | x | x |  | x |  |  |
| MAT1475 | x |  |  | x |  |  | x |  |  |
| MAT1372 | x |  |  | x |  |  | x |  |  |
| CST 1101 |  |  |  | x |  | x | x |  |  |
| CST1201 |  |  |  | x |  | x | x |  |  |
| CST1204 |  |  |  | x |  | x | x |  |  |
| Common core | x |  | x | x |  |  | x |  |  |

**Year by year suggested coursework**

|  |  |  |  |
| --- | --- | --- | --- |
| **Year 1** | **Undeclared major** | **Credits** | **Double Duty/ Notes** |
| **TERM 1** |  |  |  |
| ENG 1101 | English Comp I | 3 |  |
| MAT 1375 | Precalculus | 4 | Math & Quant |
| BIO 1101 | Biology 1 | 4 | Life & Physical Sciences |
| Any | US Experience in its Diversity | 3 |  |
| Total Credits |  | 14 |  |
|  | | | |
| **TERM 2** |  |  |  |
| BIO 1201 | Biology II | 4 |  |
| ENG 1121 | English Comp II | 3 |  |
| CHEM1110 | General Chemistry l | 4 | Scientific World |
| Any | Speech and Oral Communication | 3 |  |
| CST 1101 | Programming Fundamentals I | 3 |  |
| Total Credits |  | 17 |  |
|  |  |  |  |
| **YEAR 1** **TOTAL Accumulated Degree Credits:** | | **31** |  |
|  | | | |
| ***The student maintains a 2.5 GPA or higher - they enter the program*** | | | |
| **YEAR 2 Biomedical Informatics Major** | | |  |
| **TERM 3** |  |  |  |
| BIO 2450 | Genetics | 4 |  |
| CST1201 | Programming Fundamentals | 3 |  |
| MAT 1475 | Calculus 1 | 4 | One additional Flex Core |
| Any | Creative Expression | 3 |  |
| Total Credits |  | 14 |  |
|  | | | |
| **TERM 4:** |  |  |  |
| BIO 3620 | Molecular and Cellular Biology | 4 |  |
| BIO 2110 | Programming for Biologists | 4 |  |
| CHEM1210 | General Chemistry 2 | 4 | LAS |
| ANY | Individual & Society | 3 |  |
| Total Credits |  | 15 |  |
|  |  |  |  |
| **YEAR 2 TOTAL Accumulated Degree Credits:** | | **60** |  |
|  | | | |
| **TERM 5:** |  |  |  |
| BIO 3350 | Bioinformatics I | 4 |  |
| CHEM 2223 | Organic Chemistry 1 | 5 | Upper LAS |
| CST 1204 | Database Systems Fundamentals | 3 |  |
| MAT 1372 | Statistics | 3 | Special section |
| Total Credits |  | 15 |  |
|  | | | |
| **TERM 6:** |  |  |  |
| BIO 3352 | Bioinformatics II | 4 |  |
| BIO 3450 | Biomedical Data Analytics I | 4 |  |
| ANY | World Cultures | 3 |  |
| ANY **\*\*** | Electives | 4 |  |
| Total Credits |  | 15 |  |
|  | | | |
| **YEAR 3 TOTAL Accumulated Degree Credits:** | | **90** |  |
|  | | | |
| **TERM 7:** |  |  |  |
| Choose 3 of 5 | Specialization course | 4 |  |
| Choose 3 of 5 | Specialization course | 4 |  |
| Choose 3 of 5 | Specialization course | 4 |  |
| BIO 4050 | Colloquium | 1 |  |
| ANY | Interdisciplinary | 3 |  |
| Total Credits |  | 16 |  |
|  | | | |
| **TERM 8** |  |  |  |
| BIO 4900 | Internship | 5 |  |
| **Finish up electives \*\*** |  | 9 |  |
| Total Credits |  | 14 |  |
| **YEAR 4 TOTAL Accumulated Degree Credits:** | | **120** | **GRADUATION** |

**\*\*** A student can use these 13 credits to complete the course work suggested for pre-med students. This would include Organic Chemistry 2 (5 credits), Physics 1 and 2 (10 credits). Additionally they can take Biochemistry as one of their specialization courses.

**Student Survey**

We conducted a survey to determine the students’ interest in the modifications that we are proposing. The students were asked to identify their interest in the program as being Bioinformatics, Medical Informatics or Biomedical Informatics. Additionally, we asked them to rate their interest in the four new courses that are being proposed. While we included the Artificial Intelligence and the Brain course in our survey, please note that it is available to our students as a pathways course and is not required by the program.

We received 69 responses to our survey. There was a high level of interest displayed for all four new courses. They identified their interest on a Likert-type scale from 1-10, with 1 indicating little to no interest and 10 a high level. The Biomedical Data Analytics I course is the only course that will be required in this proposed change. Biomedical Data Analytics II and Molecular Evolution and Phylogenetics are being offered as upper level elective courses.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Course | Biomedical Data Analytics I (BIO3450) | Biomedical Data Analytics II (BIO4450) | Molecular Evolution & Phylogenetics (BIO4250) | Artificial Intelligence and the Brain  (BIO 1020) |
| Average score | 7.7 | 7.2 | 6.2 | 8.2 |

Biomedical Informatics was chosen by 36% of the students polled. As we are proposing to remove the specific concentration we were glad to see that was the largest (albeit by a small margin) percentage.

What follows are charts which break down the course preferences by program preference identified.

First we will discuss the largest block of students, those who chose Biomedical Informatics as their program. They show an almost unanimous interest in the two Biomedical Data Analytics courses with an overall positive but more mixed result for Evolution. This correlates with our understanding of these students interest in the truly biomedical aspects of this field. These students would most likely choose the Biomedical Data Analytics II course as an upper level elective and may choose the Molecular Evolution class also.

To further understand the next largest group of students we looked at the numbers of the students who chose Bioinformatics. The counts for all three courses are almost identical. There is a small group of students who are indicating a low level of interest in these courses. The only required course is the Biomedical Data Analytics I that introduces Medical Informatics concepts. As the vast majority of these students showed strong interest in all three courses this indicates support for the modification to the program.

We wanted to understand better the interest of the students who chose Medical Informatics as their interest in the proposed changes that would stress Biomedical Informatics. As expected they show a high level of interest in Biomedical Data Analytics I. The Biomedical Data Analytics II course shows the translational aspect of the proposed modification. In this course students will understand how the Bioinformatic data can be brought forward into the medical decision making process. The results show that only a very small percentage of students showed low interest. Their interest in Molecular Evolution, a pure Bioinformatics course, further shows support that this group still shows an interest in Biomedical Informatics.

These results indicate to us an overall interest of our current base of students in the changes that we are proposing. A final promising note is that a number of students approached us after taking the survey inquiring as to whether they would be able to take some of the courses proposed.

**CHANCELLOR’S REPORT FORM**

**Section AIII: Changes in Degree Programs**

**AIII.1. The following revisions are proposed for the Biological Sciences Department**

**Program: Bachelor of Science in Biomedical Informatics**

**Program Code:**

**Effective: Spring 2020**

**Establishment of a global core curriculum for the program with electives to reflect possible specializations within the field.**

|  |  |
| --- | --- |
| **FROM:** | **TO:** |
| **REQUIRED COURSES IN THE MAJOR Credits**  **General Education Common Core**: 42 credits  **I – Required Core 1 (4 courses, 12 credits)**  **English Composition (2 courses, 6 credits)**  **ENG 1101 English Composition I 3**  **ENG 1121 English Composition II 3**  **Mathematical and Quantitative Reasoning1,2 3**  **Life and Physical Sciences 1,2 3**  **II – Flexible Core (6 courses, 18 credits) From the list of approved courses, select one course from each of the following areas; no more than two courses may be selected from any discipline.**    **World Cultures and Global Issues 3**  **US Experience in its Diversity 3**  **Creative Expression 3**  **Individual and Society 3**  **Scientific World1 3**  **One additional course from any Flexible Core area1 3**  **III - College Option requirement (12-13 credits)**  **One course in speech/ oral communication 3**  **One interdisciplinary liberal arts and sciences course1 3**  **Two additional liberal arts courses1,3 to reach a minimum total of 42 credits in general education. In meeting their general education requirements overall, students must take at least one advanced liberal arts course1,3 or two sequential courses in a foreign language. 6**  **Writing Intensive Requirement**  **Students at New York City College of Technology must complete two courses designated WI for the associate level, one from GenEd and one from the major; and two additional courses designated WI for the baccalaureate level, one from GenEd and one from the major.**  **PROGRAM-SPECIFIC DEGREE REQUIREMENTS 7~~0~~-75 CREDITS**  **Biomedical Informatics Core 37-38**  **Biological Sciences and Molecular Informatics 12**  **BIO 1101 Biology I 4**  **BIO 1201 Biology II 4**  **BIO 2450 Genetics 4**  **Math and Computer Science 13-14**  **MAT 1475 Calculus I4 4**  **MAT 1372 Statistics with Probability**  **or**  **MAT 2572 Probability and Mathematical Statistics 3/4**  **CST 1101 Problem Solving with Computer Programming 3**  **CST 1201 Programming Fundamentals**  **or**  **CST 2403 C++ Programming I 3**  **Biomedical Informatics Courses 12**  **~~BIO 2000 Intro to Biomedical Informatics 2~~**  **BIO 2110 Programming for Biologists 4**  **BIO 4050 Colloquium 1**  **MED 3910 Internship 5**  **~~Students must complete all courses in one of the following concentrations~~:**  **~~Concentration 1: Bioinformatics~~**  **~~Bioinformatics Concentration Courses 25-30~~**  **~~Required Courses 19-20~~**  **BIO 3620 Molecular and Cell Biology 4**  **CHEM1110 General Chemistry I 4**  **CHEM1210 General Chemistry II**  **~~Or~~**  **~~BIO 2250 Evolution~~**  **~~Or~~**  **CST 1204 Database System Fundamentals 3/4**  **BIO 3350 Bioinformatics I 4**  **BIO 3352 Bioinformatics II 4**  **~~Concentration Electives~~**  **~~Choose 2 courses from the following list 6-10~~**  **BIO ~~3354~~ Computational Genomics ~~3~~**  **BIO ~~3356~~ Molecular Modeling ~~in Biology 3~~**  **~~BIO 3302 Microbiology 4~~**  **BIO 3601 Biochemistry 4**  **~~CHEM 2223 Organic Chemistry I 5~~**  **~~CHEM 2323 Organic Chemistry II 5~~**  **~~Concentration 2: Medical Informatics~~**  **~~Medical Informatics Concentration Courses 29-30~~**  **~~Required Courses 20~~**  **~~BIO 2311 Anatomy and Physiology I 4~~**  **~~BIO 2312 Anatomy and Physiology II 4~~**  **~~MED 2400 Medical Informatics Fundamentals 3~~**  **~~MED 4229 Healthcare Databases 3~~**  **CST 1204 Database System Fundamentals 3**  **~~PHIL 2203 Health Care Ethics 3~~**  **~~Concentration Electives~~**  **~~Choose a minimum of 9 credits 9-10~~**  **~~HSA 3510 Health Services Management 3~~**  **~~HSA 3602 Health Services Management II 3~~**  **~~HSA 3630 Healthcare Finance 3~~**  **~~HSA 4910 Introduction to Public Health 3~~**  **~~CST 2307 Networking Fundamentals 3~~**  **~~BIO 3302 Microbiology 4~~**  **~~BIO 3526 Pathophysiology 3~~**  **BIO 3601 Biochemistry 4**  **~~CHEM 2223 Organic Chemistry I 5~~**  **~~CHEM 2323 Organic Chemistry II 5~~**  **Elective Credits to equal 1205**  **The number of elective credits will vary depending upon the program-specific courses students use to meet Common Core requirements. Students may choose any recommended electives from the below lists. ~~Alternative elective substitutions may be permitted with departmental permission via a course substitution form~~. The choice of electives should ideally reflect the student’s interests, post-baccalaureate study plans, and career goals.**    **~~ANY BIO/MED class not included in program concentration~~**  **BIO2311 Anatomy & Physiology I 4**  **BIO2312 Anatomy & Physiology II 4**  **BIO 3350 Bioinformatics I 4**  **BIO 3352 Bioinformatics II 4**  **BIO 3354 Computational Genomics 3**  **BIO 3356 Molecular Modeling in Biology 3**  **BIO 3302 Microbiology 4**  **BIO 3526 Pathophysiology 3**  **BIO 2250 Evolution 3**  **BIO 3524 Nutrition 2**  **BIO 3601 Biochemistry 4**  **MED 2400 Medical Informatics Fundamentals 3**  **MED 4229 Healthcare Databases 3**  **Courses from other Science Departments**  **CHEM 1110 General Chemistry 4**  **CHEM 1210 General Chemistry II 4**  **CHEM 2223 Organic Chemistry I 5**  **CHEM 2323 Organic Chemistry II 5**  **CHEM 4822 Medicinal Chemistry 3**  **PHYS 1441 General Physics I: Calculus Based 5**  **PHYS 1442 General Physics II: Calculus Based 5**  **Health Service Administration Courses**  **HSA 3510 Health Svc Man 1 3**  **HSA 3602 Health Services Management II 3**  **HSA 3630 Health Care Finance & Accounting Management 3**  **HSA 4910 Introduction to Public Health Administration 3**  **Computer Systems Courses**  **CST 1215 Operating Systems Fundamentals 3**  **CST 2307 Networking Fundamentals 3**  **CST 2309 Web Programming I 3**  **CST 2405 System Administration (Windows) 3**  **CST 2415 System Administration (UNIX/Linux) 3**  **CST 2406 Introduction to Systems Analysis and Design 3**  **CST 2409 Web Programming II 3**  **CST 2410 Introduction to Computer Security 3**  **CST 3503 C++ Programming Part II 3**  **CST 3504 Design of Microcomputer Databases 3**  **CST 3513 Object-Oriented Programming in Java 3**  **CST 3603 Object-Oriented Programming 3**  **CST 3604 Quality Database Implementation 3**  **CST 3610 Network Security Fundamentals 3**  **CST 3613 Application Development with Databases 3**  **Math Courses**  **MAT 1476L Calculus Laboratory 1**  **MAT 1575 Calculus II 4**  **MAT 2440 Discrete Structures and Algorithms I 3**  **MAT 2540 Discrete Structures and Algorithms II 3**  **MAT 2580 Introduction to Linear Algebra 3**  **MAT 2675 Calculus III 4**  **MAT 2680 Differential Equations 3**  **MAT 3672 Probability and Mathematical Statistics II 4**  **MAT 2071 Introduction to Proofs & Logic 4**    **Total General Education Common Core credits: 42**  **Total program-specific required and elective credits: 78**  **Total Credits for Degree: 120**  **1 Students are strongly urged to consult degree requirements for “double-duty” courses: degree requirements that also meet CUNY Pathways general education requirements in that category.**  **2 Biomedical Informatics is a STEM degree program, requiring 4- or 5-credit courses in mathematics and science. Students may elect to use their required 4- or 5-credit Math or science courses to meet Common Core requirements in Mathematical and Quantitative Reasoning, Life/ Physical Sciences, or Scientific World.**  **3Complete lists of liberal arts and sciences courses and advanced liberal arts courses, as well as semester-specific lists of interdisciplinary courses and writing intensive courses, are available online at the City Tech Pathways website.**  **~~4 Students who do not have sufficient background in mathematics to place into MAT1475 can take MAT1275 and MAT1375  to satisfy the Math and Quantitative Reasoning and Scientific World and elective requirements in order to complete the degree with no more than 120 credits~~**  **~~5~~ The number of free elective credits will vary depending upon the program-specific courses students use to meet Common Core requirements.**  **~~6 In order for students to be qualified to take these courses they must take Chem I and Chem II as either elective credits or as part of their general education choices.~~** | **REQUIRED COURSES IN THE MAJOR Credits**    Students must complete a minimum of 60 credits in General Education. Many of these credits can be accomplished by taking program required courses.  **PROGRAM-SPECIFIC DEGREE REQUIREMENTS 73-75 CREDITS**  **Biomolecular Science Courses 24**  **BIO 1101 Biology I 4**  **BIO 1201 Biology II 4**  **BIO 2450 Genetics 4**  **BIO 3620 Molecular and Cell Biology 4**  **CHEM1110 General Chemistry I 4**  **CHEM1210 General Chemistry II 4**  **Math and Computer Science 16-17**  **MAT 1475 Calculus I 4**  **MAT1372 Statistics with Probability 3**  **or**  **MAT2572 Probability and Mathematical Statistics 4**  **CST1101 Problem Solving with Computer Programming 3**  **CST1201 Programming Fundamentals**  **or**  **CST2403 C++ Programming I 3**  **CST1204 Database System Fundamentals 3**  **Biomedical Informatics Core Courses 17**  **BIO2110 Programming for Biologists 4**  **BIO 3350 Bioinformatics I 4**  **BIO 3352 Bioinformatics II 4**  **BIO 3450 Biomedical Data Analytics I 4**  **BIO 4050 Biomedical Informatics Colloquium 1**  **Research Experience 5**  **BIO 4900 Internship/Research in Biomedical Informatics 5**  **or**  **BIO 4910 Independent Research Study: Information Literacy 2**  **and**  **BIO 4920 Independent Research Study: Guided Research 3**  **Biomedical Informatics Specialization Courses**  **Choose 3 courses from the following list 11-12**  **BIO 4150 Computational Genomics 4**  **BIO 4350 Molecular Modeling of**  **Biological Molecules 4**  **BIO 4450 Biomedical Data Analytics II 4**  **BIO 3601 Biochemistry 4**  **BIO 4250 Molecular Evolution and Phylogenetics 3**  **Suggested Elective Credits to equal 1204**  **The number of elective credits will vary depending upon the program-specific courses students use to meet Common Core requirements. Students are encouraged to choose electives from the below lists. The choice of electives should ideally reflect the student’s interests, post-baccalaureate study plans, and career goals.**      **BIO 1020 Artificial Intelligence and the Brain 3**  **BIO 2250 Evolution 3**  **BIO 2311 Anatomy and Physiology I 4**  **BIO 2312 Anatomy and Physiology II 4**  **BIO 3302 Microbiology 4**  **BIO 3526 Pathophysiology 3**  **Courses from other Science Departments**  **CHEM 2223 Organic Chemistry I 5**  **CHEM 2323 Organic Chemistry II 5**  **CHEM 4822 Medicinal Chemistry 3**  **MED 2400 Medical Informatics Fundamentals 3**  **MED 4229 Healthcare Databases 3**  **PHYS 1441 General Physics I: Calculus Based 5**  **PHYS 1442 General Physics II: Calculus Based 5**  **Health Service Administration Courses**  **HSA 3510 Health Services Management 3**  **HSA 3602 Health Services Management II 3**  **HSA 3630 Health Care Finance &**  **Accounting Management 3**  **HSA 4910 Introduction to Public Health Administration 3**  **Computer Systems Courses**  **There are many CST courses that would be appropriate for our students to take.**  **Math Courses**  **MAT 1476L Calculus Laboratory 1**  **MAT 1575 Calculus I 4**  **MAT 2440 Discrete Structures and Algorithms I 3**  **MAT 2540 Discrete Structures and Algorithms II 3**  **MAT 2580 Introduction to Linear Algebra 3**  **MAT 2675 Calculus III 4**  **MAT 2680 Differential Equations 3**  **MAT 3672 Probability and Mathematical Statistics II 4**  **MAT 2071 Introduction to Proofs & Logic 4**    **Total General Education Common Core credits: 42**  **Total program-specific required and elective credits: 78**  **Total Credits for Degree: 120**  **1 Students are strongly urged to consult degree requirements for “double-duty” courses: degree requirements that also meet CUNY Pathways general education requirements in that category.**  **2 Biomedical Informatics is a STEM degree program, requiring 4- or 5-credit courses in mathematics and science. Students may elect to use their required 4- or 5-credit Math or science courses to meet Common Core requirements in Mathematical and Quantitative Reasoning, Life/ Physical Sciences, or Scientific World.**  **3 Complete lists of liberal arts and sciences courses and advanced liberal arts courses, as well as semester-specific lists of interdisciplinary courses and writing intensive courses, are available online at the City Tech Pathways website.**  **4 The number of free elective credits will vary depending upon the program-specific courses students use to meet Common Core requirements.** |

SECTION 2: New course Proposal: Biomedical Data Analytics I (BIO3450)

New York City College of Technology, CUNY

CURRICULUM MODIFICATION PROPOSAL FORM

This form is used for all curriculum modification proposals. See the [Proposal Classification Chart](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-09-Proposal_Classification_Chart.pdf) for information about what types of modifications are major or minor. Completed proposals should be emailed to the Curriculum Committee chair.

|  |  |
| --- | --- |
| **Title of Proposal** | **New course: Biomedical Data Analytics I (BIO3450)** |
| **Date** | **September 28, 2018** |
| **Major or Minor** | **Major** |
| **Proposer’s Name** | **Joanne Weinreb and Evgenia Giannopoulou** |
| **Department** | **Biological Sciences** |
| **Date of Departmental Meeting in which proposal was approved** | **October 4, 2018** |
| **Department Chair Name** | **Prof Andleeb Zameer** |
| **Department Chair Signature and Date** | **SIGN.png 10/8/18** |
| **Academic Dean Name** | **Dean Justin Vazquez-Poritz** |
| **Academic Dean Signature and Date** | **Picture 110/8/18** |
| **Brief Description of Proposal**  (Describe the modifications contained within this proposal in a succinct summary. More detailed content will be provided in the proposal body. | **Introduction to the healthcare environment and the various sources of healthcare data. How to import, clean, and refine data from these sources. The course covers data analytic techniques to understand and analyze healthcare data.** |
| **Brief Rationale for Proposal**  (Provide a concise summary of why this proposed change is important to the department. More detailed content will be provided in the proposal body). | **This course will give students an understanding of the healthcare environment, the many types of data generated and give them the basics of the tools to understand and analyze these data. Training in biomedical data analytics will enhance the student learning experience and make graduates more competitive for entry into industry or graduate school.** |
| **Proposal History**  (Please provide history of this proposal: is this a resubmission? An updated version? This may most easily be expressed as a list). | **This proposal represents the first submission.** |

Please include all appropriate documentation as indicated in the Curriculum Modification Checklist.

For each new course, please also complete the New Course Proposal and submit in this document.

Please submit this document as a single .doc or .rtf format. If some documents are unable to be converted to .doc, then please provide all documents archived into a single .zip file.

**ALL PROPOSAL CHECK LIST**

|  |  |
| --- | --- |
| Completed CURRICULUM MODIFICATION FORM including: |  |
| * Brief description of proposal | X |
| * Rationale for proposal | X |
| * Date of department meeting approving the modification | X |
| * Chair’s Signature | X |
| * Dean’s Signature | X |
| Evidence of consultation with affected departments  List of the programs that use this course as required or elective, and courses that use this as a prerequisite. | X |
| Documentation of Advisory Commission views (if applicable). |  |
| Completed [Chancellor’s Report Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-09-Chancellor_Report_Quick_Reference_Guide1.doc). | X |

**EXISTING PROGRAM MODIFICATION PROPOSALS**

|  |  |
| --- | --- |
| Documentation indicating core curriculum requirements have been met for new programs/options or program changes. | X |
| Detailed rationale for each modification (this includes minor modifications) | X |

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-10-Curriculum_Modification_Proposal_Form.docx) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

|  |  |
| --- | --- |
| **Course Title** | **Biomedical Data Analytics I** |
| **Proposal Date** | **September 28, 2018** |
| **Proposer’s Name** | **Joanne Weinreb and Evgenia Giannopoulou** |
| **Course Number** | **BIO 3450** |
| **Course Credits, Hours** | **4 credit hours**  **3 cl hrs and 3 lab hrs** |
| **Course Pre / Co-Requisites** | **BIO 3350 and CST 1204** |
| **Catalog Course Description** | **Introduction to the healthcare environment and the various sources of healthcare data. How to import, clean, and refine data from these sources. The course covers data analytic techniques to understand and analyze healthcare data.** |
| **Brief Rationale**  Provide a concise summary of why this course is important to the department, school or college. | **This course will give students an understanding of the healthcare environment, the many types of data generated and give them the basics of the tools to understand and analyze these data. Training in biomedical data analytics will enhance the student learning experience and make graduates more competitive for entry into industry or graduate school.** |
| **Intent to Submit as Common Core**  If this course is intended to fulfill one of the requirements in the common core, then indicate which area. | **No.** |
| **Intent to Submit as An Interdisciplinary Course** | **No.** |
| **Intent to Submit as a Writing Intensive Course** | **No.** |

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

**NEW COURSE PROPOSAL CHECK LIST**

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

|  |  |
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| **Completed NEW COURSE PROPOSAL FORM** |  |
| * Title, Number, Credits, Hours, Catalog course description | √ |
| * Brief Rationale | √ |
| Completed [Library Resources and Information Literacy Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/curriculum_modification_library_form.doc) |  |
| **Course Outline**  Include within the outline the following. |  |
| Hours and Credits for Lecture and Labs  If hours exceed mandated Carnegie Hours, then rationale for this | √ |
| Prerequisites/Co- requisites | √ |
| Detailed Course Description | √ |
| Course Specific Learning Outcome and Assessment Tables   * Discipline Specific * General Education Specific Learning Outcome and Assessment Tables | √ |
| Example Weekly Course outline | √ |
| Grade Policy and Procedure | √ |
| Recommended Instructional Materials (Textbooks, lab supplies, etc.) | √ |
| Library resources and bibliography | √ |
| **Course Need Assessment.**  Describe the need for this course. Include in your statement the following information. |  |
| Target Students who will take this course. Which programs or departments, and how many anticipated?  Documentation of student views (if applicable, e.g. non-required elective). | √ |
| Projected headcounts (fall/spring and day/evening) for each new or modified course. | √ |
| If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction. | √ |
| Where does this course overlap with other courses, both within and outside of the department? | √ |
| Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? | √ |
| If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. | √ |
| **Course Design**  Describe how this course is designed. |  |
| Course Context (e.g. required, elective, capstone) | √ |
| Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? | √ |
| Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) | √ |
| How does this course support Programmatic Learning Outcomes? | √ |
| Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. | √ |
| **Additional Forms for Specific Course Categories** |  |
| [Interdisciplinary Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/Application-for-Interdisciplinary-Course-Designation.docx) (if applicable) | N/A |
| [Common Core (Liberal Arts) Intent to Submit](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/CommonCoreCourseSubmissionForm_4.2.12.doc) (if applicable) | N/A |
| Writing Intensive Form if course is intended to be a WIC (under development) | N/A |
| If course originated as an experimental course, then results of evaluation plan as developed with director of assessment. | N/A |
| **(Additional materials for [Curricular Experiments](http://www.300jaystreet.com/college-council/curriculum_proposals/curricular-experiments))** |  |
| Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information). | N/A |
| Established Timeline for Curricular Experiment | N/A |

**LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION**

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new acquisitions; it will not affect curriculum proposals either positively or negatively.

Consult with library faculty subject selectors (<http://cityte.ch/dir>) **3 weeks in advance**.

**Course proposer:** please complete boxes 1-4. **Library faculty subject selector:** please complete box 5.

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| **1** | **Title of proposal**  New Course: BIO3450 (Biomedical Data Analytics 1) | **Department/Program**  Biological Sciences/Biomedical Informatics |
|  | **Proposed by** (include email & phone)  Joanne Weinreb  [jweinreb@citytech.cuny.edu](mailto:jweinreb@citytech.cuny.edu)  718-260-4958  Evgenia Giannopoulou  [egiannopoulou@citytech.cuny.edu](mailto:egiannopoulou@citytech.cuny.edu)  718-260-4971 | **Expected date course(s) will be offered**  Spring 2020  **# of students**  **20** |

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| **2** | **The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?**  Even though currently there is a textbook listed for this course students can rent it online for approximately $10 and therefore I do not see a reason for the library to purchase a copy. Additionally there are many online resources that we will be using for this course. |

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| **3** | **Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.**  No additional resources are required. |

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| **4** | **Library faculty focus on strengthening students' information literacy skills in finding, evaluating, and ethically using information. We can collaborate on developing assignments and offer customized information literacy instruction and research guides for your course.**  **Do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**  Instructors of the course will have the freedom to collaborate with library faculty at their own discretion. |

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| **5** | **Library Faculty Subject Specialist** Cailean Cooney Picture 14  **Comments and Recommendations**  The Library provides resources relevant to the course subject, available both on-site and online, including print and electronic books, reference materials, and journal subscriptions. Print books from other CUNY campuses are also available to request. In addition, the library provides digital resources and can offer programming to support students in developing information literacy and research skills. The Library will consider additional resource requests based on budgetary means and welcomes recommendations for book monograph purchases to update the collection on a yearly basis.  Zero-cost open course materials can provide students with reliable access to revisit concepts and test their knowledge independently and at the advisement of instructors. Prof. Cooney will keep the Biology Department informed of potential funding opportunities to develop OERs, and will pass along any relevant OERs for the Department’s review.  **Date:** 10/18/18 |

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| NEW YORK CITY COLLEGE OF TECHNOLOGY  **The City University**  **Of New York** | | School of Arts and Sciences  **Biological Sciences Department** |
| **Course Information** | | |
| **Course title:** | Biomedical Data Analytics I | |
| **Course code:** | BIO 3450 | |
| **Credit Hours:** | 4 credit hours | |
| 6 hours per week; 15 weeks total.  3 cl hrs 3 lab hrs | |
| **Prerequisite:** | BIO3350 and CST1204 | |
| **Text:** | *Healthcare Analytics Made Simple : Techniques in healthcare computing using maching learning and Python.* PACKT Publishing. Vikas Kumar : 2018. ISBN : 9781787283220 | |
| **Official Course Description (from the College Catalog)** | Introduction to the healthcare environment and the various sources of healthcare data. How to import, clean, and refine data from these sources. The course covers data analytic techniques to understand and analyze healthcare data. | |
| **Course Mechanics** | All the concepts and techniques taught in this course are computer-based. Assignments will be assigned periodically, and regular and active participation in discussions is required. Timely completion of assignments is critical to success in the course. Attendance is absolutely required. Aside from serving as the venue to introduce new topics, it will also provide an opportunity for students to discuss any difficulty they are having regarding the course. | |
| **Grading Procedure (see Grading Policies for details)** | | |
| The grade is based on assignments, a group project, and exams. | | |
| **Course Objectives and Student Expectations** | | |
| Students are expected to be able to work independently and regularly, as well as collaborate with fellow students on group projects if required. This course is fast paced, and covers a diverse set of topics, and therefore students must be able to keep up with the work assigned in order to be successful in the course. | | |
| **Course Objectives** | Having successfully completed this course, the student will be able to:   1. Illustrate an understanding of the healthcare environment. 2. Illustrate an understanding of relational databases and how to access them. 3. Have experience working with a team on a project. 4. Describe the various sources of healthcare data including electronic health records, biomedical images, sensor data, biomedical signals, genomic data, clinical text, biomedical literature, and data gathered from social media 5. Describe the different techniques used to process healthcare data 6. Demonstrate an understanding of machine learning techniques and the ability to apply it to process healthcare data | |
| **Technology Prerequisites** | 1. Students should have access to and be able to use Internet Explorer, Firefox, or any appropriate web browser. Internet Explorer and Firefox work best with Blackboard. 2. Students will need a City Tech email account and should be comfortable using it. Students will also need access to CUNY’s Blackboard service. Accounts and passwords to the CUNY Portal should be arranged prior to the beginning of the semester. 3. Students should check if their e-mail address on Blackboard is the e-mail address they check most. The instructor will send e-mail announcements only via Blackboard. | |
| **Online Resources** | CUNY’s Blackboard resource can be accessed via the CUNY Portal, at:  <http://portal.cuny.edu/portal/site/cuny/index.jsp>  A Beginner’s Guide to Blackboard, as well as help on other resources such as Wiki and Wimba, can be found here:  <http://websupport1.citytech.cuny.edu/websupport1/It/online/students/index.htm>  The National Center for Biotechnology Information, which hosts all the databases that will be used in this course, as well as tutorials on how to navigate around the website and the databases, can be found here:  <http://www.ncbi.nlm.nih.gov/>  Easy access to all the online resources for Bioinformatics can be found here:  <http://www.ncbi.nlm.nih.gov/guide/all/>  Other online resources will be assigned as necessary. | |

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| **Joanne Weinreb**  **Office: A501D**  **Email:** jweinreb@citytech.cuny.edu | **Evgenia Giannopoulou**  **Office: A502**  **Email:** egiannopoulou@citytech.cuny.edu |

**General Education**

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| **LEARNING OUTCOMES** | **ASSESSMENT** |
| Employ scientific reasoning and logical thinking. | Analysis of student performance on participation, assignments, group project and exams. |
| Communicate in diverse settings and groups, using written, oral, and visual means | Analysis of student performance group projects. |

**Discipline Specific**

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| **LEARNING OUTCOMES** | **ASSESSMENT** |
| Employ knowledge of the fundamentals of computer programming and databases. | Computer activities and group project |
| Describe the various sources of healthcare data including electronic health records, and ancillary sources. | Computer activities and exams |
| Use quantitative reasoning to apply statistical methods and mathematical modeling in the analysis of biomedical datasets. | Computer activities and exams |
| Apply fundamental biomedical informatics principles and methods within an area of practice. | Exams and assignments |

**Lecture Schedule**

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| **Week 1** | Class Mechanics and Policies, and Introduction to Blackboard Features  **Lecture: Introduction to Biomedical Data Analytics I**   1. What is healthcare analytics? 2. Foundations of healthcare analytics. 3. History of healthcare analytics   **LAB**: Introduction to programming environment and Electronic Health Records (EHR). Examples of healthcare analytics. |
| **Week 2** | **Lecture: Introduction to Healthcare Foundations**   1. History of EHRs 2. Patient data flow in different healthcare environments 3. Overview of healthcare policy   **LAB**: EHR: What is the flow of data in EHRs during practice administration and a patient encounter. |
| **Week 3** | **Lecture: Healthcare data sources: Electronic Health Records**   1. What are the different types data formats? 2. An introduction to the different data sources:   Biomedical images, sensor data, genomic data, social media, biomedical literature  **LAB**: EHR: How are these different data types managed in an EHR; labs and imaging. Managing different data types. |
| **Week 4** | **Lecture: Healthcare terminologies and classification systems**   1. Why do we need standards? 2. Review of the standardized clinical code sets 3. Data interchange standards   **LAB:** EHR – medical coding. Explore on-line resources for terminologies and ontologies |
| **Week 5** | **Lecture: Introduction to healthcare analytics**   1. What are the different categories of healthcare analytics? 2. Introduction to medical decision making 3. Machine learning frameworks for medical decision making   **LAB:** Review of python; Create a patient class. |
| **Week 6** | **Lecture: Machine learning pipeline for healthcare data**   1. What is a machine learning pipeline? 2. Cleaning and pre-processing the healthcare data 3. Introduction to techniques to evaluate model performance   **LAB:** Introduction to pandas. Data structures and frames for analyzing healthcare data. |
| **Week 7** | **Lecture: Midterm**  **LAB:** Introduce scikit learn module. Use sklearn breast cancer and diabetes dataset to introduce one-hot encoding of categorical variables, binarization, imputation and feature selection. |
| **Week 8** | **Lecture: Computing Foundations – Introduction to Databases**   1. Introduction to SQL 2. Contents of a healthcare database   **LAB:** Introduction to databases, working in SQL. Create a small clinical database. |
| **Week 9** | **Lecture: Computing Foundations – Databases continued**   1. How to engineer healthcare data in a database format. 2. Data mining from clinical databases   **LAB:** Introduction to the MIMIC database and using MySQL. |
| **Week 10** | **Lecture: Computing Foundations – Databases continued**   1. Manipulating data from databases including:    1. Binning and aggregating diagnoses    2. Binning abnormal results   **LAB:** Using the MIMIC database |
| **Week 11** | **Lecture: Natural Language Processing and Data Mining Clinical Text Part I**   1. What is Natural Language Processing (NLP) 2. Information Extraction vs. Information Retrieval (IR). 3. The NLP pipeline    1. Sentence detection    2. Tokenizer   **LAB:** Introduction to NLTK. |
| **Week 12** | **Lecture: Natural Language Processing and Data Mining Clinical Text Part II**   1. The NLP pipeline continued:    1. Spell checking    2. Word sense disambiguation    3. Part of speech (POS) tagging    4. Parsing sentence structure    5. Named entity recognition   **LAB:** Use NLP to analyze on a corpora of Clinical texts |
| **Week 13** | **Lecture: Natural Language Processing and Data Mining Clinical Text Part III**   1. Clinical Text extraction vs. Biomedical Text extraction 2. Contextual feature detection and analysis    1. Negation, temporality, disambiguate acronyms and event subject identification 3. Extraction of clinical specific information    1. Findings, diagnosis, laboratory test names and results   **LAB:** Intro to some NLP tools in the medical domain: (e.g MetaMap, MedEx, MedLee) |
| **Week 14** | **Lecture: Measuring Healthcare Quality**   1. Introduction to healthcare measures 2. US Medicare value-based programs 3. What data points need to be analyzed in these clinical domains?   **LAB:** Using HEDIS data run a use case analysis. |
| **Week 15** | **Group project presentation**  **FINAL exam** |

**Grading Policies**

Please bear in mind that this course is a 4**-credit** course. Student performance on this course will be evaluated as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **ASSIGNMENT** | | **DESCRIPTION** | **POINTS** |
|  | Assignments | Expected timely completion of each  lab assignments | 35% |
| Participation | In class discussion | 5% |
| Group Project | Open Access | 20% |
|  | Exams | Midterm and Final exam | 40% |

|  |
| --- |
| **NOTE: Letter grades will be determined using a**  **standard percentage point evaluation as outlined below:**  **A:** 93-100  **A-:** 90-92.9  **B+:** 87-89.9  **B:** 83-86.9  **B-:** 80-82.9  **C+:** 77-79.9  **C** 70-76.9  **D:** 60-69.9  **F:** Below 60 |

**CHANCELLOR’S REPORT FORM**

New course to be offered in the Biology department

|  |  |
| --- | --- |
| **Department** | **Biology** |
| **Academic Level** | **[ X ] Regular  [   ] Compensatory  [   ] Developmental  [   ] Remedial** |
| **Subject Area** | **Biomedical Informatics** |
| **Course Prefix** | **BIO** |
| **Course Number** | **3450** |
| **Course Title** | **Biomedical Data Analytics I** |
| **Catalog Description** | **Introduction to the healthcare environment and the various sources of healthcare data. How to import, clean, and refine data from these sources. The course covers data analytic techniques to understand and analyze healthcare data.** |
| **Prerequisite** | **BIO3350 and CST1204** |
| **Corequisite** |  |
| **Pre- or corequisite** |  |
| **Credits** | **4** |
| **Contact Hours** | **6 (3 cl hrs 3 lab hrs)** |
| **Liberal Arts** | **[X] Yes  [   ] No** |
| **Course Attribute** |  |
| **Course Applicability** | **[X] Major**  **[ ] Gen Ed Required [ ] Gen Ed - Flexible [ ] Gen Ed - College Option**  **[ ] English Composition [ ] World Cultures [ ] Speech**  **[ ] Mathematics [ ] US Experience in its Diversity [ ] Interdisciplinary**  **[ ] Science [ ] Creative Expression [ ] Advanced Liberal Arts**  **[ ] Individual and Society**  **[ ] Scientific World** |
| **Effective Term** | Spring 2020 |

**Rationale:** This course will give students an understanding of the healthcare environment, the many types of data generated and the basics of the tools needed to understand and analyze these data.Training in biomedical data analytics will enhance the student learning experience and make graduates more competitive for entry into industry or graduate school.

SECTION 3: New course Proposal: Biomedical Data Analytics II (BIO 4450)

New York City College of Technology, CUNY

CURRICULUM MODIFICATION PROPOSAL FORM

This form is used for all curriculum modification proposals. See the [Proposal Classification Chart](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-09-Proposal_Classification_Chart.pdf) for information about what types of modifications are major or minor. Completed proposals should be emailed to the Curriculum Committee chair.

|  |  |
| --- | --- |
| **Title of Proposal** | **New course: Biomedical Data Analytics II (BIO4450)** |
| **Date** | **September 28, 2018** |
| **Major or Minor** | **Major** |
| **Proposer’s Name** | **Evgenia Giannopoulou and Joanne Weinreb** |
| **Department** | **Biological Sciences** |
| **Date of Departmental Meeting in which proposal was approved** | **October 4, 2018** |
| **Department Chair Name** | **Prof Andleeb Zameer** |
| **Department Chair Signature and Date** | **SIGN.png 10/8/18** |
| **Academic Dean Name** | **Dean Justin Vazquez-Poritz** |
| **Academic Dean Signature and Date** | **Picture 110/8/18** |
| **Brief Description of Proposal**  (Describe the modifications contained within this proposal in a succinct summary. More detailed content will be provided in the proposal body. | **Builds upon the analytics techniques introduced in Biomedical Data Analytics to explore how data mining and deep learning are applicable to biomedical data. Precision medicine and genomics analysis that shape medical research, diagnosis and care.** |
| **Brief Rationale for Proposal**  (Provide a concise summary of why this proposed change is important to the department. More detailed content will be provided in the proposal body). | **This course is an upper level specialization course. It will give students the opportunity to further explore the application of data analytics techniques and deep learning to biomedical data. Advanced training in biomedical data analytics will enhance the student learning experience and make graduates more competitive for entry into industry or graduate school.** |
| **Proposal History**  (Please provide history of this proposal: is this a resubmission? An updated version? This may most easily be expressed as a list). | **This proposal represents the first submission.** |

Please include all appropriate documentation as indicated in the Curriculum Modification Checklist.

For each new course, please also complete the New Course Proposal and submit in this document.

Please submit this document as a single .doc or .rtf format. If some documents are unable to be converted to .doc, then please provide all documents archived into a single .zip file.

**ALL PROPOSAL CHECK LIST**

|  |  |
| --- | --- |
| Completed CURRICULUM MODIFICATION FORM including: |  |
| * Brief description of proposal | X |
| * Rationale for proposal | X |
| * Date of department meeting approving the modification | X |
| * Chair’s Signature | X |
| * Dean’s Signature | X |
| Evidence of consultation with affected departments  List of the programs that use this course as required or elective, and courses that use this as a prerequisite. | X |
| Documentation of Advisory Commission views (if applicable). |  |
| Completed [Chancellor’s Report Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-09-Chancellor_Report_Quick_Reference_Guide1.doc). | X |

**EXISTING PROGRAM MODIFICATION PROPOSALS**

|  |  |
| --- | --- |
| Documentation indicating core curriculum requirements have been met for new programs/options or program changes. | X |
| Detailed rationale for each modification (this includes minor modifications) | X |

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-10-Curriculum_Modification_Proposal_Form.docx) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

|  |  |
| --- | --- |
| **Course Title** | **Biomedical Data Analytics II** |
| **Proposal Date** | **September 28, 2018** |
| **Proposer’s Name** | **Evgenia Giannopoulou and Joanne Weinreb** |
| **Course Number** | **BIO 4450** |
| **Course Credits, Hours** | **4 credit hours**  **3 cl hrs and 3 lab hrs** |
| **Course Pre / Co-Requisites** | **BIO 3450 (Biomedical Data Analytics I)** |
| **Catalog Course Description** | **Builds upon the analytics techniques introduced in Biomedical Data Analytics to explore how data mining and deep learning are applicable to biomedical data. Precision medicine and genomics analysis that shape medical research, diagnosis and care.** |
| **Brief Rationale**  Provide a concise summary of why this course is important to the department, school or college. | **This course is an upper level specialization course. It will give students the opportunity to further explore the application of data analytics techniques and deep learning to biomedical data. Advanced training in biomedical data analytics will enhance the student learning experience and make graduates more competitive for entry into industry or graduate school.** |
| **Intent to Submit as Common Core**  If this course is intended to fulfill one of the requirements in the common core, then indicate which area. | **No.** |
| **Intent to Submit as An Interdisciplinary Course** | **No.** |
| **Intent to Submit as a Writing Intensive Course** | **No.** |

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

**NEW COURSE PROPOSAL CHECK LIST**

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

|  |  |
| --- | --- |
| **Completed NEW COURSE PROPOSAL FORM** |  |
| * Title, Number, Credits, Hours, Catalog course description | √ |
| * Brief Rationale | √ |
| Completed [Library Resources and Information Literacy Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/curriculum_modification_library_form.doc) |  |
| **Course Outline**  Include within the outline the following. |  |
| Hours and Credits for Lecture and Labs  If hours exceed mandated Carnegie Hours, then rationale for this | √ |
| Prerequisites/Co- requisites | √ |
| Detailed Course Description | √ |
| Course Specific Learning Outcome and Assessment Tables   * Discipline Specific * General Education Specific Learning Outcome and Assessment Tables | √ |
| Example Weekly Course outline | √ |
| Grade Policy and Procedure | √ |
| Recommended Instructional Materials (Textbooks, lab supplies, etc) | √ |
| Library resources and bibliography | √ |
| **Course Need Assessment.**  Describe the need for this course. Include in your statement the following information. |  |
| Target Students who will take this course. Which programs or departments, and how many anticipated?  Documentation of student views (if applicable, e.g. non-required elective). | √ |
| Projected headcounts (fall/spring and day/evening) for each new or modified course. | √ |
| If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction. | √ |
| Where does this course overlap with other courses, both within and outside of the department? | √ |
| Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? | √ |
| If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. | √ |
| **Course Design**  Describe how this course is designed. |  |
| Course Context (e.g. required, elective, capstone) | √ |
| Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? | √ |
| Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) | √ |
| How does this course support Programmatic Learning Outcomes? | √ |
| Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. | √ |
| **Additional Forms for Specific Course Categories** |  |
| [Interdisciplinary Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/Application-for-Interdisciplinary-Course-Designation.docx) (if applicable) | N/A |
| [Common Core (Liberal Arts) Intent to Submit](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/CommonCoreCourseSubmissionForm_4.2.12.doc) (if applicable) | N/A |
| Writing Intensive Form if course is intended to be a WIC (under development) | N/A |
| If course originated as an experimental course, then results of evaluation plan as developed with director of assessment. | N/A |
| **(Additional materials for [Curricular Experiments](http://www.300jaystreet.com/college-council/curriculum_proposals/curricular-experiments))** |  |
| Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information). | N/A |
| Established Timeline for Curricular Experiment | N/A |

**LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION**

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new acquisitions; it will not affect curriculum proposals either positively or negatively.

Consult with library faculty subject selectors (<http://cityte.ch/dir>) **3 weeks in advance**.

**Course proposer:** please complete boxes 1-4. **Library faculty subject selector:** please complete box 5.

|  |  |  |
| --- | --- | --- |
| **1** | **Title of proposal**  New Course: BIO4450 (Biomedical Data Analytics II) | **Department/Program**  Biological Sciences/Biomedical Informatics |
|  | **Proposed by** (include email & phone)  Evgenia Giannopoulou  [egiannopoulou@citytech.cuny.edu](mailto:egiannopoulou@citytech.cuny.edu)  718-260-4971  Joanne Weinreb  [jweinreb@citytech.cuny.edu](mailto:jweinreb@citytech.cuny.edu)  718-260-4958 | **Expected date course(s) will be offered**  Spring 2020  **# of students**  **16** |

|  |  |
| --- | --- |
| **2** | **The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?**  Even though currently there is a textbook listed for this course students can rent it online for approximately $10 and therefore I do not see a reason for the library to purchase a copy. Additionally there are many online resources that we will be using for this course. |

|  |  |
| --- | --- |
| **3** | **Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.**  No additional resources are required. |

|  |  |
| --- | --- |
| **4** | **Library faculty focus on strengthening students' information literacy skills in finding, evaluating, and ethically using information. We can collaborate on developing assignments and offer customized information literacy instruction and research guides for your course.**  **Do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**  Instructors of the course can collaborate with library faculty at their own discretion. |

|  |  |
| --- | --- |
| **5** | **Library Faculty Subject Specialist** Cailean Cooney Picture 13  **Comments and Recommendations**  The Library provides resources relevant to the course subject, available both on-site and online, including print and electronic books, reference materials, and journal subscriptions. Print books from other CUNY campuses are also available to request. In addition, the library provides digital resources and can offer programming to support students in developing information literacy and research skills. The Library will consider additional resource requests based on budgetary means and welcomes recommendations for book monograph purchases to update the collection on a yearly basis.  Zero-cost open course materials can provide students with reliable access to revisit concepts and test their knowledge independently and at the advisement of instructors. Prof. Cooney will keep the Biology Department informed of potential funding opportunities to develop OERs, and will pass along any relevant OERs for the Department’s review.  **Date:** 10/18/18 |

|  |  |  |
| --- | --- | --- |
| NEW YORK CITY COLLEGE OF TECHNOLOGY  **The City University**  **Of New York** | | School of Arts and Sciences  **Biological Sciences Department** |
| **Course Information** | | |
| **Course title:** | **Biomedical Data Analytics II** | |
| **Course code:** | **BIO 4450** | |
| **Credit Hours:** | **4 credit hours** | |
| **6 hours per week; 15 weeks total.**  **3 cl hrs 3 lab hrs** | |
| **Prerequisite:** | **BIO3450 (Biomedical Data Analytics I)** | |
| **Text:** | ***Healthcare Analytics Made Simple : Techniques in healthcare computing using maching learning and Python.* PACKT Publishing. Vikas Kumar : 2018. ISBN : 9781787283220** | |
| **Official Course Description (from the College Catalog)** | **Builds upon the analytics techniques introduced in Biomedical Data Analytics to explore how data mining and deep learning are applicable to biomedical data. Precision medicine and genomics analysis that shape medical research, diagnosis and care.** | |
| **Course Mechanics** | **All the concepts and techniques taught in this course are computer-based. Assignments will be assigned periodically, and regular and active participation in discussions is required. Timely completion of assignments is critical to success in the course. Attendance is absolutely required. Aside from serving as the venue to introduce new topics, it will also provide an opportunity for students to discuss any difficulty they are having regarding the course.** | |
| **Grading Procedure (see Grading Policies for details)** | | |
| The grade is based on assignments, a group project, and exams. | | |
| **Course Objectives and Student Expectations** | | |
| Students are expected to be able to work independently and regularly, as well as collaborate with fellow students on group projects if required. This course is fast paced, and covers a diverse set of topics, and therefore students must be able to keep up with the work assigned in order to be successful in the course. | | |
| **Course Objectives** | 1. Introduce student to the basics of data mining biomedical data. 2. Learn about statistic techniques and modeling as applied to biomedical data. 3. Demonstrate an understanding of both supervised and unsupervised learning methods. 4. Demonstrate an understanding of precision medicine. | |
| **Technology Prerequisites** | 1. Students should have access to and be able to use Internet Explorer, Firefox, or any appropriate web browser. Internet Explorer and Firefox work best with Blackboard. 2. Students will need a City Tech email account and should be comfortable using it. Students will also need access to CUNY’s Blackboard service. Accounts and passwords to the CUNY Portal should be arranged prior to the beginning of the semester. 3. Students should check if their e-mail address on Blackboard is the e-mail address they check most. The instructor will send e-mail announcements only via Blackboard. | |
| **Online Resources** | CUNY’s Blackboard resource can be accessed via the CUNY Portal, at:  <http://portal.cuny.edu/portal/site/cuny/index.jsp>  A Beginner’s Guide to Blackboard, as well as help on other resources such as Wiki and Wimba, can be found here:  <http://websupport1.citytech.cuny.edu/websupport1/It/online/students/index.htm>  The National Center for Biotechnology Information, which hosts all the databases that will be used in this course, as well as tutorials on how to navigate around the website and the databases, can be found here:  <http://www.ncbi.nlm.nih.gov/>  Easy access to all the online resources for Bioinformatics can be found here:  <http://www.ncbi.nlm.nih.gov/guide/all/>  Other online resources will be assigned as necessary. | |

|  |  |
| --- | --- |
| **Joanne Weinreb**  **Office: A501D**  **Email:** jweinreb@citytech.cuny.edu | **Evgenia Giannopoulou**  **Office: A502**  **Email:** egiannopoulou@citytech.cuny.edu |

**General Education**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **ASSESSMENT** |
| Employ scientific reasoning and logical thinking. | Analysis of student performance on participation, assignments, group project and exams. |
| Communicate in diverse settings and groups, using written, oral, and visual means | Analysis of student performance group projects. |

**Discipline Specific**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **ASSESSMENT** |
| Employ knowledge of the fundamentals of computer programming and databases. | Computer activities, assignments and exams |
| Demonstrate the ability to apply the process of science to develop problem-solving strategies, including hypothesis generation, evaluation of results, and formulation of potential applications. | Computer activities, assignments and exams |
| Demonstrate the ability to effectively communicate complex biomedical concepts within and across disciplinary boundaries. | Computer activities and group project |
| Use quantitative reasoning to apply statistical methods and mathematical modeling in the analysis of biomedical datasets. | Computer activities, assignments and exams |
| Apply fundamental biomedical informatics principles and methods within an area of practice. | Computer activities, exams and assignments |

**Lecture Schedule**

|  |  |
| --- | --- |
| **Week 1** | Class Mechanics and Policies, and Introduction to Blackboard Features  **Introduction to Biomedical Data Analytics**   1. What is *data analytics*, *data science* and *big data*? 2. History of *machine learning* and *artificial intelligence* 3. Applications of data analytics in genomics and healthcare 4. High-performance computation   **LAB:** Introduction to data analytics tools |
| **Week 2** | **Statistics and Modeling I**   1. Predictive modeling 2. Model selection 3. Linear regression analysis   **LAB:** Linear regression example on biomedical data |
| **Week 3** | **Statistics and Modeling II of Biomedical data**   1. Dimensionality reduction and feature selection methods   **LAB:** Principal Component Analysis, Singular Value Decomposition, Non-negative Matrix Factorization, and their application on gene expression data |
| **Week 4** | **Biomedical Data Mining Basics**   1. Data preprocessing (cleaning/transformation/reduction) 2. Association Rules   **LAB:** A priori algorithm and its application on a medical dataset. |
| **Week 5** | **Supervised learning**   1. Classification   **LAB:** Cross validation, decision trees, random forests |
| **Week 6** | **Unsupervised learning**   1. Clustering 2. Partitioning methods 3. Hierarchical methods   **LAB:** K-means, hierarchical clustering |
| **Week 7** | **Midterm** |
| **Week 8** | **Pattern Recognition**   1. Speech/image/text recognition, Natural Language Processing   **LAB:** Basic Pattern Analysis and example on medical images |
| **Week 9** | **Deep Learning I**   1. Artificial neural networks, backpropagation, single-layer perceptron.   **LAB:** Building neural networks in tensorflow |
| **Week 10** | **Deep Learning II**   1. Multilayer perceptron, self-organizing maps.   **LAB:** Building neural networks in tensorflow |
| **Week 11** | **Applications in Precision Medicine and Biomedical Data I**   1. Working with personal genomics data 2. Challenges in data storage and interpretation   **LAB:** Accessing online personal genomes, sequencing pattern matching |
| **Week 12** | **Applications in Precision Medicine and Biomedical Data II**   1. Pharmacogenomics and Population Health   **LAB:** Medical imaging and NLP examples |
| **Week 13** | **Applications in Precision Medicine and Biomedical Data III**   1. Deep learning and cancer   **LAB:** Models of disease progression and prediction of patient outcomes |
| **Week 14** | **Guest lecture**  **LAB:** Group project presentations |
| **Week 15** | **CUMULATIVE FINAL EXAM** |

**Grading Policies**

Please bear in mind that this course is a 4-credit course. Student performance on this course will be evaluated as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **ASSIGNMENT** | | **DESCRIPTION** | **POINTS** |
|  | Assignments | Expected timely completion of each  lab assignment | 35% |
| Participation | In class discussion | 5% |
| Group Project | Open Access | 20% |
|  | Exams | Midterm and Final exam | 40% |

|  |
| --- |
| **NOTE: Letter grades will be determined using a**  **standard percentage point evaluation as outlined below:**  **A:** 93-100  **A-:** 90-92.9  **B+:** 87-89.9  **B:** 83-86.9  **B-:** 80-82.9  **C+:** 77-79.9  **C** 70-76.9  **D:** 60-69.9  **F:** Below 60 |

|  |  |
| --- | --- |
| **Policy on Academic Integrity** | |
| Academic dishonesty includes any act that is designed to obtain fraudulently, either for oneself or for someone else, academic credit, grades, or any other form of recognition that was not properly earned. Academic dishonesty, which will not be tolerated in this course and at City Tech, encompasses the following: | |
| **Cheating** | Defined as intentionally giving, receiving, using or attempting to use unauthorized materials, information, notes, study aids, including any form of unauthorized communication, in any academic exercise. It is the student’s responsibility to consult with instructors to determine whether or not a study aid or device may be used. |
| **Plagiarism** | Plagiarism is intentionally and knowingly presenting the ideas or works of another as one’s own original idea or works in any academic exercise without proper acknowledgement of the source. The purchase and submission of a term paper, essay, or other written assignment to fulfill the requirements of a course, and violates section 213-b of the *State Education Law*. This also applies to the submission of all or substantial portions of the same academic work previously submitted by the student or any other individual for credit at another institution, or in more than one course. |
| **Course Policy**  **on Academic Integrity** | Cheating and plagiarism will not be tolerated in this course. Penalties are the following. Cheating on in-class exams or quizzes will merit an automatic zero for the exercise. Copying from classmates’ lab worksheets and other take-home or online assignments will also merit an automatic zero for the exercise. Repeated violations will be reported to the Chair and the Dean, and may result in a final grade of “F” in the course, or even expulsion from the College. If you are unsure whether any of your actions constitute cheating or plagiarism, please consult the instructor for guidance. |
| **College Policy on Academic Integrity** | Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion. |

**CHANCELLOR’S REPORT FORM**

New course to be offered in the Biology department

|  |  |
| --- | --- |
| **Department** | **Biology** |
| **Academic Level** | **[ X ] Regular  [   ] Compensatory  [   ] Developmental  [   ] Remedial** |
| **Subject Area** | **Biomedical Informatics** |
| **Course Prefix** | **BIO** |
| **Course Number** | **4450** |
| **Course Title** | **Biomedical Data Analytics II** |
| **Catalog Description** | **Builds upon the analytics techniques introduced in Biomedical Data Analytics to explore how data mining and deep learning are applicable to biomedical data. Precision medicine and genomics analysis that shape medical research, diagnosis and care.** |
| **Prerequisite** | **BIO3450** |
| **Corequisite** |  |
| **Pre- or corequisite** |  |
| **Credits** | 4 |
| **Contact Hours** | **3 cl hrs and 3 lab hrs** |
| **Liberal Arts** | **[X] Yes  [   ] No** |
| **Course Attribute (** |  |
| **Course Applicability** | **[X] Major**  **[ ] Gen Ed Required [ ] Gen Ed - Flexible [ ] Gen Ed - College Option**  **[ ] English Composition [ ] World Cultures [ ]Speech**  **[ ] Mathematics [ ] US Experience in its Diversity [ ] Interdisciplinary**  **[ ] Science [ ] Creative Expression [ ] Advanced Liberal Arts**  **[ ] Individual and Society**  **[ ] Scientific World** |
| **Effective Term** | **Spring 2020** |

**Rationale:** This course is an upper level specialization course. It will give students the opportunity to further explore the application of data analytics techniques and deep learning to biomedical data. Advanced training in biomedical data analytics will enhance the student learning experience and make graduates more competitive for entry into industry or graduate school.

SECTION 4: New course proposal:

Molecular Evolution & Phylogenetics (BIO 4250)

New York City College of Technology, CUNY

CURRICULUM MODIFICATION PROPOSAL FORM

This form is used for all curriculum modification proposals. See the [Proposal Classification Chart](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-09-Proposal_Classification_Chart.pdf) for information about what types of modifications are major or minor. Completed proposals should be emailed to the Curriculum Committee chair.

|  |  |
| --- | --- |
| **Title of Proposal** | **New course: Molecular Evolution & Phylogenetics (BIO 4250)** |
| **Date** | **September 28, 2018** |
| **Major or Minor** | **Major** |
| **Proposer’s Name** | **Prof. Christopher Blair** |
| **Department** | **Biological Sciences** |
| **Date of Departmental Meeting in which proposal was approved** | **October 4, 2018** |
| **Department Chair Name** | **Prof Andleeb Zameer** |
| **Department Chair Signature and Date** | **SIGN.png 10/8/18** |
| **Academic Dean Name** | **Dean Justin Vazquez-Poritz** |
| **Academic Dean Signature and Date** | **Picture 1 10/8/18** |
| **Brief Description of Proposal**  (Describe the modifications contained within this proposal in a succinct summary. More detailed content will be provided in the proposal body. | **A broad introduction to the field of molecular evolution and phylogenetics. The first portion of the course focuses on foundational genetic and evolutionary principles, whereas the latter half of the course discusses how molecular phylogenies are created from molecular sequences and can be used to test specific evolutionary hypotheses. Discussions of specific case studies complement lectures.** |
| **Brief Rationale for Proposal**  (Provide a concise summary of why this proposed change is important to the department. More detailed content will be provided in the proposal body). | **BIO4250 will be an upper-level elective for students in the Biomedical Informatics program. Importantly, the course will fill a gap in student knowledge regarding the creation, interpretation, and use of molecular phylogenies in biological and bioinformatics research. This course will enable students to synthesize knowledge acquired in both lower-level biology courses and foundational bioinformatics courses. Training in computational evolutionary biology will enhance the student learning experience and make graduates more competitive for entry into industry or graduate school.** |
| **Proposal History**  (Please provide history of this proposal: is this a resubmission? An updated version? This may most easily be expressed as a list). | **This proposal represents the first submission.** |

Please include all appropriate documentation as indicated in the Curriculum Modification Checklist.

For each new course, please also complete the New Course Proposal and submit in this document.

Please submit this document as a single .doc or .rtf format. If some documents are unable to be converted to .doc, then please provide all documents archived into a single .zip file.

**ALL PROPOSAL CHECK LIST**

|  |  |
| --- | --- |
| Completed CURRICULUM MODIFICATION FORM including: |  |
| * Brief description of proposal | X |
| * Rationale for proposal | X |
| * Date of department meeting approving the modification | X |
| * Chair’s Signature | X |
| * Dean’s Signature | X |
| Evidence of consultation with affected departments  List of the programs that use this course as required or elective, and courses that use this as a prerequisite. | X |
| Documentation of Advisory Commission views (if applicable). |  |
| Completed [Chancellor’s Report Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-09-Chancellor_Report_Quick_Reference_Guide1.doc). | X |

**EXISTING PROGRAM MODIFICATION PROPOSALS**

|  |  |
| --- | --- |
| Documentation indicating core curriculum requirements have been met for new programs/options or program changes. | X |
| Detailed rationale for each modification (this includes minor modifications) | X |

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-10-Curriculum_Modification_Proposal_Form.docx) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

|  |  |
| --- | --- |
| **Course Title** | **Molecular Evolution & Phylogenetics** |
| **Proposal Date** | **9/28/18** |
| **Proposer’s Name** | **Prof. Christopher Blair** |
| **Course Number** | **BIO 4250** |
| **Course Credits, Hours** | **3** |
| **Course Pre / Co-Requisites** | **BIO2250** |
| **Catalog Course Description** | **A broad introduction to the field of molecular evolution and phylogenetics. The first portion of the course focuses on foundational genetic and evolutionary principles, whereas the latter half of the course discusses how molecular phylogenies are created from molecular sequences and can be used to test specific evolutionary hypotheses. Discussions of specific case studies complement lectures.** |
| **Brief Rationale**  Provide a concise summary of why this course is important to the department, school or college. | **BIO4450 will be an upper-level elective for students in the Biomedical Informatics program. Importantly, the course will fill a gap in student knowledge regarding the creation, interpretation, and use of molecular phylogenies in biological and bioinformatics research. This course will enable students to synthesize knowledge acquired in both lower-level biology courses and foundational bioinformatics courses. Training in computational evolutionary biology will enhance the student learning experience and make graduates more competitive for entry into industry or graduate school.** |
| **CUNY – Course Equivalencies**  Provide information about equivalent courses within CUNY, if any. | **-Brooklyn College –BIOL 4025 (Molecular Phylogenetics and Evolution)**  **-Hunter College –BIOL 375 (Molecular Evolution)** |
| **Intent to Submit as Common Core**  If this course is intended to fulfill one of the requirements in the common core, then indicate which area. | **NA** |
| **Intent to Submit as An Interdisciplinary Course** | **No.** |
| **Intent to Submit as a Writing Intensive Course** | **NA** |

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

**NEW COURSE PROPOSAL CHECK LIST**

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

|  |  |
| --- | --- |
| **Completed NEW COURSE PROPOSAL FORM** |  |
| * Title, Number, Credits, Hours, Catalog course description | X |
| * Brief Rationale | X |
| * CUNY – Course Equivalencies | X |
| Completed [Library Resources and Information Literacy Form](https://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/curriculum_modification_library_form-rev3F16.doc) | X |
| **Course Outline**  Include within the outline the following. |  |
| Hours and Credits for Lecture and Labs  If hours exceed mandated Carnegie Hours, then rationale for this | X |
| Prerequisites/Co- requisites | X |
| Detailed Course Description | X |
| Course Specific Learning Outcome and Assessment Tables   * Discipline Specific * General Education Specific Learning Outcome and Assessment Tables | X |
| Example Weekly Course outline | X |
| Grade Policy and Procedure | X |
| Recommended Instructional Materials (Textbooks, lab supplies, etc) | X |
| Library resources and bibliography | X |
| **Course Need Assessment.**  Describe the need for this course. Include in your statement the following information. |  |
| Target Students who will take this course. Which programs or departments, and how many anticipated?  Documentation of student views (if applicable, e.g. non-required elective). | X |
| Projected headcounts (fall/spring and day/evening) for each new or modified course. | X |
| If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction. | NA |
| Where does this course overlap with other courses, both within and outside of the department? | X |
| Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? | X |
| If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. | NA |
| **Course Design**  Describe how this course is designed. |  |
| Course Context (e.g. required, elective, capstone) | X |
| Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? | X |
| Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) | X |
| How does this course support Programmatic Learning Outcomes? | X |
| Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. | NA |
| **Additional Forms for Specific Course Categories** |  |
| [Interdisciplinary Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/Application-for-Interdisciplinary-Course-Designation.docx) (if applicable) | NA |
| Interdisciplinary Committee Recommendation (if applicable and if received)\*  \*Recommendation must be received before consideration by full Curriculum Committee | NA |
| [Common Core (Liberal Arts) Intent to Submit](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/CommonCoreCourseSubmissionForm_4.2.12.doc) (if applicable) | NA |
| Writing Intensive Form if course is intended to be a WIC (under development) | NA |
| If course originated as an experimental course, then results of evaluation plan as developed with director of assessment. | NA |
| **(Additional materials for [Curricular Experiments](http://www.300jaystreet.com/college-council/curriculum_proposals/curricular-experiments))** |  |
| Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information). | NA |
| Established Timeline for Curricular Experiment | NA |

|  |  |  |  |
| --- | --- | --- | --- |
| NEW YORK CITY COLLEGE OF TECHNOLOGY  **The City University Of New York** | | School of Arts and Sciences  **Department of Biological Sciences** | |
| **Course Information** | | | |
| **Course title:** | Molecular Evolution and Phylogenetics | | |
| **Course code:** | BIO 4250 | | |
| **Credit Hours:** | 3 credit hours | | Lecture and in-class discussions |
| **Prerequisites:** | BIO2250 | | |
| **Text:** | An Introduction to Molecular Evolution and Phylogenetics (2nd edition).  By: Bromham, Lindell | | |
| **Course Description:** | A broad introduction to the field of molecular evolution and phylogenetics. The first portion of the course focuses on foundational genetic and evolutionary principles, whereas the latter half of the course discusses how molecular phylogenies are created from molecular sequences and can be used to test specific evolutionary hypotheses. Discussions of specific case studies complement lectures. | | |
| **Grading Procedure (see Grading Policy for details)** | | | |
| Participation is required. Grades will be based on four exams, case studies, participation in discussions, and a short presentation on a recent (<5 years) article related to molecular evolution and phylogenetics. | | | |
| **Course Coordinators** | | | |
| **Dr. Christopher Blair** | | | |
| (718) 260-5342 | CBlair@citytech.cuny.edu | | |
| **Instructor** | | | |
| **Dr. Christopher Blair** | | | |
| **(718) 260-5342; [CBlair@citytech.cuny.edu](mailto:CBlair@citytech.cuny.edu); A-501A** | | | |

**Extended Course Description**

BIO4250 is a 3-credit course intended to introduce students to how molecular phylogenies can be used to test a variety of evolutionary hypotheses. The course begins with a review of foundational genetic and evolutionary principles. These topics are followed by several chapters on molecular phylogenetics, hypothesis testing, and methods of statistical analysis. One major goal of the course is to provide students with an understanding of the field of molecular evolution without the use of complex equations and calculations. Blackboard will be used heavily in this course.

**Grading Policy**

The grade for this course will be based on weekly participation, four exams, individual case studies, and a short presentation on recent research in molecular evolution and phylogenetics. Exams will be a combination of multiple choice, short answer, true/false, and fill-in-the-blank. Following each chapter in the textbook there will be two case studies. Students are expected to carefully read through the case studies at home or in class (time permitting) and submit carefully written answers **to one of the two** questions presented. Answers to case study questions are to be submitted through Blackboard. If time permits, there will be periodic class discussions of the material each week.

Each student will be required to find and present a recent article (<5 years old) related to the field of molecular evolution and phylogenetics. The City Tech library is an excellent resource to help you search for a relevant article. Some specific journals to search include the following: *Molecular Ecology, Molecular Ecology Resources, Molecular Phylogenetics and Evolution, Molecular Biology and Evolution, Systematic Biology, Biological Journal of the Linnean Society, Journal of Heredity, Proceedings of the Royal Society of London B*. Each student is required to email the potential paper to the instructor for approval prior to beginning the assignment. Presentations should be ~15 min in length and include an overview of the primary question(s) of interest, a brief overview of the methods the researchers used to address their questions/hypotheses, the major findings of the study, and conclusions, limitations, and future directions.

Student performance on this course will be evaluated as follows:

|  |  |
| --- | --- |
| **CRITERIA** | **POINTS** |
| 4 Exams | 60% |
| Case studies | 20% |
| Presentation | 10% |
| Participation | 10% |
| Total | 100% |

**Attendance Policy**

Although City Tech and CUNY do not have a formal attendance policy, attendance and participation in this course is necessary to obtain a passing grade. Missing class means missing the lecture, which means that students will not be able to discuss topics in class and will likely not perform as well on exams.

**Academic Integrity**

City Tech and CUNY have strict policies regarding academic integrity, cheating and plagiarism. Cheating can be defined as giving, receiving, using, or attempting to use unauthorized study materials for exams or other assignments. Punishment for cheating/plagiarism is at the discretion of the instructor, and can range anywhere from receiving a zero for the assignment or exam to receiving a zero for the entire course and possibly expulsion from the college. Disciplinary actions are usually undertaken with consultation from the Department Chair and Dean. Violations should also be reported to the City Tech Academic Integrity Committee.

|  |
| --- |
| **NOTE: Letter grades will be determined using a standard percentage point evaluation as outlined below.**  **A:** 93-100  **A-:** 90-92.9  **B+:** 87-89.9  **B:** 83-86.9  **B-:** 80-82.9  **C+:** 77-79.9  **C** 70-76.9  **D:** 60-69.9  **F:** Below 60 |

Plagiarism can be defined as portraying someone else’s ideas as your own without proper acknowledgement. An example of plagiarism would be copying or paraphrasing text from a published research article for your own report without the appropriate citations. Students can also plagiarize other student’s work and even their own previous reports (e.g., reports submitted for credit in other classes or at other institutions)! Plagiarism is a serious offense that is not taken lightly by CUNY or New York State. Be careful!

**College Statement on Academic Integrity**

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

**Course Need and Justification**

This course will serve as an upper level elective within the Biomedical Informatics program. Although the department currently offers several related courses (e.g. Genetics, Evolution, Bioinformatics I and II), the proposed course differs in several important ways. First, the course will be an upper level elective for students after they have taken a second year general Evolution course (BIO2250). A large portion of the course will focus on basic molecular evolutionary principles and concepts, significantly expanding on the topics covered in BIO2250 and including more computational/bioinformatics examples and exercises. The proposed course will also fill a much-needed gap for training students in basic molecular phylogenetics research. Phylogenetic trees inferred from molecular sequences are now used in some capacity for almost all fields of biology. Unfortunately, these topics are covered at a very basic/rudimentary level in the current course offerings. This shortcoming has progressed through to student internships, many of which use evolutionary trees. This course will remedy the situation by providing students with a comprehensive introduction to both the theory behind evolutionary trees and also expose them to some of the common computational methods used to infer trees. The course will most likely be offered once per year with an initial cap of 16 students.

**Weekly Schedule**

All readings are from “An Introduction to Molecular Evolution and Phylogenetics” by Bromham, L.

|  |  |  |  |
| --- | --- | --- | --- |
| **Week** | **Contents** | **Reading** | **Date** |
| **1** | **Introduction and DNA**  -Reading the story in DNA  -Overview of textbook  -Review of genetics and heredity  -DNA extraction  -*Case studies* | Ch. 1: 2-30  Ch. 2: 31-60 |  |
| **2** | **Mutation**  -Overview of mutation  -SNPs  -Estimating mutation rates  -*Case studies* | Ch. 3: 61-94 |  |
| **3** | **DNA Replication**  -Overview of DNA replication  -DNA amplification and PCR  -DNA sequence evolution  -*Case studies* | Ch. 4: 95-130 |  |
| **4** | **Exam 1**: Background, mutation, DNA replication and PCR | | |
| **Genome**  -Evolution of genome size  -Repeat sequences  -Transposable elements  -*Case studies* | Ch. 5: 131-166 |  |
| **5** | **Gene**  -Molecular properties of genes  -Review of transcription and translation  -Regulation of gene expression  -Gene sequence evolution  -*Case studies* | Ch. 6: 167-196 |  |
| **6** | **Natural Selection**  -Variation in natural populations  -Fitness, linkage, and human evolution  -*Case studies* | Ch. 7: 197-228 |  |
| **7** | **Genetic Drift**  -The neutral theory of evolution  -Drift and effective population size  -Inbreeding and homozygosity  -Substitution patterns  -*Case studies* | Ch. 8: 229-261 |  |
| **8** | **Exam 2**: Genes, genomes, natural selection and genetic drift | | |
| **Species**  -Taxonomy and classification  -Divergence, speciation and hybrid incompatibility  -Defining species through DNA-based methods  -*Case studies* | Ch. 9: 262-294 |  |
| **9** | **Alignment**  -Homology vs. analogy/homoplasy  -DNA homology vs. morphological homology  -Indels and gaps  -Manual and automated multiple sequence alignment | Ch. 10: 295-328 |  |
| **10** | **Phylogeny**  -Tree-based thinking in evolutionary biology  -Principles and characteristics of phylogenetic trees  -Methods of phylogenetic inference  -Phylogenetic networks  -*Case studies* | Ch. 11: 329-368 |  |
| **11** | **Hypotheses**  -Evaluating and comparing phylogenetic trees  -Models of molecular evolution  -Maximum likelihood and Bayesian inference of trees  -Statistical methods of tree support  -*Case studies* | Ch. 12: 369-402 |  |
| **12** | **Exam 3**: Species, sequence alignment, statistical methods of phylogeny reconstruction | | |
| **Substitution Rates**  -Rate variation across sites and branches of trees  -Potential causes of evolutionary rate variation  -Testing for rate variation  -*Case studies* | Ch. 13: 403-437 |  |
| **13** | **Dates/Divergence Time Estimation**  -The importance of the fossil record  -Estimation of divergence times  -Gene divergence vs. population/species divergence  -Strict vs. relaxed molecular clocks  -*Case studies* | Ch. 14: 438-483 |  |
| **14** | **Student Presentations** | None |  |
| **15** | **Student Presentations/Review for Final** | None |  |
| **Final Exam (Cumulative)** |  |  |

**Grading Rubric for Student Presentations**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criteria** | **Excellent** | **Very Good** | **Good** | **Unacceptable** |
| **Presentation**  **Preparedness and clarity**   1. **Preparation** 2. **Structure/Style** 3. **Content**   **30 points max.**  **Presentation will count for 10% of final grade** | 1. Shows an excellent understanding of research paper. Presentation of material is clear and encourages discussion from peers.  **(9 pts)** | 1. Shows a good understanding of research and is able to clearly articulate ideas to peers. Instructor may rarely clarify ideas or concepts.  **(6-8 points)** | 1. Demonstrates basic understanding of material and is able to initiate some discussion. Instructor may have to lead periodically.  **(3-5 points)** | 1. Clear lack of preparation and understanding of the research paper. Unable to present the material and initiate discussion.  **(1-2 points)** |
| 2. The presentation is well structured. Clearly provides background information, states methods, results and conclusions **(9 pts)** | 2. Minor issues with structure and style may be present.  Flow of presentation generally concise and understandable  **(6-8 points)** | 2. Issues with structure and style are present. Flow of presentation difficult to follow, although purpose may be intelligible  **(3-5 points)** | 2. Major issues with structure and style that impede meaning. Difficult to understand purpose of research.  **(1-2 points)** |
| 3. Content is relevant to the course objectives. Article <5 years old.  **(12 pts)** | 3. Content and presentation is moderately relevant to course, and shows the student’s engagement and contribution. Article <5 years old.  **(7-11 pts)** | 3. Content and presentation weakly relevant to course. Article >5 years old.  **(3-6 pts)** | 3. Content and presentation distantly related to course objectives/topics. Article >5 years old.  **(1-2 points)** |

**Discipline Specific**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **ASSESSMENT** |
| Develop both qualitative and quantitative analytical skills in the life sciences. | Analysis of case studies; critical evaluation of peer-reviewed research papers; in-class discussions of statistical methods for phylogenetic inference. |
| Use quantitative reasoning to apply statistical methods and mathematical modeling in the analysis of biomedical datasets. | Analysis of case studies; critical evaluation of peer-reviewed research papers; in-class discussions of statistical methods for phylogenetic inference. |
| Demonstrate the ability to effectively communicate complex biomedical concepts within and across disciplinary boundaries. | Synthesis and presentation of a current (<5 years old) research paper in the field of molecular evolution & phylogenetics; in-class discussions and written answers to case studies. |
| Illustrate an understanding of how molecular phylogenies are being used in diverse disciplines within the life sciences. | Weekly discussions; performance on exams; presentation of a current research paper in the field. |

**General Education**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **ASSESSMENT** |
| Employ scientific reasoning and logical thinking | Analysis of student performance on lecture exams and discussions. |
| Communicate in diverse settings and groups, using written, oral, and visual means. | Performance in class discussions and presentation of research paper. |
| Acquire tools for lifelong learning – how to learn, how they learn, knowledge of resources. | Analysis of student performance on lecture exams, discussions, presentation, and written responses to case studies. |
| Demonstrate an understanding of professional and ethical responsibility | Weekly discussions of current research themes in molecular evolution & phylogenetics |

**LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION**

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs. Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline**.

**Course proposer:** please complete boxes 1-4. **Library faculty subject specialist:** please complete box 5.

|  |  |  |
| --- | --- | --- |
| **1** | **Title of proposal**  New Course: Molecular Evolution & Phylogenetics (BIO4250) | **Department/Program**  Biological Sciences/Biomedical Informatics |
|  | **Proposed by** (include email & phone)  Prof. Christopher Blair  [cblair@citytech.cuny.edu](mailto:cblair@citytech.cuny.edu)  718-260-5342 | **Expected date course(s) will be offered**  Spring 2020  **# of students**  16 per year |

|  |  |
| --- | --- |
| **2** | **The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?**  The textbook selected for the course is up-to-date and written in a way conducive to student learning at City Tech. |

|  |  |
| --- | --- |
| **3** | **Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.**  The materials available should be sufficient. |

|  |  |
| --- | --- |
| **4** | **Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**  I will periodically consult with the library subject specialist as needs arise. |

|  |  |
| --- | --- |
| **5** | **Library Faculty Subject Specialist \_\_** Cailean CooneyPicture 12  **Comments and Recommendations**  The Library provides resources relevant to the course subject, available both on-site and online, including print and electronic books, reference materials, and journal subscriptions. Print books from other CUNY campuses are also available to request. In addition, the library provides digital resources and can offer programming to support students in developing information literacy and research skills. The Library will consider additional resource requests based on budgetary means and welcomes recommendations for book monograph purchases to update the collection on a yearly basis.  Zero-cost open course materials can provide students with reliable access to revisit concepts and test their knowledge independently and at the advisement of instructors. Prof. Cooney will keep the Biology Department informed of potential funding opportunities to develop OERs, and will pass along any relevant OERs for the Department’s review. To that end, I recommend conducting a search in [OER Commons](https://www.oercommons.org/?gclid=EAIaIQobChMI7e2VktKQ3gIVyFSGCh3PWQ3ZEAAYASAAEgLKlPD_BwE) – there may be supplemental and ancillary resources to reinforce student knowledge.  **Date:** 10/18/18 |

**CHANCELLOR’S REPORT FORM**

New course to be offered in the Biology department

|  |  |
| --- | --- |
| **Department** | **Biology** |
| **Academic Level** | **[ X ] Regular  [   ] Compensatory  [   ] Developmental  [   ] Remedial** |
| **Subject Area** | **Biomedical Informatics** |
| **Course Prefix** | **BIO** |
| **Course Number** | **4250** |
| **Course Title** | **Molecular Evolution & Phylogenetics** |
| **Catalog Description** | **A broad introduction to the field of molecular evolution and phylogenetics. The first portion of the course focuses on foundational genetic and evolutionary principles, whereas the latter half of the course discusses how molecular phylogenies are created from molecular sequences and can be used to test specific evolutionary hypotheses. Discussions of specific case studies complement lectures.** |
| **Prerequisite** | **BIO2250** |
| **Corequisite** |  |
| **Pre- or corequisite** |  |
| **Credits** | **3** |
| **Contact Hours** | **3** |
| **Liberal Arts** | **[ ] Yes  [X] No** |
| **Course Attribute (e.g. Writing Intensive, etc)** |  |
| **Course Applicability** | **[X] Major**  **[ ] Gen Ed Required [ ] Gen Ed - Flexible [ ] Gen Ed - College Option**  **[ ] English Composition [ ] World Cultures [ [ ]Speech**  **[ ] Mathematics [ ] US Experience in its Diversity [ ] Interdisciplinary**  **[ ] Science [ ] Creative Expression [ ] Advanced Liberal Arts**  **[ ] Individual and Society**  **[ ] Scientific World** |
| **Effective Term** | **Spring 2020** |

**Rationale:** BIO4450 will be an upper-level elective for students in the Biomedical Informatics program. Importantly, the course will fill a gap in student knowledge regarding the creation, interpretation, and use of molecular phylogenies in biological and bioinformatics research. This course will enable students to synthesize knowledge acquired in both lower-level biology courses and foundational bioinformatics courses.Training in computational evolutionary biology will enhance the student learning experience and make graduates more competitive for entry into industry or graduate school.

SECTION 5: New course Proposal: Artificial Intelligence and the Brain (BIO 1020)

New York City College of Technology, CUNY

CURRICULUM MODIFICATION PROPOSAL FORM

This form is used for all curriculum modification proposals. See the [Proposal Classification Chart](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-09-Proposal_Classification_Chart.pdf) for information about what types of modifications are major or minor. Completed proposals should be emailed to the Curriculum Committee chair.

|  |  |
| --- | --- |
| **Title of Proposal** | **New course: Artificial Intelligence and the Brain (BIO1020)** |
| **Date** | **September 28, 2018** |
| **Major or Minor** | **Major** |
| **Proposer’s Name** | **Prof. Vasiliy Kolchenko** |
| **Department** | **Biological Sciences** |
| **Date of Departmental Meeting in which proposal was approved** | **October 4, 2018** |
| **Department Chair Name** | **Prof Andleeb Zameer** |
| **Department Chair Signature and Date** | **SIGN.png 10/8/18** |
| **Academic Dean Name** | **Dean Justin Vazquez-Poritz** |
| **Academic Dean Signature and Date** | **Picture 1 10/8/18** |
| **Brief Description of Proposal**  (Describe the modifications contained within this proposal in a succinct summary. More detailed content will be provided in the proposal body. | **The course explores basic biology of the human brain and how it is related to the biologically inspired and pervasive field of artificial intelligence, AI. It covers fundamentals of neuroscience and AI history, current advances, methods, applications, ethical issues and potential developments in society and sciences. Students use online tools that do not require advanced math or programming. The brain-AI study is focused on learning, prediction and adaptation.** |
| **Brief Rationale for Proposal**  (Provide a concise summary of why this proposed change is important to the department. More detailed content will be provided in the proposal body). | **Developing a new introductory general education course that explores the human brain biology in the context of the artificial intelligence methods and applications will provide an important and much needed educational opportunity to our students, both in the Biomedical Informatics Program in the Biology Department and in other programs at City Tech.** |
| **Proposal History**  (Please provide history of this proposal: is this a resubmission? An updated version? This may most easily be expressed as a list). | **This proposal represents the first submission.** |

Please include all appropriate documentation as indicated in the Curriculum Modification Checklist.

For each new course, please also complete the New Course Proposal and submit in this document.

Please submit this document as a single .doc or .rtf format. If some documents are unable to be converted to .doc, then please provide all documents archived into a single .zip file.

**ALL PROPOSAL CHECK LIST**

|  |  |
| --- | --- |
| Completed CURRICULUM MODIFICATION FORM including: |  |
| * Brief description of proposal | X |
| * Rationale for proposal | X |
| * Date of department meeting approving the modification | X |
| * Chair’s Signature | X |
| * Dean’s Signature | X |
| Evidence of consultation with affected departments  List of the programs that use this course as required or elective, and courses that use this as a prerequisite. | X |
| Documentation of Advisory Commission views (if applicable). |  |
| Completed [Chancellor’s Report Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-09-Chancellor_Report_Quick_Reference_Guide1.doc). | X |

**EXISTING PROGRAM MODIFICATION PROPOSALS**

|  |  |
| --- | --- |
| Documentation indicating core curriculum requirements have been met for new programs/options or program changes. | X |
| Detailed rationale for each modification (this includes minor modifications) | X |

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-10-Curriculum_Modification_Proposal_Form.docx) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

|  |  |
| --- | --- |
| **Course Title** | **Artificial Intelligence and the Brain** |
| **Proposal Date** | **September 28, 2018** |
| **Proposer’s Name** | **Prof. Vasiliy Kolchenko** |
| **Course Number** | **BIO 1020** |
| **Course Credits, Hours** | **3 credits, 3 hours of integrated lecture and laboratory** |
| **Course Pre / Co-Requisites** | **CUNY proficiency in reading, writing (or concurrent enrollment in ENG 092W, ESOL 021W, or ESOL 031W) and math (or concurrent enrollment in MAT 0650).** |
| **Catalog Course Description** | **The course explores basic biology of the human brain and how it is related to the biologically inspired and pervasive field of artificial intelligence, AI. It covers fundamentals of neuroscience and AI history, current advances, methods, applications, ethical issues and potential developments in society and sciences. Students use online tools that do not require advanced math or programming. The brain-AI study is focused on learning, prediction and adaptation.** |
| **Brief Rationale**  Provide a concise summary of why this course is important to the department, school or college. | **Developing a new introductory general education course that explores the human brain biology in the context of the artificial intelligence methods and applications will provide an important and much needed educational opportunity to our students, both in the Biomedical Informatics Program in the Biology Department and in other programs at City Tech.** |
| **CUNY – Course Equivalencies**  Provide information about equivalent courses within CUNY, if any. | **There are no equivalent General Education courses within CUNY.** |
| **Intent to Submit as Common Core**  If this course is intended to fulfill one of the requirements in the common core, then indicate which area. | **The course fulfills the Common Core requirement in the Life and Physical Sciences area.** |
| **Intent to Submit as An Interdisciplinary Course** | **No** |
| **Intent to Submit as a Writing Intensive Course** | **Yes** |

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

**NEW COURSE PROPOSAL CHECK LIST**

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

|  |  |
| --- | --- |
| **Completed NEW COURSE PROPOSAL FORM** |  |
| * Title, Number, Credits, Hours, Catalog course description | √ |
| * Brief Rationale | √ |
| Completed [Library Resources and Information Literacy Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/curriculum_modification_library_form.doc) |  |
| **Course Outline**  Include within the outline the following. |  |
| Hours and Credits for Lecture and Labs  If hours exceed mandated Carnegie Hours, then rationale for this | √ |
| Prerequisites/Co- requisites | √ |
| Detailed Course Description | √ |
| Course Specific Learning Outcome and Assessment Tables   * Discipline Specific * General Education Specific Learning Outcome and Assessment Tables | √ |
| Example Weekly Course outline | √ |
| Grade Policy and Procedure | √ |
| Recommended Instructional Materials (Textbooks, lab supplies, etc) | √ |
| Library resources and bibliography | √ |
| **Course Need Assessment.**  Describe the need for this course. Include in your statement the following information. |  |
| Target Students who will take this course. Which programs or departments, and how many anticipated?  Documentation of student views (if applicable, e.g. non-required elective). | √ |
| Projected headcounts (fall/spring and day/evening) for each new or modified course. | √ |
| If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction. | √ |
| Where does this course overlap with other courses, both within and outside of the department? | √ |
| Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? | √ |
| If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. | √ |
| **Course Design**  Describe how this course is designed. |  |
| Course Context (e.g. required, elective, capstone) | √ |
| Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? | √ |
| Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) | √ |
| How does this course support Programmatic Learning Outcomes? | √ |
| Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. | √ |
| **Additional Forms for Specific Course Categories** |  |
| [Interdisciplinary Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/Application-for-Interdisciplinary-Course-Designation.docx) (if applicable) | N/A |
| [Common Core (Liberal Arts) Intent to Submit](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/CommonCoreCourseSubmissionForm_4.2.12.doc) (if applicable) | √ |
| Writing Intensive Form if course is intended to be a WIC (under development) | √ |
| If course originated as an experimental course, then results of evaluation plan as developed with director of assessment. | N/A |
| **(Additional materials for [Curricular Experiments](http://www.300jaystreet.com/college-council/curriculum_proposals/curricular-experiments))** |  |
| Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information). | N/A |
| Established Timeline for Curricular Experiment | N/A |

**LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION**

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs. Consult with your library faculty subject specialist (<http://cityte.ch/dir>) 3 weeks before the proposal deadline. Course proposer: please complete boxes 1-4. Library faculty subject specialist: please complete box 5.

|  |  |  |
| --- | --- | --- |
| **1** | **Title of proposal**  **BIO 1020, Artificial Intelligence and the Brain** | **Department/Program**  **Biological Sciences** |
|  | **Proposed by** (include email & phone)  Dr. Vasiliy Kolchenko  [vkolchenko@citytech.cuny.edu](mailto:vkolchenko@citytech.cuny.edu), 718-260-5904 | **Expected date course(s) will be offered**  Spring 2020  **# of students** 20 |

|  |  |
| --- | --- |
| **2** | **The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?**  The search of our OER guide for the course did not provide any results. There are some relevant articles and books available at the library. |

|  |  |
| --- | --- |
| **3** | **Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.**  No additional resources are needed at the moment. |

|  |  |
| --- | --- |
| **4** | **Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**  Instructors will consult with the library faculty subject specialist as soon as the new publications of particular interest appear. |

|  |  |
| --- | --- |
| **5** | **Library Faculty Subject Specialist \_\_** Cailean CooneyPicture 11  **Comments and Recommendations**  Zero-cost open course materials will provide students with reliable access to revisit concepts and test their knowledge independently and at the advisement of instructors. Prof. Cooney will keep the Biology Department informed of potential funding opportunities to develop OERs, possibly for the lab component of this course, and will pass along relevant OERs and library materials in this subject area to the department.  The Library provides resources relevant to the course topic, available both on-site and online, including print and electronic books, and journal subscriptions. Print books from other CUNY campuses are also available to request. The Library will consider additional resource requests based on budgetary means.  **Date:** 9/27/18 |

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| NEW YORK CITY COLLEGE OF TECHNOLOGY  **The City University**  **Of New York** | | School of Arts and Sciences  **Biological Sciences Department** |
| **Course Information** | | |
| **Course title:** | **Artificial Intelligence and the Brain** | |
| **Course code:** | **BIO 1020** | |
| **Credit Hours:** | **3 credit hours of integrated lecture and lab** | |
| **3 hours per week; 15 weeks total.** | |
| **Prerequisite:** | **CUNY proficiency in reading, writing (or concurrent enrollment in ENG 092W, ESOL 021W, or ESOL 031W) and math (or concurrent enrollment in MAT 0650).** | |
| **Text:** | **Russel, Stuart J., and Peter Norvig. *Artificial intelligence: a modern approach*. Pearson Education Limited, 2016**. | |
| **Official Course Description (from the College Catalog)** | **The course explores basic biology of the human brain and how it is related to the biologically inspired and pervasive field of artificial intelligence, AI. It covers fundamentals of neuroscience and AI history, current advances, methods, applications, ethical issues and potential developments in society and sciences. Students use online tools that do not require advanced math or programming. The brain-AI study is focused on learning, prediction and adaptation.** | |
| **Course Mechanics** | **All the concepts and techniques taught in this course are computer-based. Assignments will be given periodically, and regular and active participation in discussions is required. Timely completion of assignments is critical to success in the course. Attendance is absolutely required. Aside from serving as the venue to introduce new topics, it will also provide an opportunity for students to discuss any difficulty they are having regarding the course.** | |
| **Grading Procedure (see Grading Policies for details)** | | |
| The grade is based on regular quizzes and assignments, exams, lab activities, and a group project. | | |
| **Course Objectives and Student Expectations** | | |
| Students are expected to be able to work independently and regularly, as well as collaborate with fellow students on group projects as required. This course is fast paced, and covers a diverse set of topics, and therefore students must be able to keep up with the work assigned in order to be successful in the course. | | |
| **Course Objectives** | Having successfully completed this course, the student will be able to:   1. Describe the history of neuroscience and artificial intelligence. 2. Describe the basics of using relevant online databases and tools. 3. Work as a team on a group project. 4. Briefly describe the various artificial intelligence applications and basic methods. 5. Describe the different aspects of the natural vs. artificial neural networks. 6. Demonstrate understanding of ethical issues in the fields of artificial intelligence and neuroscience. 7. Discuss and identify the reliable sources of information concerning the potential developments in artificial intelligence, both in society and in sciences. | |
| **Online Resources** | CUNY’s Blackboard resource can be accessed via the CUNY Portal, at:  <http://portal.cuny.edu/portal/site/cuny/index.jsp>  A Beginner’s Guide to Blackboard, as well as help on other resources such as Wiki and Wimba, can be found here:  <http://websupport1.citytech.cuny.edu/websupport1/It/online/students/index.htm>  The National Center for Biotechnology Information, which hosts all the databases that will be used in this course, as well as tutorials on how to navigate around the website and the databases, can be found here:  <http://www.ncbi.nlm.nih.gov/>  Easy access to all the online resources for Bioinformatics can be found here:  <http://www.ncbi.nlm.nih.gov/guide/all/>  Other online resources will be assigned as necessary. | |

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| --- |
| **Vasiliy Kolchenko**  **Office: A501F**  **Email:** vkolchenko@citytech.cuny.edu, |

**Detailed Course Description and Rationale**

This is a 3-credit general education course in the *Life and Physical Sciences* area. It includes an integrated lecture and lab. The course explores basic biology of the human brain and how it is related to the biologically inspired and pervasive field of artificial intelligence, AI. It covers fundamentals of neuroscience and AI history, current advances, methods, applications, ethical issues and potential developments in society and sciences. Students use online tools that do not require advanced math or programming. The brain-AI study is focused on learning, prediction and adaptation. All the concepts and techniques taught in this course use computer and online-based resources. Assignments will be given periodically, and regular and active participation in discussions is required. Blackboard is used extensively throughout the course.

**General Education Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **ASSESSMENT** |
| Understand how the multiple academic disciplines contribute to the field’s knowledge. | Analysis of student performance on participation, assignments, group projects quizzes and exams. |
| Employ scientific reasoning and logical thinking in order to solve problems. Apply and develop reading, writing and analytical skills in order to work productively within and across disciplines. | Effectiveness in in-class and online exercises as assessed through exams, assignments, lab reports and project reports and presentations. |
| Work with teams. Build consensus. Respect and use creativity. Develop skills for lifelong learning including scientific curiosity and critical thinking. | Analysis of student performance in group projects based on project reports and presentations. |

**The Common Core Life and Physical Sciences Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **ASSESSMENT** |
| Identify and apply the fundamental concepts and methods of the human brain biology and artificial intelligence, AI, for reviewing the foundations of information processing in the organism and analyzing some biologically inspired concepts and methods of AI (neural networks, genetic and evolutionary computing, etc.). | Analysis of student performance based on quizzes, exams and participation in in-class and online discussions. |
| Apply the scientific method to explore the introductory neuroscience, robotics, AI methods of DNA and protein analysis and others. The labs are based on testing hypotheses by analyzing experimental data and presenting the results in a laboratory report. | Effectiveness of participation in online and in-class exercises and lab activities based on the quizzes, lab reports and Blackboard discussions. |
| Use biological databases and online tools for modeling and prediction of biological processes and molecular structures in order to carry out collaborative laboratory investigations. | Proficiency in using biological databases and online tools based on the completion of assignments and lab report analysis. |
| Retrieve, analyze and interpret experimental data stored in the biological databases or collected and presented online in a well-structured laboratory report. This course is a Writing Intensive Course. | Analysis of student performance based on the lab reports and online discussion participation. |
| Explore and apply research ethics and unbiased assessment of data in the investigation of artificial intelligence and neuroscience, including the current and potential developments in science and society. | Analysis of student performance in group projects and online discussions based on project reports and presentations and on Blackboard metrics. |

**Course-based Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **ASSESSMENT** |
| Understand and describe the range of artificial intelligence applications across the fields of scientific, professional and applied study. | Analysis of student performance based on lab quizzes, lecture exams and completed assignments. |
| Recognize and outline the role of the biological and artificial neural networks in information processing. | Evaluation of student participation in lab activities and online discussions based on the lab reports, Blackboard metrics and lab quizzes. |
| Using neural networks, apply the scientific method and critical thinking to the analysis of learning, prediction and decision making. | Assessment of student skills based on the completion of assignments and lab reports. |
| Explain the current and potential developments in artificial intelligence and analyze the ethical, social and biological implications of these developments. | Analysis of student performance based on the group project reports and presentations and on the results of the online discussions. |

**Integrated Lecture and Lab Schedule**

|  |  |
| --- | --- |
| **Week 1** | Introduction to the course. History of neuroscience and artificial intelligence.  Can a machine think?  *Lab*: The Turing test, pros and cons. Online Turing Machine.Artificial intelligence  digital assistants. |
| **Week 2** | DNA structure, function and information content. Genetic code vs. binary  code. The nature of computers.  *Lab*: Artificial intelligence tools for DNA analysis. |
| **Week 3** | The basic structure and function of the nervous system and the brain.  Introduction to neurons, action potentials and neurotransmission.  *Lab*: McCulloch-Pitts neurons. Artificial neural networks. |
| **Week 4** | Learning from examples. The review of the machine learning methods.  Supervised and unsupervised learning.  *Lab*: Artificial intelligence tools for protein function and structure analysis. |
| **Week 5** | The review of the artificial neural network applications: natural language  processing. The multilayered neural networks.  *A virtual neuroscience lab*: electroencephalogram patterns and their correlates. |
| **Week 6** | The review of the artificial neural network applications: speech recognition and  computer translation. The feed-forward neural networks. The recurrent neural  networks.  *Lab*: Artificial intelligence tools for gene finding. |
| **Week 7** | **Midterm Exam** Genetic and evolutionary computing. Probabilistic approaches in  artificial intelligence. Hidden Markov models.  *Lab*: Complex adaptive systems. |
| **Week 8** | The review of the artificial neural network applications: computer vision and  object recognition. The back-propagation learning approach.  *Lab*: Computer programs that can see. |
| **Week 9** | The review of the artificial neural network applications: introductions to robotics.  Driverless vehicles. Deep neural networks.  *A virtual robotics lab*: Behavior based or “Bottom-up” robots. |
| **Week 10** | The artificial neural network applications in medicine: the A.I. medical  diagnostician. Deep learning.  *A virtual robotics lab*: “Top-down” robots. ProtoThinker: A model of the mind. |
| **Week 11** | The artificial neural network applications in medicine: The A.I. drug discovery and  personalized therapy.  *A virtual neuroscience lab*: Neurotransmission and Parkinson’s disease. |
| **Week 12** | The artificial neural network applications in medicine: The A.I. smart electronic  health records. Artificial general intelligence.  *A virtual neuroscience lab*: Neurotransmission and addiction. |
| **Week 13** | The artificial neural network applications in medicine: The A.I. fitness instructor,  nutritionist and the behavioral modification.  *A virtual neuroscience lab*: The cerebrovascular accident. |
| **Week 14** | Group project presentations. The state-of-the-art A.I. and the future of artificial intelligence. Ethical, social and biological implications.  *Lab*: Reinforcement learning. |
| **Week 15** | Group project presentations.  **Final Exam** |

**Grading Policies**

Please bear in mind that this course is a **3-credit** course. Student performance on this course will be evaluated as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **ASSIGNMENT** | | **DESCRIPTION** | **POINTS** |
|  | Laboratory assignments | Expected timely completion of each  lab assignment and lab report | 30% |
| Participation | In-class and online discussions | 10% |
| Group Project | Topics assigned after the Midterm  Project report – 5%; project presentation – 5% | 10% |
|  | Lecture exams and lab quizzes | Midterm Exam – 15%  Final Exam – 20%  Five quizzes – 15% | 50% |

|  |
| --- |
| **NOTE: Letter grades will be determined using a**  **standard percentage point evaluation as outlined below:**  **A:** 93-100  **A-:** 90-92.9  **B+:** 87-89.9  **B:** 83-86.9  **B-:** 80-82.9  **C+:** 77-79.9  **C** 70-76.9  **D:** 60-69.9  **F:** Below 60 |

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| --- | --- |
| **Policy on Academic Integrity** | |
| Academic dishonesty includes any act that is designed to obtain fraudulently, either for oneself or for someone else, academic credit, grades, or any other form of recognition that was not properly earned. Academic dishonesty, which will not be tolerated in this course and at City Tech, encompasses the following: | |
| **Cheating** | Defined as intentionally giving, receiving, using or attempting to use unauthorized materials, information, notes, study aids, including any form of unauthorized communication, in any academic exercise. It is the student’s responsibility to consult with instructors to determine whether or not a study aid or device may be used. |
| **Plagiarism** | Plagiarism is intentionally and knowingly presenting the ideas or works of another as one’s own original idea or works in any academic exercise without proper acknowledgement of the source. The purchase and submission of a term paper, essay, or other written assignment to fulfill the requirements of a course, and violates section 213-b of the *State Education Law*. This also applies to the submission of all or substantial portions of the same academic work previously submitted by the student or any other individual for credit at another institution, or in more than one course. |
| **Course Policy**  **on Academic Integrity** | Cheating and plagiarism will not be tolerated in this course. Penalties are the following. Cheating in in-class exams or quizzes will merit an automatic zero for the exercise. Copying from classmates’ lab worksheets and other take-home or online assignments will also merit an automatic zero for the exercise. Repeated violations will be reported to the Chair and the Dean, and may result in a final grade of “F” in the course, or even expulsion from the College. If you are unsure whether any of your actions constitute cheating or plagiarism, please consult the instructor for guidance. |
| **College Policy on Academic Integrity** | Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion. |

**Recommended Instructional Materials**

Textbook: Russell, Stuart J., and Peter Norvig. *Artificial intelligence: a modern approach*. Pearson Education Limited, 2016.

The labs are using online resources (The Mind Project, DNA from the Beginning and others)

<http://www.mind.ilstu.edu/curriculum/list.php?sortBy=category>

<http://www.dnaftb.org/>

**Bibliography**

Nilsson, Nils J. *The quest for artificial intelligence*. Cambridge University Press, 2009.

Kurzweil, Ray. *How to create a mind: The secret of human thought revealed*. Penguin, 2013.

Russell, Stuart J., and Peter Norvig. *Artificial intelligence: a modern approach*. Pearson Education Limited, 2016.

Domingos, Pedro. *The master algorithm: How the quest for the ultimate learning machine will remake our world*. Basic Books, 2015.

Hawkins, Jeff, and Sandra Blakeslee. *On intelligence: How a new understanding of the brain will lead to the creation of truly intelligent machines*. Macmillan, 2007.

Bostrom, Nick. *Superintelligence*. Dunod, 2017.

Banich, Marie T., and Rebecca J. Compton. *Cognitive neuroscience*. Cambridge University Press, 2018.

**Course Needs Assessment**

Developing a new introductory general education course that explores the human brain biology in the context of the artificial intelligence methods and applications will provide an important and much needed educational opportunity to our students, both in the Biomedical Informatics Program in the Biology Department and in other programs at City Tech.

- Target Students who will take this course: In addition to the students in the Biomedical Informatics program, other City Tech students can also take this course in order to fulfill the General Education common core requirement or as a General Education elective. Initial anticipated enrollment is 20 students per semester, starting in the Spring 2020.

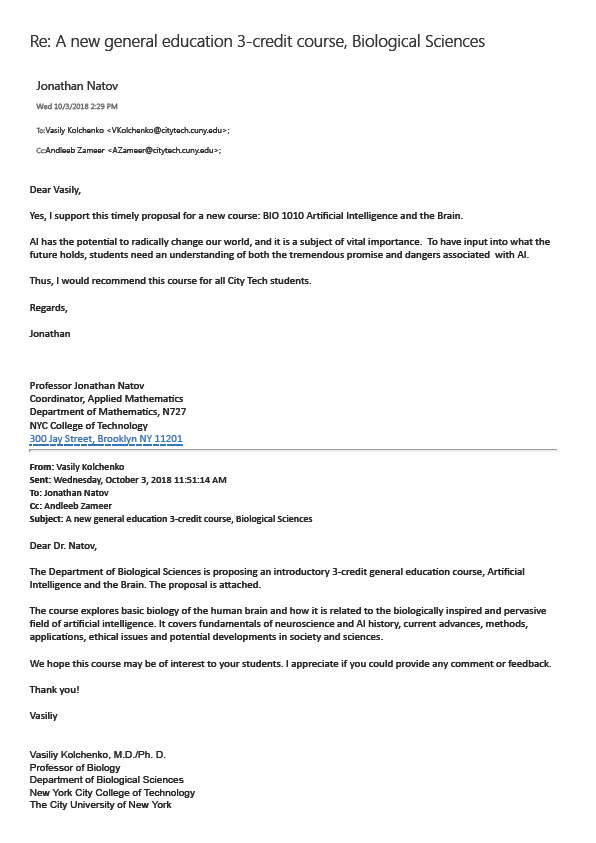
- No additional physical resources are required.

- There are no other general education courses, both within and outside of the department, focused on the AI-brain comparison. The Department of Biological Sciences has full time faculty qualified to teach this course, particularly the instructors who are currently teaching Biolmedical Informatics required courses.

**Course Design**

This is a 3-credit General Education course in the *Life and Physical Sciences* area. It can be taken to fulfill the General Education requirement or as a General Education elective. It will be offered as an integrated lecture and lab. Anticipated pedagogical strategies and instructional design include group work for the lab activities, team projects and presentations, lectures, discussions and online assignments. The course is designed to be partially online. Online resources are particularly important for the subject. Students will acquire much needed skills working online, both individually and in groups.

**Consultations with Other Departments**



**CHANCELLOR’S REPORT FORM**

New courses to be offered in the Biology department

|  |  |
| --- | --- |
| **Department** | Biology |
| **Academic Level** | **[ X ] Regular  [   ] Compensatory  [   ] Developmental  [   ] Remedial** |
| **Subject Area** | Biomedical Informatics |
| **Course Prefix** | BIO |
| **Course Number** | 1020 |
| **Course Title** | Artificial Intelligence and the Brain |
| **Catalog Description** | The course explores basic biology of the human brain and how it is related to the biologically inspired and pervasive field of artificial intelligence, AI. It covers fundamentals of neuroscience and AI history, current advances, methods, applications, ethical issues and potential developments in society and sciences. Students use online tools that do not require advanced math or programming. The brain-AI study is focused on learning, prediction and adaptation. |
| **Prerequisite** | CUNY proficiency in reading, writing (or concurrent enrollment in ENG 092W, ESOL 021W, or ESOL 031W) and math (or concurrent enrollment in MAT 0650). |
| **Corequisite** |  |
| **Pre- or corequisite** |  |
| **Credits** | 3 |
| **Contact Hours** | 3 |
| **Liberal Arts** | **[X] Yes  [   ] No** |
| **Course Attribute (e.g. Writing Intensive, etc)** | Writing Intensive Course |
| **Course Applicability** | **[ ] Major**  **[ X ] Gen Ed Required [ ] Gen Ed - Flexible [ ] Gen Ed - College Option**  **[ ] English Composition [ ] World Cultures [ [ ]Speech**  **[ ] Mathematics [ ] US Experience in its Diversity [ ] Interdisciplinary**  **[ X ] Science [ ] Creative Expression [ ] Advanced Liberal Arts**  **[ ] Individual and Society**  **[ ] Scientific World** |
| **Effective Term** | Spring 2020 |

**Rationale:** Developing a new introductory general education course that explores the human brain biology in the context of the artificial intelligence methods and applications will provide an important and much needed educational opportunity to our students, both in the Biomedical Informatics Program in the Biology Department and in other programs at City Tech. Intend to submit as a Pathways Life and Physical Sciences course.

**CUNY Common Core   
Course Submission Form**

Instructions: All courses submitted for the Common Core must be liberal arts courses. Courses may be submitted for only one area of the Common Core. All courses must be 3 credits/3 contact hours unless the college is seeking a waiver for another type of Math or Science course that meets major requirements. Colleges may submit courses to the Course Review Committee at any time. Courses must also receive local campus governance approval for inclusion in the Common Core.

|  |  |  |
| --- | --- | --- |
| **College** | New York City College of Technology | |
| **Course Prefix and Number** | BIO 1020 | |
| **Course Title** | Artificial Intelligence and the Brain | |
| **Department(s)** | Biological Sciences | |
| **Discipline** | Biology | |
| **Credits** | 3 | |
| **Contact Hours** | 3 | |
| **Pre-requisites (if none, enter N/A)** | CUNY proficiency in reading, writing (or concurrent enrollment in ENG 092W, ESOL 021W, or ESOL 031W) and math (or concurrent enrollment in MAT 0650). | |
| **Co-requisites (if none, enter N/A)** | N/A | |
| **Catalogue Description** | The course explores basic biology of the human brain and how it is related to the biologically inspired and pervasive field of artificial intelligence, AI. It covers fundamentals of neuroscience and AI history, current advances, methods, applications, ethical issues and potential developments in society and sciences. Students use online tools that do not require advanced math or programming. The brain-AI study is focused on learning, prediction and adaptation. | |
| **Special Features (e.g., linked courses)** | N/A | |
| **Sample Syllabus** | Syllabus is included. | |
| **Indicate the status of this course being nominated:**  current course revision of current course a new course being proposed | | |
| **CUNY COMMON CORE Location**  **Please check below the area of the Common Core for which the course is being submitted. (Select only one.)** | | |
| Required  English Composition  Mathematical and Quantitative Reasoning  Life and Physical Sciences | | Flexible  World Cultures and Global Issues Individual and Society  US Experience in its Diversity Scientific World  Creative Expression |
| **Waivers for Math and Science Courses with more than 3 credits and 3 contact hours**  Waivers for courses with more than 3 credits and 3 contact hours will only be accepted in the required areas of “Mathematical and Quantitative Reasoning” and “Life and Physical Sciences.” Three credit/3-contact hour courses must also be available in these areas. | | |
| **If you would like to request a waiver please check here:** | | Waiver requested |
| **If waiver requested:**  Please provide a brief explanation for why the course will not be 3 credits and 3 contact hours. | |  |
| **If waiver requested:**  Please indicate whether this course will satisfy a major requirement, and if so, which major requirement(s) the course will fulfill. | |  |

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| --- | --- |
| **Learning Outcomes**  **In the left column explain the course assignments and activities that will address the learning outcomes in the right column.** | |
| 1. **Required Core (12 credits)** | |
| **A. English Composition:** Six credits  A course in this area must meet all the learning outcomes in the right column. A student will: | |
|  | * Read and listen critically and analytically, including identifying an argument's major assumptions and assertions and evaluating its supporting evidence. |
|  | * Write clearly and coherently in varied, academic formats (such as formal essays, research papers, and reports) using standard English and appropriate technology to critique and improve one's own and others' texts. |
|  | * Demonstrate research skills using appropriate technology, including gathering, evaluating, and synthesizing primary and secondary sources. |
|  | * Support a thesis with well-reasoned arguments, and communicate persuasively across a variety of contexts, purposes, audiences, and media. |
|  | * Formulate original ideas and relate them to the ideas of others by employing the conventions of ethical attribution and citation. |
| **B. Mathematical and Quantitative Reasoning:** Three credits  A course in this area must meet all the learning outcomes in the right column. A student will: | |
|  | * Interpret and draw appropriate inferences from quantitative representations, such as formulas, graphs, or tables. |
|  | * Use algebraic, numerical, graphical, or statistical methods to draw accurate conclusions and solve mathematical problems. |
|  | * Represent quantitative problems expressed in natural language in a suitable mathematical format. |
|  | * Effectively communicate quantitative analysis or solutions to mathematical problems in written or oral form. |
|  | * Evaluate solutions to problems for reasonableness using a variety of means, including informed estimation. |
|  | * Apply mathematical methods to problems in other fields of study. |

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| **C. Life and Physical Sciences:** Three credits  A course in this area must meet all the learning outcomes in the right column. A student will: | |
| * Identify and apply the fundamental concepts and methods of the human brain biology and artificial intelligence, AI, for reviewing the foundations of information processing in the organism and analyzing some biologically inspired concepts and methods of AI (neural networks, genetic and evolutionary computing, etc.). | * Identify and apply the fundamental concepts and methods of a life or physical science. |
| * Apply the scientific method to explore the introductory neuroscience, robotics, AI methods of DNA and protein analysis and others. The labs are based on testing hypotheses by analyzing experimental data and presenting the results in a laboratory report. | * Apply the scientific method to explore natural phenomena, including hypothesis development, observation, experimentation, measurement, data analysis, and data presentation. |
| * Use biological databases and online tools for modeling and prediction of biological processes and molecular structures in order to carry out collaborative laboratory investigations. | * Use the tools of a scientific discipline to carry out collaborative laboratory investigations. |
| * Retrieve, analyze and interpret experimental data stored in the biological databases or collected and presented online in a well-structured laboratory report. This course is a Writing Intensive Course. | * Gather, analyze, and interpret data and present it in an effective written laboratory or fieldwork report. |
| * Explore and apply research ethics and unbiased assessment of data in the investigation of artificial intelligence and neuroscience, including the current and potential developments in science and society. | * Identify and apply research ethics and unbiased assessment in gathering and reporting scientific data. |
| **II. Flexible Core** **(18 credits)**  Six three-credit liberal arts and sciences courses, with at least one course from each of the following five areas and no more than two courses in any discipline or interdisciplinary field. | |
| **A. World Cultures and Global Issues** | |
| A Flexible Core course must meet the three learning outcomes in the right column. | |
|  | * Gather, interpret, and assess information from a variety of sources and points of view. |
|  | * Evaluate evidence and arguments critically or analytically. |
|  | * Produce well-reasoned written or oral arguments using evidence to support conclusions. |
| A course in this area (II.A) must meet at least three of the additional learning outcomes in the right column. A student will: | |
|  | * Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring world cultures or global issues, including, but not limited to, anthropology, communications, cultural studies, economics, ethnic studies, foreign languages (building upon previous language acquisition), geography, history, political science, sociology, and world literature. |
|  | * Analyze culture, globalization, or global cultural diversity, and describe an event or process from more than one point of view. |
|  | * Analyze the historical development of one or more non-U.S. societies. |
|  | * Analyze the significance of one or more major movements that have shaped the world's societies. |
|  | * Analyze and discuss the role that race, ethnicity, class, gender, language, sexual orientation, belief, or other forms of social differentiation play in world cultures or societies. |
|  | * Speak, read, and write a language other than English, and use that language to respond to cultures other than one's own. |

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| **B. U.S. Experience in its Diversity**  A Flexible Core course must meet the three learning outcomes in the right column. | |
|  | * Gather, interpret, and assess information from a variety of sources and points of view. |
|  | * Evaluate evidence and arguments critically or analytically. |
|  | * Produce well-reasoned written or oral arguments using evidence to support conclusions. |
| A course in this area (II.B) must meet at least three of the additional learning outcomes in the right column. A student will: | |
|  | * Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the U.S. experience in its diversity, including, but not limited to, anthropology, communications, cultural studies, economics, history, political science, psychology, public affairs, sociology, and U.S. literature. |
|  | * Analyze and explain one or more major themes of U.S. history from more than one informed perspective. |
|  | * Evaluate how indigenous populations, slavery, or immigration have shaped the development of the United States. |
|  | * Explain and evaluate the role of the United States in international relations. |
|  | * Identify and differentiate among the legislative, judicial, and executive branches of government and analyze their influence on the development of U.S. democracy. |
|  | * Analyze and discuss common institutions or patterns of life in contemporary U.S. society and how they influence, or are influenced by, race, ethnicity, class, gender, sexual orientation, belief, or other forms of social differentiation. |
| **C. Creative Expression** | |
| A Flexible Core course must meet the three learning outcomes in the right column. | |
|  | * Gather, interpret, and assess information from a variety of sources and points of view. |
|  | * Evaluate evidence and arguments critically or analytically. |
|  | * Produce well-reasoned written or oral arguments using evidence to support conclusions. |
| A course in this area (II.C) must meet at least three of the additional learning outcomes in the right column. A student will: | |
|  | * Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring creative expression, including, but not limited to, arts, communications, creative writing, media arts, music, and theater. |
|  | * Analyze how arts from diverse cultures of the past serve as a foundation for those of the present, and describe the significance of works of art in the societies that created them. |
|  | * Articulate how meaning is created in the arts or communications and how experience is interpreted and conveyed. |
|  | * Demonstrate knowledge of the skills involved in the creative process. |
|  | * Use appropriate technologies to conduct research and to communicate. |

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| **D. Individual and Society**  A Flexible Core course must meet the three learning outcomes in the right column. | |
|  | * Gather, interpret, and assess information from a variety of sources and points of view. |
|  | * Evaluate evidence and arguments critically or analytically. |
|  | * Produce well-reasoned written or oral arguments using evidence to support conclusions. |
| A course in this area (II.D) must meet at least three of the additional learning outcomes in the right column. A student will: | |
|  | * Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the relationship between the individual and society, including, but not limited to, anthropology, communications, cultural studies, history, journalism, philosophy, political science, psychology, public affairs, religion, and sociology. |
|  | * Examine how an individual's place in society affects experiences, values, or choices. |
|  | * Articulate and assess ethical views and their underlying premises. |
|  | * Articulate ethical uses of data and other information resources to respond to problems and questions. |
|  | * Identify and engage with local, national, or global trends or ideologies, and analyze their impact on individual or collective decision-making. |
| **E. Scientific World**  A Flexible Core course must meet the three learning outcomes in the right column. | |
|  | * Gather, interpret, and assess information from a variety of sources and points of view. |
|  | * Evaluate evidence and arguments critically or analytically. |
|  | * Produce well-reasoned written or oral arguments using evidence to support conclusions. |
| A course in this area (II.E) must meet at least three of the additional learning outcomes in the right column. A student will: | |
|  | * Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the scientific world, including, but not limited to: computer science, history of science, life and physical sciences, linguistics, logic, mathematics, psychology, statistics, and technology-related studies. |
|  | * Demonstrate how tools of science, mathematics, technology, or formal analysis can be used to analyze problems and develop solutions. |
|  | * Articulate and evaluate the empirical evidence supporting a scientific or formal theory. |
|  | * Articulate and evaluate the impact of technologies and scientific discoveries on the contemporary world, such as issues of personal privacy, security, or ethical responsibilities. |
|  | * Understand the scientific principles underlying matters of policy or public concern in which science plays a role. |

SECTION 6: Course modification proposal: Computational Genomics (BIO4150)

Change course number from BIO 3354 to BIO 4150 to more accurately reflect that this course will be taken as a senior student.

Computational Genomics (BIO4150) to become a 4cr (instead of 3cr) course.

Currently as 3 cl hrs, 0 lab hrs, 3 cr

Will change to 3 cl hrs, 3 lab hrs, 4 cr

**Justification**

BIO4150 has currently been structured as a 3hr lecture, with a very short (30-40min/week) lab component induced by the instructors during the classroom meetings. This lab component is organized around Galaxy, an online Bioinformatics toolbox (<https://galaxyproject.org/>) that is easy to use and does not require prior programming knowledge. The course coordinator chose this online toolbox for the lab component, because of the limited programming experience of the BIB students. Although Galaxy is an easy solution for performing basic computational genomics analyses, it does not reflect the realistic needs of a computational genomics scientist that we aim to educate in order to become competitive in the job market. These needs could be met by offering our students hands-on practice in command-line (R-based or UNIX-based) tools that are extremely popular in the field of computational genomics, such as bedtools, samtools, fastqc, bwa, bowtie, and more.

With the addition of the Programming for Biologists course (BIO 2110) to the BIB curriculum, as well as with the course syllabi updates (BIO3350 and BIO3352), the new cohorts of BIB students will reach BIO4150 with an advanced programming skillset. The preparedness of these students would allow us to implement a more demanding, yet realistic, lab component that would equip them with the necessary knowledge and classroom-level expertise to meet the requirements of an outside computational genomics setting (e.g., internship projects, bioinformatics positions).

Adding a 3hr lab component to BIO4150 will allow us to: (1) link lecture concepts to practical applications, (2) enhance hands-on practice in command-line tools that are the backbone of any computational analysis.

BIO 4150: Computational Genomics

syllabus

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| --- | --- |
| **Week 1** | Class Mechanics and Policies, and Introduction to Blackboard Features  **Introduction to Computational Genomics**   1. What is computational genomics? 2. History of genome sequencing 3. Applications of Next-Generation Sequencing   **LAB 1**:  Introduction to command-line computational tools.  Short introduction to Galaxy as an alternative to command-line programs. |
| **Week 2** | **Data formats and visualization**   1. Basic formats in genomics (e.g., FASTQ, BAM, BED) 2. Quality scores of sequences 3. Genome browsers   **LAB 2**:  Visualization of genomes.  Revision on the UCSC Genome Browser. Introduction to IGV. |
| **Week 3** | **Quality control and data processing**   1. FASTQ format 2. Quality Control metrics   **LAB 3**:  QC anaysis on genomic sequences.  Using fastqc and related tools. |
| **Week 4** | **DNA alignment and annotation**   1. DNA sequence alignment algorithms 2. Genome annotation databases   **LAB 4**:  DNA alignment.  Using bwa and bowtie. |
| **Week 5** | **RNA-seq I: Introduction**   1. Advantages of RNA-seq 2. Design of RNA-seq experiments   **LAB 5**:  Using command-line sequence aligners specific to RNA-seq data alignment.  Tophat and STAR. |
| **Week 6** | **RNA-seq II: Data analysis**   1. Computational pipeline 2. Gene expression measures 3. Differential expression analysis   **LAB 6**:  Using edgeR for RNA-seq data analysis. |
| **Week 7** | **Midterm** |
| **Week 8** | **Epigenomics I: ChIP-seq**   1. Gene regulation and transcription factors 2. ChIP experiment and computational pipeline   **LAB 7**:  Using R for ChIP-seq data analysis |
| **Week 9** | **Epigenomics II: DNA methylation**   1. The role of DNA methylation 2. Experimental methods and computational pipeline   **LAB 8**:  Using R for DNA methylation data analysis |
| **Week 10** | **Variant calling and human population genomics**   1. Genetic variations and databases 2. Variant calling methods and pipelines 3. Population genomics projects   **LAB 9**:  Using GATK for variant calling analysis |
| **Week 11** | **Personalized Medicine and Cancer Genomics**   1. What is personalized medicine? 2. Methods and computational pipelines   **LAB 10**:  Introducing the cBioPortal. |
| **Week 12** | **Metagenomics**   1. Microbiome databases 2. Computational pipeline   **LAB 11**:  Using R for microbiome data analysis |
| **Week 13** | **Public sequence databases**   1. Accessing genomic sequences 2. Personal genome databases   **LAB 12**:  Webtools |
| **Week 14** | **In-class project presentations** |
| **Week 15** | **CUMULATIVE FINAL EXAM** |

**CHANCELLOR’S REPORT FORM**

**Section AV: Changes in Existing Courses**

**AV.1 Changes to be offered in the Biology department**

**BIO 4150 Computational Genomics**

|  |  |  |  |
| --- | --- | --- | --- |
| **CUNYFirst Course ID** |  |  |  |
| **FROM:** | **~~BIO 3354~~** | **TO:** | **BIO 4150** |
| **Department(s)** |  | **Department(s)** |  |
| **Course** |  | **Course** |  |
| **Prerequisite** |  | **Prerequisite** |  |
| **Corequisite** |  | **Corequisite** |  |
| **Pre- or corequisite** |  | **Pre- or corequisite** |  |
| **Hours** | **~~3 cl hrs~~** | **Hours** | **3 cls hrs 3 lab hrs** |
| **Credits** | **~~3~~** | **Credits** | **4** |
| **Description** |  | **Description** |  |
| **Requirement Designation** |  | **Requirement Designation** |  |
| **Liberal Arts** | **[ ] Yes [ ] No** | **Liberal Arts** | **[ ] Yes [ ] No** |
| **Course Attribute (e.g. Writing Intensive, Honors, etc** |  | **Course Attribute (e.g. Writing Intensive, Honors, etc** |  |
| **Course Applicability** | **[ ] Major**  **[ ] Gen Ed Required**  **[ ] English Composition**  **[ ] Mathematics**  **[ ] Science**  **[ ] Gen Ed - Flexible**  **[ ] World Cultures**  **[ ] US Experience in its Diversity**  **[ ] Creative Expression**  **[ ] Individual and Society**  **[ ] Scientific World**  **[ ] Gen Ed - College Option**  **[ ] Speech**  **[ ] Interdisciplinary**  **[ ] Advanced Liberal Arts** | **Course Applicability** | **[ ] Major**  **[ ] Gen Ed Required**  **[ ] English Composition**  **[ ] Mathematics**  **[ ] Science**  **[ ] Gen Ed - Flexible**  **[ ] World Cultures**  **[ ] US Experience in its Diversity**  **[ ] Creative Expression**  **[ ] Individual and Society**  **[ ] Scientific World**  **[ ] Gen Ed - College Option**  **[ ] Speech**  **[ ] Interdisciplinary**  **[ ] Advanced Liberal Arts** |
| **Effective Term** | Spring 2020 |  |  |

**Rationale:** The modifications being proposed adds a lab component that will equip the students with the necessary knowledge and classroom-level expertise to meet the requirements of an outside computational genomics setting.

SECTION 7: Course modification proposal: Molecular Modeling of Biological Molecules (BIO 4350)

We are proposing three modifications to the current course:

* Change course number from BIO 3356 to BIO 4350 to more accurately reflect that this course will be taken as a senior student.
* Modifying the name of the course to better describe the contents Molecular Modeling in Biology to Molecular Modeling of Biological Molecules.
* Increase number of credits of the course to 4 credits from 3 credits. It is currently as 3 class hrs, 0 lab hrs, 3 credits and it will change to 3 class hrs, 3 lab hrs, 4 credits

**Justification**

Because of the type of the material covered, namely modeling of molecules, the instructors have had to make use of the 3h allocated hours as a 2h theory and lecture and 1h of practical exercises. Students learn the use of two state-of-the-art tools that provide the necessary foundation to perform basic modeling and analyses tasks, *Visual Molecular Dynamics* and *Modeller*. However, because of the limited allocated time, students are only learning the most basics concepts and do not get a chance to learn about advanced use of those tools as they are used in the field of molecular modeling.

The upgrade of the BIB curriculum with the addition of a programming course: BIO 2110, and the update of BIO3350 and BIO3352 course syllabi, is going to provide BIB students with advanced programming skills that will be beneficial for their future in the field. Those new skillsets will prepare students for more demanding and realistic upper level classes that will prepare them for their internship and future bioinformatics positions.

Therefore, students will significantly benefit from adding a 3hr lab component of BIO4350 as it will allow them to: (1) enhance hands-on practice in commonly used tools, (2) provide more room for detailed lectures, allowing to link theory to practical applications.

BIO 4350: Molecular Modeling of Biological molecules Syllabus

|  |  |
| --- | --- |
| **Week 1** | Class Mechanics and Policies, and Introduction to Blackboard Features  **Introduction to Molecular Modeling**   * What is molecular modeling? * Applications of molecular modeling * Review of protein structure, structure prediction, and protein folding   **LAB 1**: Visualization of biological macromolecules using Chimera |
| **Week 2** | **Prediction of protein/protein interaction from evolutionary information**   * Interactions at the interface * Review of structure alignment * Electrostatics and other energetic interactions   **LAB 2**: Calculate electrostatic potentials with APBS |
| **Week 3** | **Prediction of DNA/protein interaction**   * Review of molecular structure of the DNA double helix * DNA helical geometries * Physical forces that stabilize DNA protein binding * Sequence-dependent recognition   **LAB 3:** Calculate Nucleic Acids properties with Curves and develop python scripts |
| **Week 4** | **Prediction of protein structure: Homology Modeling**   * Theoretical basis of homology modeling * Sequence similarity vis-a-vis structure homology * Homology modeling tools   **LAB 4**: Use and compare the results from Phyre2 and SwissModel |
| **Week 5** | **Prediction of protein structure: Homology Modeling**   * Strategies for choosing the best template(s) * Sequence alignment using Modeller Python library * Prediction of the structure using Modeller Python Library   **LAB 5**: Use of Modeller Python tools |
| **Week 6** | **Prediction of protein structure: Other techniques**   * Threading * *Ab initio*   **LAB 6**: Use of Rosetta Webserver |
| **Week 7** | **Midterm** |
| **Week 8** | **Structural bioinformatics in drug discovery**   1. Traditional methods for drug design 2. High throughput screening of chemical libraries 3. Current technologies   **LAB 7**: Chemdraw, Literature review |
| **Week 9** | **Computational design of small molecules**   1. Identifying ligand binding regions 2. Rational drug design 3. Current technologies   **LAB 8**: Use of RosettaLigand |
| **Week 10** | **Physics-based vs knowledge-based potential functions**   1. Principles of molecular energetics 2. Molecular forces in physics 3. The Boltzmann device 4. Strategies to derive knowledge-based potentials from databases   **LAB 9**: Webtools |
| **Week 11** | **Remote access to High Performance Computing Center**   1. Introduction to high performance computing 2. SSH 3. Login to your account   **LAB 10**: Access a remote server |
| **Week 12** | **Force field Models for Molecular Dynamics Calculation**   1. Theory of molecular dynamics 2. Basic assumptions in molecular dynamics simulations 3. Force fields: bond stretching, angle bending, torsion, improper torsion, Lennard-Jones potential and van der Waals interactions   **LAB 11**: Use of Gromacs |
| **Week 13** | **Analysis of the Molecular Dynamics trajectory**   1. Assessing the stability of the system 2. RMSD, RMSF, radius of gyration 3. Analysis of hydrogen bonds, distances between atoms   **LAB 12**: Use of VMD |
| **Week 14** | **Computer-Aided Drug Design and Docking methods**   1. Target docking 2. Blind docking   **LAB 13**: Use of SwissDock, Autodock-Vina |
| **Week 15** | **CUMULATIVE FINAL EXAM** |

**CHANCELLOR’S REPORT FORM**

**Section AV: Changes in Existing Courses**

**AV.1 Changes to be offered in the Biology department**

**BIO 4350 Molecular Modeling of Biological Molecules.**

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| --- | --- | --- | --- |
| **CUNYFirst Course ID** |  |  |  |
| **FROM:** | **~~BIO 3356~~** | **TO:** | **BIO 4350** |
| **Department(s)** |  | **Departmentt(s)** |  |
| **Course** |  | **Course** |  |
| **Prerequisite** |  | **Prerequisite** |  |
| **Corequisite** |  | **Corequisite** |  |
| **Pre- or corequisite** |  | **Pre- or corequisite** |  |
| **Hours** | **~~3 cls hrs~~** | **Hours** | **3 cls hrs 3 lab hrs** |
| **Credits** | **~~3~~** | **Credits** | **4** |
| **Description** |  | **Description** |  |
| **Requirement Designation** |  | **Requirement Designation** |  |
| **Liberal Arts** | **[ ] Yes [ ] No** | **Liberal Arts** | **[ ] Yes [ ] No** |
| **Course Attribute (e.g. Writing Intensive, Honors, etc** |  | **Course Attribute (e.g. Writing Intensive, Honors, etc** |  |
| **Course Applicability** | **[ ] Major**  **[ ] Gen Ed Required**  **[ ] English Composition**  **[ ] Mathematics**  **[ ] Science**  **[ ] Gen Ed - Flexible**  **[ ] World Cultures**  **[ ] US Experience in its Diversity**  **[ ] Creative Expression**  **[ ] Individual and Society**  **[ ] Scientific World**  **[ ] Gen Ed - College Option**  **[ ] Speech**  **[ ] Interdisciplinary**  **[ ] Advanced Liberal Arts** | **Course Applicability** | **[ ] Major**  **[ ] Gen Ed Required**  **[ ] English Composition**  **[ ] Mathematics**  **[ ] Science**  **[ ] Gen Ed - Flexible**  **[ ] World Cultures**  **[ ] US Experience in its Diversity**  **[ ] Creative Expression**  **[ ] Individual and Society**  **[ ] Scientific World**  **[ ] Gen Ed - College Option**  **[ ] Speech**  **[ ] Interdisciplinary**  **[ ] Advanced Liberal Arts** |
| **Effective Term** | **Spring 2020** |  |  |

**Rationale:** The modifications being proposed adds a lab component that will provide the BIB students with advanced programming skills that will be beneficial for their future in the field. Those new skillsets will prepare students for more demanding and realistic upper level classes that will prepare them for their internship and future bioinformatics positions.

SECTION 8: Course modification proposal: Programming for Biologists (BIO2110)

Replace Introduction to Biomedical Informatics (BIO2000) from being a pre-requisite and replace it with the courses which had been pre-requisites for BIO2000: BIO1101 and CST1101.

**Justification**

BIO2000 is no longer a required course in the program. The pre-requisites for BIO2000 had been BIO 1101 and CST 1101. These will now serve as pre-requisites to this course.

**Section AV:**

**CHANCELLOR’S REPORT FORM**

**Changes in Existing Courses**

**AV.1 Changes to be offered in the Biology department**

**BIO2110 Programming for Biologists**

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| **CUNYFirst Course ID** |  |  |  |
| **FROM:** |  | **TO:** |  |
| **Department(s)** |  | **Department(s)** |  |
| **Course** |  | **Course** |  |
| **Prerequisite** | **~~BIO2000~~** | **Prerequisite** | **BIO1101 and CST1101** |
| **Corequisite** |  | **Corequisite** |  |
| **Pre- or corequisite** |  | **Pre- or corequisite** |  |
| **Hours** |  | **Hours** |  |
| **Credits** |  | **Credits** |  |
| **Description** |  | **Description** |  |
| **Requirement Designation** |  | **Requirement Designation** |  |
| **Liberal Arts** | **[ ] Yes [ ] No** | **Liberal Arts** | **[ ] Yes [ ] No** |
| **Course Attribute** |  | **Course Attribute** |  |
| **Course Applicability** | **[ ] Major**  **[ ] Gen Ed Required**  **[ ] English Composition**  **[ ] Mathematics**  **[ ] Science**  **[ ] Gen Ed - Flexible**  **[ ] World Cultures**  **[ ] US Experience in its Diversity**  **[ ] Creative Expression**  **[ ] Individual and Society**  **[ ] Scientific World**  **[ ] Gen Ed - College Option**  **[ ] Speech**  **[ ] Interdisciplinary**  **[ ] Advanced Liberal Arts** | **Course Applicability** | **[ ] Major**  **[ ] Gen Ed Required**  **[ ] English Composition**  **[ ] Mathematics**  **[ ] Science**  **[ ] Gen Ed - Flexible**  **[ ] World Cultures**  **[ ] US Experience in its Diversity**  **[ ] Creative Expression**  **[ ] Individual and Society**  **[ ] Scientific World**  **[ ] Gen Ed - College Option**  **[ ] Speech**  **[ ] Interdisciplinary**  **[ ] Advanced Liberal Arts** |
| **Effective Term** | **Spring 2020** |  |  |

**Rationale:** BIO2000 is no longer a required course in the program. The pre-requisites for BIO2000 had been BIO 1101 and CST 1101which will now serve as pre-requisites to this course.

SECTION 9: Course modification proposal: Bioinformatics I (BIO3350)

Change Molecular and Cellular Biology (BIO3620) from being a pre-requisite to be **Pre- or corequisite** to Bioinformatics I (BIO3350).

**Justification**

The coursework covered in Molecular and Cellular Biology (BIO3620) reinforces the learning objectives in BIO3350. As such Molecular and Cellular Biology (BIO3620) can function as pre or corequisite to BIO3350. Additionally, the modifications being proposed will allow the students to complete coursework for graduation one semester earlier. This will especially help transfer students who come in with many of the non-program related courses completed. **Section AV:**

**CHANCELLOR’S REPORT FORM**

**Changes in Existing Courses**

**AV.1 Changes to be offered in the Biology department**

**BIO3350 Bioinformatics I**

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| --- | --- | --- | --- |
| **CUNYFirst Course ID** |  |  |  |
| **FROM:** |  | **TO:** |  |
| **Department(s)** |  | **Department(s)** |  |
| **Course** |  | **Course** |  |
| **Prerequisite** | **MAT 1375 or higher, BIO 2110 ~~and BIO 3620~~. Note:This course can fulfill the General Education requirements for Science II (in place of BIO 1201)** | **Prerequisite** | **MAT 1375 or higher and BIO 2110. Note:This course can fulfill the General Education requirements for Science II (in place of BIO 1201)** |
| **Corequisite** |  | **Corequisite** |  |
| **Pre- or corequisite** |  | **Pre- or corequisite** | **BIO 3620** |
| **Hours** |  | **Hours** |  |
| **Credits** |  | **Credits** |  |
| **Description** |  | **Description** |  |
| **Requirement Designation** |  | **Requirement Designation** |  |
| **Liberal Arts** | **[ ] Yes [ ] No** | **Liberal Arts** | **[ ] Yes [ ] No** |
| **Course Attribute** |  | **Course Attribute** |  |
| **Course Applicability** | **[ ] Major**  **[ ] Gen Ed Required**  **[ ] English Composition**  **[ ] Mathematics**  **[ ] Science**  **[ ] Gen Ed - Flexible**  **[ ] World Cultures**  **[ ] US Experience in its Diversity**  **[ ] Creative Expression**  **[ ] Individual and Society**  **[ ] Scientific World**  **[ ] Gen Ed - College Option**  **[ ] Speech**  **[ ] Interdisciplinary**  **[ ] Advanced Liberal Arts** | **Course Applicability** | **[ ] Major**  **[ ] Gen Ed Required**  **[ ] English Composition**  **[ ] Mathematics**  **[ ] Science**  **[ ] Gen Ed - Flexible**  **[ ] World Cultures**  **[ ] US Experience in its Diversity**  **[ ] Creative Expression**  **[ ] Individual and Society**  **[ ] Scientific World**  **[ ] Gen Ed - College Option**  **[ ] Speech**  **[ ] Interdisciplinary**  **[ ] Advanced Liberal Arts** |
| **Effective Term** | **Spring 2020** |  |  |

**Rationale:** The coursework covered in Molecular and Cellular Biology (BIO3620) reinforces the learning objectives in BIO3350. As such Molecular and Cellular Biology (BIO3620) can function as pre or corequisite to BIO3350. Additionally, the modifications being proposed will allow the students to complete coursework for graduation one semester earlier. This will especially help transfer students who come in with many of the non-program related courses completed.

SECTION 10: Course modification proposal: Biomedical Informatics Colloquium (BIO 4050)

The course description for the Colloquium class is being modified to allow for a seminar based course.

From: A seminar-based course that exposes students to current research topics in the fields of Bioinformatics and Medical Informatics. Weekly presentations by invited speakers and/or faculty introduce students to the broad diversity of research areas in both fields, and engages them in critical thinking and writing. Online lectures and reading activities may also be given periodically. This course is only offered once per year.

To: A seminar-based course that exposes students to current research topics in the field of Bioinformatics (broadly defined). Course structure can include presentations by invited speakers and/or student-led discussions of recent peer-reviewed research papers (<5 years old). This course is only offered once per year.

**Justification**

The BIB Colloquium course, as currently offered, is based solely on external or internal speakers presenting recent research in the field of Biomedical Informatics. Although this provides students with excellent exposure to current research in the field, it can be very challenging for faculty to locate ~13 speakers each time the course is offered. The proposed modification to the course description will encompass both invited seminars and discussions of recent peer-reviewed research papers. Thus, in-class discussions of papers can be implemented in weeks where no external speaker is scheduled. Additionally, the pre-requisites were changed to pre or co- requisites to allow the students greater flexibility in taking the course.

**CHANCELLOR’S REPORT FORM**

**Changes in Existing Courses**

**AV.1 Changes to be offered in the Biology department**

**BIO4050 Biomedical Informatics Colloquium**

|  |  |  |  |
| --- | --- | --- | --- |
| **CUNYFirst Course ID** | **BIO4050** |  |  |
| **FROM:** |  | **TO:** |  |
| **Department(s)** |  | **Department(s)** |  |
| **Course** |  | **Course** |  |
| **Prerequisite** | ~~BIO3352 or MED4229~~ | **Prerequisite** |  |
| **Corequisite** |  | **Corequisite** |  |
| **Pre- or corequisite** |  | **Pre- or corequisite** | BIO3352 or MED4229 |
| **Hours** |  | **Hours** |  |
| **Credits** |  | **Credits** |  |
| **Description** | ~~A seminar-based course that exposes students to current research topics in the fields of Bioinformatics and Medical Informatics. Weekly presentations by invited speakers and/or faculty introduce students to the broad diversity of research areas in both fields, and engages them in critical thinking and writing. Online lectures and reading activities may also be given periodically. This course is only offered once per year.~~ | **Description** | A seminar-based course that exposes students to current research topics in the field of bioinformatics (broadly defined). Course structure can include presentations by invited speakers and/or student-led discussions of recent peer-reviewed research papers (<5 years old). This course is only offered once per year. |
| **Requirement Designation** |  | **Requirement Designation** |  |
| **Liberal Arts** | **[ ] Yes [ ] No** | **Liberal Arts** | **[ ] Yes [ ] No** |
| **Course Attribute** |  | **Course Attribute** |  |
| **Course Applicability** | **[ ] Major**  **[ ] Gen Ed Required**  **[ ] English Composition**  **[ ] Mathematics**  **[ ] Science**  **[ ] Gen Ed – Flexible**  **[ ] World Cultures**  **[ ] US Experience in its Diversity**  **[ ] Creative Expression**  **[ ] Individual and Society**  **[ ] Scientific World**  **[ ] Gen Ed - College Option**  **[ ] Speech**  **[ ] Interdisciplinary**  **[ ] Advanced Liberal Arts** | **Course Applicability** | **[ ] Major**  **[ ] Gen Ed Required**  **[ ] English Composition**  **[ ] Mathematics**  **[ ] Science**  **[ ] Gen Ed - Flexible**  **[ ] World Cultures**  **[ ] US Experience in its Diversity**  **[ ] Creative Expression**  **[ ] Individual and Society**  **[ ] Scientific World**  **[ ] Gen Ed - College Option**  **[ ] Speech**  **[ ] Interdisciplinary**  **[ ] Advanced Liberal Arts** |
| **Effective Term** | **Spring 2020** |  |  |

**Rationale:** The BIB Colloquium course, as currently offered, is based solely on external or internal speakers presenting recent research in the field of Biomedical Informatics. Although this provides students with excellent exposure to current research in the field, it can be very challenging for faculty to locate ~13 speakers each time the course is offered. The proposed modification to the course description will encompass both invited seminars and discussions of recent peer-reviewed research papers. Thus, in-class discussions of papers can be implemented in weeks where no external speaker is scheduled.

SECTION 11: Course modification proposal: Internship/Research in Biomedical Informatics (BIO 4900)

We are changing the course number and the pre-requisites to the Internship course.

Current course number: MED 3910

New course number: BIO 4900

Current pre-requisites: BIO 3352 or MED 4229

New pre-requisites: BIO3352 and BIO3450

Rationale: The new course number being proposed will more accurately reflect that this is a capstone project. The modified pre-requisites will allow it to better fit into the new layout of classes.

**CHANCELLOR’S REPORT FORM**

**Changes in Existing Courses**

**AV.1 Changes to be offered in the Biology department**

**BIO 4900 Internship/Research in Biomedical Informatics**

|  |  |  |  |
| --- | --- | --- | --- |
| **CUNYFirst Course ID** |  |  |  |
| **FROM:** | ~~MED 3910~~ | **TO:** | BIO 4900 |
| **Department(s)** |  | **Department(s)** |  |
| **Course** |  | **Course** |  |
| **Prerequisite** | BIO3352 ~~or MED4229~~ | **Prerequisite** | BIO3352 and BIO3450 |
| **Corequisite** |  | **Corequisite** |  |
| **Pre- or corequisite** |  | **Pre- or corequisite** |  |
| **Hours** |  | **Hours** |  |
| **Credits** |  | **Credits** |  |
| **Description** |  | **Description** |  |
| **Requirement Designation** |  | **Requirement Designation** |  |
| **Liberal Arts** | [ ] Yes [ ] No | **Liberal Arts** | [ ] Yes [ ] No |
| **Course Attribute** |  | **Course Attribute** |  |
| **Course Applicability** | [ ] Major  [ ] Gen Ed Required  [ ] English Composition  [ ] Mathematics  [ ] Science  [ ] Gen Ed - Flexible  [ ] World Cultures  [ ] US Experience in its Diversity  [ ] Creative Expression  [ ] Individual and Society  [ ] Scientific World  [ ] Gen Ed - College Option  [ ] Speech  [ ] Interdisciplinary  [ ] Advanced Liberal Arts | **Course Applicability** | [ ] Major  [ ] Gen Ed Required  [ ] English Composition  [ ] Mathematics  [ ] Science  [ ] Gen Ed - Flexible  [ ] World Cultures  [ ] US Experience in its Diversity  [ ] Creative Expression  [ ] Individual and Society  [ ] Scientific World  [ ] Gen Ed - College Option  [ ] Speech  [ ] Interdisciplinary  [ ] Advanced Liberal Arts |
| **Effective Term** | Spring 2020 |  |  |

**Rationale:** The new course number being proposed will more accurately reflect that this is a capstone project. The modified prerequisites reflect the modification to the required courses.

SECTION 12: New Course Proposal: Independent Research in Biomedical Informatics: Information Literacy (BIO 4910) New York City College of Technology, CUNY

CURRICULUM MODIFICATION PROPOSAL FORM

This form is used for all curriculum modification proposals. See the [Proposal Classification Chart](http://www.300jaystreet.com/college-council/resources/2010/04/2013-10-09-Proposal_Classification_Chart.docx) for information about what types of modifications are major or minor. Completed proposals should be emailed to the Curriculum Committee chair.

|  |  |
| --- | --- |
| **Title of Proposal** | **Independent Research Study in Biomedical Informatics: Information Literacy (BIO4910)** |
| **Date** | **September 28, 2018** |
| **Major or Minor** | **Major** |
| **Proposer’s Name** | **Jeremy Seto** |
| **Department** | **Biological Sciences Department** |
| **Date of Departmental Meeting in which proposal was approved** | **October 4, 2018** |
| **Department Chair Name** | **Prof. Andleeb Zameer** |
| **Department Chair Signature and Date** | **SIGN.png 10/8/18** |
| **Academic Dean Name** | **Dean Justin Vazquez-Poritz** |
| **Academic Dean Signature and Date** | **Picture 1** 10/8/18 |
| **Brief Description of Proposal**  (Describe the modifications contained within this proposal in a succinct summary. More detailed content will be provided in the proposal body.) | **Working with a mentor selected from the Biological Sciences Department, students develop and complete a semester-long intensive research project that integrates aspects of information literacy, scientific communication and oral presentation. Activities include a guided independent reading of scientific literature and development of a research proposal and plan of action that implements hypothesis testing to answer a question germane to the biological sciences, bioinformatics or health informatics.** |
| **Brief Rationale for Proposal**  (Provide a concise summary of why this proposed change is important to the department. More detailed content will be provided in the proposal body.) | **Students have difficulty in obtaining external internships due to GPA considerations and competition. While the external Internship is preferred, an alternative means of having students follow a similar routine within the confines of the College will enable students to proceed with their degree requirements.** |
| **Proposal History** | **This proposal constitutes a first submission.** |

Please include all appropriate documentation as indicated in the Curriculum Modification Checklist.

For each new course, please also complete the New Course Proposal and submit in this document.

**ALL PROPOSAL CHECK LIST**

|  |  |
| --- | --- |
| Completed CURRICULUM MODIFICATION FORM including: |  |
| * Brief description of proposal | √ |
| * Rationale for proposal | √ |
| * Date of department meeting approving the modification | √ |
| * Chair’s Signature | √ |
| * Dean’s Signature | √ |
| Evidence of consultation with affected departments  List of the programs that use this course as required or elective, and courses that use this as a prerequisite. | √  N/A |
| Documentation of Advisory Commission views (if applicable). | N/A |
| Completed [Chancellor’s Report Form](http://www.300jaystreet.com/college-council/resources/2010/04/2013-10-09-Chancellor_Report_Quick_Reference_Guide.doc). | √ |

**EXISTING PROGRAM MODIFICATION PROPOSALS**

|  |  |
| --- | --- |
| Documentation indicating core curriculum requirements have been met for new programs/options or program changes. | N/A |
| Detailed rationale for each modification (this includes minor modifications) | √ |

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-10-Curriculum_Modification_Proposal_Form.docx) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

|  |  |
| --- | --- |
| **Course Title** | **Independent Research Study in Biomedical Informatics: Information Literacy** |
| **Proposal Date** | **September 28, 2018** |
| **Proposer’s Name** | **Prof. Jeremy Seto** |
| **Course Number** | **BIO 4910** |
| **Course Credits, Hours** | **2 credit hours, 3 hours laboratory** |
| **Course Pre / Co-Requisites** | **BIO3352 and BIO 3450** |
| **Catalog Course Description** | **Working with a mentor selected from the Biological Sciences Department, students develop and complete a semester-long intensive research project that integrates aspects of information literacy, scientific communication and oral presentation. Activities include a guided independent reading of scientific literature and development of a research proposal and plan of action that implements hypothesis testing to answer a question germane to the biological sciences, bioinformatics or health informatics.** |
| **Brief Rationale**  Provide a concise summary of why this course is important to the department, school or college. | **Students have difficulty in obtaining external internships due to GPA considerations and competition. While the external Internship is preferred, an alternative means of having students follow a similar routine within the confines of the College will enable students to proceed with their degree requirements.** |
| **Intent to Submit as Common Core**  If this course is intended to fulfill one of the requirements in the common core, then indicate which area. | **No.** |
| **Intent to Submit as An Interdisciplinary Course** | **No.** |
| **Intent to Submit as a Writing Intensive Course** | **Yes.** |

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

**NEW COURSE PROPOSAL CHECK LIST**

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

|  |  |
| --- | --- |
| **Completed NEW COURSE PROPOSAL FORM** |  |
| * Title, Number, Credits, Hours, Catalog course description | √ |
| * Brief Rationale | √ |
| Completed [Library Resources and Information Literacy Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/curriculum_modification_library_form.doc) |  |
| **Course Outline**  Include within the outline the following. |  |
| Hours and Credits for Lecture and Labs  If hours exceed mandated Carnegie Hours, then rationale for this | √ |
| Prerequisites/Co- requisites | √ |
| Detailed Course Description | √ |
| Course Specific Learning Outcome and Assessment Tables   * Discipline Specific * General Education Specific Learning Outcome and Assessment Tables | √ |
| Example Weekly Course outline | √ |
| Grade Policy and Procedure | √ |
| Recommended Instructional Materials (Textbooks, lab supplies, etc) | √ |
| Library resources and bibliography | √ |
| **Course Need Assessment.**  Describe the need for this course. Include in your statement the following information. |  |
| Target Students who will take this course. Which programs or departments, and how many anticipated?  Documentation of student views (if applicable, e.g. non-required elective). | √ |
| Projected headcounts (fall/spring and day/evening) for each new or modified course. | √ |
| If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction. | √ |
| Where does this course overlap with other courses, both within and outside of the department? | √ |
| Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? | √ |
| If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. | √ |
| **Course Design**  Describe how this course is designed. |  |
| Course Context (e.g. required, elective, capstone) | √ |
| Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? | √ |
| Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) | √ |
| How does this course support Programmatic Learning Outcomes? | √ |
| Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. | √ |
| **Additional Forms for Specific Course Categories** |  |
| [Interdisciplinary Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/Application-for-Interdisciplinary-Course-Designation.docx) (if applicable) | N/A |
| [Common Core (Liberal Arts) Intent to Submit](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/CommonCoreCourseSubmissionForm_4.2.12.doc) (if applicable) | N/A |
| Writing Intensive Form if course is intended to be a WIC (under development) | N/A |
| If course originated as an experimental course, then results of evaluation plan as developed with director of assessment. | N/A |
| **(Additional materials for [Curricular Experiments](http://www.300jaystreet.com/college-council/curriculum_proposals/curricular-experiments))** |  |
| Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information). | N/A |
| Established Timeline for Curricular Experiment | N/A |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NEW YORK CITY COLLEGE OF TECHNOLOGY  **The City University**  **Of New York** | | School of Arts and Sciences  **Biological Sciences Department** | | |
| **Course Information** | | | | |
| **Course title:** | **Independent Research Study in Biomedical Informatics:** Information Literacy | | | |
| **Course code:** | **BIO 4910** | | | |
| **Credit Hours:** | **2 credit hours** | | | |
| **3 Independent study hours** | | | |
| **Pre or co-requisite:** | BIO3352 and BIO 3450 | | | |
| **Text:** | **No course textbook will be assigned** | | | |
| **Official Course Description (from the College Catalog)** | Working with a mentor selected from the Biological Sciences Department, students develop and complete a semester-long intensive research project that integrates aspects of information literacy, scientific communication and oral presentation. Activities include a guided independent reading of scientific literature and development of a research proposal and plan of action that implements hypothesis testing to answer a question germane to the biological sciences, bioinformatics or health informatics. | | | |
| **Grading Procedure (see Grading Policies for details)** | | | | |
| **Faculty Advisor will grade**:   * Written Report 60% * Participation 10%   **Advisory Committee will grade:**   * Research Plan 5% * Poster 25% | | | | |
| **Instructional Objectives**  **(derived from NSF Vision & Change)** | | | | Assessment |
| Apply the Scientific Process (hypothesis testing) | | | Use of a written research plan highlighting the fundamental hypothesis and research question | |
| Implementation of Interdisciplinary analysis and Communication | | | Use of written report illustrating information literacy and coalescence of weighted scientific literature to formulate the research question | |

|  |  |
| --- | --- |
| Implement quantitative reasoning through statistics and visualization of data | Use of written report and scientific poster |
| Understand the science and society relationship in the project | Students will integrate this into their written reports to illustrate the scientific relevance of their work |
| Formulation and application of models or simulations to explain the phenomena | Students will demonstrate proficiency in applying models/simulations in their written report and poster |
| **Teaching/Learning Methods** | |
| * Guided independent reading of scientific literature * Research proposal with plan of action * Written reports and scientific poster | |
| **Academic Integrity Policy** | |
| Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion. | |

**LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION**

Consult with library faculty subject selectors (<http://cityte.ch/dir>) **3 weeks in advance** when planning course proposals to ensure enough time to allocate budgets if materials need to be purchased.

**Course proposer:** please complete boxes 1-4. **Library faculty subject selector:** please complete box 5.

|  |  |  |
| --- | --- | --- |
| **1** | **Title of proposal**  New Course: BIO4910 (Independent Research Study in Biomedical Informatics: Information Literacy) | **Department/Program**  Biological Sciences/Biomedical Informatics |
|  | **Proposed by** (include email & phone)  Dr. Jeremy Seto  [jseto@citytech.cuny.edu](mailto:jseto@citytech.cuny.edu)  718-260-5078 | **Expected date course(s) will be offered**  Spring 2020  **# of students** |

|  |  |
| --- | --- |
| **2** | **The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?**  No textbooks required for the class. |

|  |  |
| --- | --- |
| **3** | **Are additional resources needed for course assignments? Please provide details about format of resources (e.g., ebooks , journals, DVDs, etc.), author, title, publisher, edition, date, and price.**  No additional resources are required. |

|  |  |
| --- | --- |
| **4** | **Library faculty focus on strengthening students' information literacy skills in finding, evaluating, and ethically using information. We can collaborate on developing assignments and offer customized information literacy instruction and research guides for your course.**  **Do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**  Instructors of the course will have the freedom to collaborate with library faculty at their own discretion. |

|  |  |
| --- | --- |
| **5** | **Library Faculty Subject Specialist \_\_** Cailean CooneyPicture 9  **Comments and Recommendations**  The Library provides resources relevant to the independent study course, available both on-site and online, including print and electronic books, reference materials, and journal subscriptions. Print books from other CUNY campuses are also available to request. In addition, the library provides digital resources and can offer programming to support students in developing information literacy and research skills. The Library will consider additional resource requests based on budgetary means and welcomes recommendations for book monograph purchases to update the collection on a yearly basis.  **Date:** 10/18/18 |

**CHANCELLOR’S REPORT FORM**

New course to be offered in the Biology department

|  |  |
| --- | --- |
| **Department** | **Biology** |
| **Academic Level** | **[ X ] Regular  [   ] Compensatory  [   ] Developmental  [   ] Remedial** |
| **Subject Area** | **Biomedical Informatics** |
| **Course Prefix** | **BIO** |
| **Course Number** | **4910** |
| **Course Title** | **Independent Research Study in Biomedical Informatics: Information Literacy** |
| **Catalog Description** | **Working with a mentor selected from the Biological Sciences Department, students develop and complete a semester-long intensive research project that integrates aspects of information literacy, scientific communication and oral presentation. Activities include a guided independent reading of scientific literature and development of a research proposal and plan of action that implements hypothesis testing to answer a question germane to the biological sciences, bioinformatics or health informatics.** |
| **Prerequisite** | **BIO3352 and BIO 3450** |
| **Corequisite** |  |
| **Pre- or corequisite** |  |
| **Credits** | **2** |
| **Contact Hours** | **3** |
| **Liberal Arts** | **[ ] Yes  [X] No** |
| **Course Attribute** | **Writing Intensive** |
| **Course Applicability** | **[X] Major**  **[ ] Gen Ed Required [ ] Gen Ed - Flexible [ ] Gen Ed - College Option**  **[ ] English Composition [ ] World Cultures [ [ ]Speech**  **[ ] Mathematics [ ] US Experience in its Diversity [ ] Interdisciplinary**  **[ ] Science [ ] Creative Expression [ ] Advanced Liberal Arts**  **[ ] Individual and Society**  **[ ] Scientific World** |
| **Effective Term** | **Spring 2020** |

**Rationale:** Students have difficulty in obtaining external internships due to GPA considerations and competition. While the external Internship is preferred, an alternative means of having students follow a similar routine within the confines of the College will enable students to proceed with their degree requirements.

SECTION 13: New course Proposal: Independent Research Study in Biomedical Informatics: Guided Research (BIO4920)

CURRICULUM MODIFICATION PROPOSAL FORM

This form is used for all curriculum modification proposals. See the [Proposal Classification Chart](http://www.300jaystreet.com/college-council/resources/2010/04/2013-10-09-Proposal_Classification_Chart.docx) for information about what types of modifications are major or minor. Completed proposals should be emailed to the Curriculum Committee chair.

|  |  |
| --- | --- |
| **Title of Proposal** | **Independent Research Study in Biomedical Informatics: Guided Research (BIO4920)** |
| **Date** | **September 28, 2018** |
| **Major or Minor** | **Major** |
| **Proposer’s Name** | **Jeremy Seto** |
| **Department** | **Biological Sciences Department** |
| **Date of Departmental Meeting in which proposal was approved** | **October 4, 2018** |
| **Department Chair Name** | **Prof. Andleeb Zameer** |
| **Department Chair Signature and Date** | **SIGN.png 10/8/18** |
| **Academic Dean Name** | **Dean Justin Vazquez-Poritz** |
| **Academic Dean Signature and Date** | **Picture 1** 10/8/18 |
| **Brief Description of Proposal**  (Describe the modifications contained within this proposal in a succinct summary. More detailed content will be provided in the proposal body.) | **Working with a mentor selected from the Biological Sciences Department, students conduct the research and experimentation on the work proposed from BIO 4910. This course helps students in applying the process of science towards answering a research question in the biological sciences, bioinformatics or health informatics. This course culminates in the examination of oral, written and visual representations of research.** |
| **Brief Rationale for Proposal**  (Provide a concise summary of why this proposed change is important to the department. More detailed content will be provided in the proposal body.) | **Students have difficulty in obtaining external internships due to GPA considerations and competition. While the external Internship is preferred, an alternative means of having students follow a similar routine within the confines of the College will enable students to proceed with their degree requirements.** |
| **Proposal History**  (Please provide history of this proposal: is this a resubmission? An updated version? This may most easily be expressed as a list.) | **This proposal constitutes a first submission.** |

Please include all appropriate documentation as indicated in the Curriculum Modification Checklist.

For each new course, please also complete the New Course Proposal and submit in this document.

Please submit this document as a single .doc or .rtf format. If some documents are unable to be converted to .doc, then please provide all documents archived into a single .zip file.

**ALL PROPOSAL CHECK LIST**

|  |  |
| --- | --- |
| Completed CURRICULUM MODIFICATION FORM including: |  |
| * Brief description of proposal | √ |
| * Rationale for proposal | √ |
| * Date of department meeting approving the modification | √ |
| * Chair’s Signature | √ |
| * Dean’s Signature | √ |
| Evidence of consultation with affected departments  List of the programs that use this course as required or elective, and courses that use this as a prerequisite. | √  N/A |
| Documentation of Advisory Commission views (if applicable). | N/A |
| Completed [Chancellor’s Report Form](http://www.300jaystreet.com/college-council/resources/2010/04/2013-10-09-Chancellor_Report_Quick_Reference_Guide.doc). | √ |

**EXISTING PROGRAM MODIFICATION PROPOSALS**

|  |  |
| --- | --- |
| Documentation indicating core curriculum requirements have been met for new programs/options or program changes. | N/A |
| Detailed rationale for each modification (this includes minor modifications) | √ |

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/2013-10-10-Curriculum_Modification_Proposal_Form.docx) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

|  |  |
| --- | --- |
| **Course Title** | **Independent Research Study in Biomedical Informatics: Guided Research** |
| **Proposal Date** | **September 28, 2018** |
| **Proposer’s Name** | **Prof. Jeremy Seto** |
| **Course Number** | **BIO 4920** |
| **Course Credits, Hours** | **3 credit hours, 5 hours laboratory** |
| **Course Pre / Co-Requisites** | **BIO 4910** |
| **Catalog Course Description** | **Working with a mentor selected from the Biological Sciences Department, students conduct the research and experimentation on the work proposed from BIO 4910. This course helps students in applying the process of science towards answering a research question in the biological sciences, bioinformatics or health informatics. This course culminates in the examination of oral, written and visual representations of research.** |
| **Brief Rationale**  Provide a concise summary of why this course is important to the department, school or college. | **Students have difficulty in obtaining external internships due to GPA considerations and competition. While the external Internship is preferred, an alternative means of having students follow a similar routine within the confines of the College will enable students to proceed with their degree requirements.** |
| **Intent to Submit as Common Core**  If this course is intended to fulfill one of the requirements in the common core, then indicate which area. | **No.** |
| **Intent to Submit as An Interdisciplinary Course** | **No.** |
| **Intent to Submit as a Writing Intensive Course** | **Yes.** |

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

**NEW COURSE PROPOSAL CHECK LIST**

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

|  |  |
| --- | --- |
| **Completed NEW COURSE PROPOSAL FORM** |  |
| * Title, Number, Credits, Hours, Catalog course description | √ |
| * Brief Rationale | √ |
| Completed [Library Resources and Information Literacy Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/curriculum_modification_library_form.doc) |  |
| **Course Outline**  Include within the outline the following. |  |
| Hours and Credits for Lecture and Labs  If hours exceed mandated Carnegie Hours, then rationale for this | √ |
| Prerequisites/Co- requisites | √ |
| Detailed Course Description | √ |
| Course Specific Learning Outcome and Assessment Tables   * Discipline Specific * General Education Specific Learning Outcome and Assessment Tables | √ |
| Example Weekly Course outline | √ |
| Grade Policy and Procedure | √ |
| Recommended Instructional Materials (Textbooks, lab supplies, etc) | √ |
| Library resources and bibliography | √ |
| **Course Need Assessment.**  Describe the need for this course. Include in your statement the following information. |  |
| Target Students who will take this course. Which programs or departments, and how many anticipated?  Documentation of student views (if applicable, e.g. non-required elective). | √ |
| Projected headcounts (fall/spring and day/evening) for each new or modified course. | √ |
| If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction. | √ |
| Where does this course overlap with other courses, both within and outside of the department? | √ |
| Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? | √ |
| If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. | √ |
| **Course Design**  Describe how this course is designed. |  |
| Course Context (e.g. required, elective, capstone) | √ |
| Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? | √ |
| Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) | √ |
| How does this course support Programmatic Learning Outcomes? | √ |
| Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. | √ |
| **Additional Forms for Specific Course Categories** |  |
| [Interdisciplinary Form](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/Application-for-Interdisciplinary-Course-Designation.docx) (if applicable) | N/A |
| [Common Core (Liberal Arts) Intent to Submit](http://openlab.citytech.cuny.edu/collegecouncil/files/2014/08/CommonCoreCourseSubmissionForm_4.2.12.doc) (if applicable) | N/A |
| Writing Intensive Form if course is intended to be a WIC (under development) | N/A |
| If course originated as an experimental course, then results of evaluation plan as developed with director of assessment. | N/A |
| **(Additional materials for [Curricular Experiments](http://www.300jaystreet.com/college-council/curriculum_proposals/curricular-experiments))** |  |
| Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information). | N/A |
| Established Timeline for Curricular Experiment | N/A |

**LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION**

Consult with library faculty subject selectors (<http://cityte.ch/dir>) **3 weeks in advance** when planning course proposals to ensure enough time to allocate budgets if materials need to be purchased.

**Course proposer:** please complete boxes 1-4. **Library faculty subject selector:** please complete box 5.

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| **1** | **Title of proposal**  New Course: BIO4910 (Independent Research Study in Biomedical Informatics: Guided Research) | **Department/Program**  Biological Sciences/Biomedical Informatics |
|  | **Proposed by** (include email & phone)  Dr. Jeremy Seto  [jseto@citytech.cuny.edu](mailto:jseto@citytech.cuny.edu)  718-260-5078 | **Expected date course(s) will be offered**  Spring 2020  **# of students** |

|  |  |
| --- | --- |
| **2** | **The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?**  No textbooks required for the class. |

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| **3** | **Are additional resources needed for course assignments? Please provide details about format of resources (e.g., ebooks , journals, DVDs, etc.), author, title, publisher, edition, date, and price.**  No additional resources are required. |

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| **4** | **Library faculty focus on strengthening students' information literacy skills in finding, evaluating, and ethically using information. We can collaborate on developing assignments and offer customized information literacy instruction and research guides for your course.**  **Do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**  Instructors of the course will have the freedom to collaborate with library faculty at their own discretion. |

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| **5** | **Library Faculty Subject Specialist \_\_** Cailean CooneyPicture 8  **Comments and Recommendations**  The Library provides resources relevant to the independent study course, available both on-site and online, including print and electronic books, reference materials, and journal subscriptions. Print books from other CUNY campuses are also available to request. In addition, the library provides digital resources and can offer programming to support students in developing information literacy and research skills. The Library will consider additional resource requests based on budgetary means and welcomes recommendations for book monograph purchases to update the collection on a yearly basis.  **Date:** 10/18/18 |

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| NEW YORK CITY COLLEGE OF TECHNOLOGY  **The City University**  **Of New York** | | School of Arts and Sciences  **Biological Sciences Department** | | |
| **Course Information** | | | | |
| **Course title:** | **Independent Research Study in Biomedical Informatics: Guided Research** | | | |
| **Course code:** | **BIO 4920** | | | |
| **Credit Hours:** | **3 credit hours** | | | |
| **5 Independent study hours** | | | |
| **Pre or co-requisite:** | **BIO 4910** | | | |
| **Text:** | **No course textbook will be assigned** | | | |
| **Official Course Description (from the College Catalog)** | **Students will work with a mentor selected from the Biological Sciences Department to develop and complete a semester long intensive research project that integrates aspects of information literacy, scientific communication and oral presentation. Students will conduct the research and experimentation on the work proposed from Information Literacy. This course helps students in applying the process of science towards answering a research project in the Biological Sciences, Bioinformatics or Health Informatics. This course culminates in the examination of oral, written and visual representation of research work. These projects will implement hypothesis testing to answer a question germane to the Biological Sciences, Bioinformatics or Health Informatics.** | | | |
| **Grading Procedure (see Grading Policies for details)** | | | | |
| * Written Report 60% * Oral Presentation 25% * Mentor Evaluation 10% * Journal/Notebo 5% | | | | |
| **Instructional Objectives**  **(derived from NSF Vision & Change)** | | | | Assessment |
| Apply the Scientific Process (hypothesis testing) | | | Use of a written research plan highlighting the fundamental hypothesis and research question | |
| Implementation of Interdisciplinary analysis and Communication | | | Use of written report illustrating information literacy and coalescence of weighted scientific literature to formulate the research question | |
| Implement quantitative reasoning through statistics and visualization of data | | | Use of written report and scientific poster | |
| Understand the science and society relationship in the project | | | Students will integrate this into their written reports to illustrate the scientific relevance of their work | |
| Formulation and application of models or simulations to explain the phenomena | | | Students will demonstrate proficiency in applying models/simulations in their written report and poster | |
| **Teaching/Learning Methods** | | | | |
| * Guided independent reading of scientific literature * Experimental or data driven science and analysis * Written reports and scientific poster | | | | |
| **Academic Integrity Policy** | | | | |
| Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion. | | | | |

**CHANCELLOR’S REPORT FORM**

New course to be offered in the Biology department

|  |  |
| --- | --- |
| **Department** | **Biology** |
| **Academic Level** | **[ X ] Regular  [   ] Compensatory  [   ] Developmental  [   ] Remedial** |
| **Subject Area** | **Biomedical Informatics** |
| **Course Prefix** | **BIO** |
| **Course Number** | **4920** |
| **Course Title** | **Independent Research Study in Biomedical Informatics: Guided Research** |
| **Catalog Description** | **Working with a mentor selected from the Biological Sciences Department, students conduct the research and experimentation on the work proposed from BIO 5010. This course helps students in applying the process of science towards answering a research question in the biological sciences, bioinformatics or health informatics. This course culminates in the examination of oral, written and visual representations of research.** |
| **Prerequisite** |  |
| **Corequisite** |  |
| **Pre- or corequisite** | **BIO4910** |
| **Credits** | **3** |
| **Contact Hours** | **5** |
| **Liberal Arts** | **[ ] Yes  [X] No** |
| **Course Attribute** | **Writing Intensive** |
| **Course Applicability** | **[X] Major**  **[ ] Gen Ed Required [ ] Gen Ed - Flexible [ ] Gen Ed - College Option**  **[ ] English Composition [ ] World Cultures [ [ ]Speech**  **[ ] Mathematics [ ] US Experience in its Diversity [ ] Interdisciplinary**  **[ ] Science [ ] Creative Expression [ ] Advanced Liberal Arts**  **[ ] Individual and Society**  **[ ] Scientific World** |
| **Effective Term** | **Spring 2020** |

**Rationale:** Students have difficulty in obtaining external internships due to GPA considerations and competition. While the external Internship is preferred, an alternative means of having students follow a similar routine within the confines of the College will enable students to proceed with their degree requirements.

1. “The faculty believed that the joint training was a strength because (1) it prepared students for a wide range of application opportunities after graduation, and (2) it allowed students to see the underlying methodological similarities across biomedical informatics (particularly in schema design, knowledge representation, machine learning, and data mining).” In Altman, R. B., & Klein, T. E. (2007). Biomedical informatics training at Stanford in the 21st century. *Journal of biomedical informatics*, 40(1), 55-58. [↑](#footnote-ref-1)
2. “(I)t is the depth of informatics methods, shared across the spectrum from the molecular to the population levels that defines the core discipline of BMI and provides its coherence and its professional foundation for defining a common set of core competencies.” In Kulikowski, C. A., Shortliffe, E. H., Currie, L. M., Elkin, P. L., Hunter, L. E., Johnson, T. R., ... & Smith, J. W. (2012). AMIA Board white paper: definition of biomedical informatics and specification of core competencies for graduate education in the discipline. *Journal of the American Medical Informatics Association*, 19(6), 931-938. [↑](#footnote-ref-2)
3. “Research challenges can be attributed to four areas: bioinformatics and systems biology, biomedical engineering and informatics, health informatics and individual healthcare, and public health informatics. In order to bridge existing gaps between different disciplines and cultures, we suggest focusing on interdisciplinary education, taking an integrative approach and starting interdisciplinary practice at early stages of education.” In Kuhn, K., & Knoll, A. (2008). Informatics and medicine. From molecules to populations. *Methods Inf Med*, 47(4), 283-295. [↑](#footnote-ref-3)
4. See Table 1 in Welch, L., Lewitter, F., Schwartz, R., Brooksbank, C., Radivojac, P., Gaeta, B., & Schneider, M. V. (2014). Bioinformatics curriculum guidelines: toward a definition of core competencies. *PLOS computational biology*, 10(3), e1003496. [↑](#footnote-ref-4)