



9201 University City Boulevard, Charlotte, NC 28223-0001

TO: Faculty Council Members
FROM: Ed Jernigan, Faculty President
DATE: May 10, 2012
RE: Consent Calendar

Attached is the Consent Calendar (See Article V, Section 3.A (3 & 4), J. (3 & 5) and K.3 of the Standing Rules of the Faculty Council.) consisting of these proposals:

- BINF 02-03-12 Revisions of Graduate Curriculum for the Department of Bioinformatics
- ECON 02-03-12 Establishment of an option within the Economics concentration of the MS Economics Degree
- MDSK 02-06-12 Creation of a New Interdisciplinary Minor: Urban Youth and Communities
- SON 11-17-11 Revision of the Nurse Anesthesia Major and Post Masters Certificate in Nursing Anesthesia

Below are the catalog copy descriptions. If you wish to read the full proposals, they are posted on the Academic Affairs website.

If there are any objections regarding these proposals, they must be registered with Faculty Governance (facultygovernance@uncc.edu) by **5 PM on May 24, 2012**. If no objections are registered, the proposals will stand approved.

BINF 02-03-12 Revisions of Graduate Curriculum for the Department of Bioinformatics

Summary

The Department of Bioinformatics and Genomics within the College of Computing and Informatics seeks to modify its graduate curriculum. The proposed changes primarily affect program requirements and course offerings for the Professional Science Masters (PSM) in Bioinformatics, the Graduate Certificate in Bioinformatics Applications, and the Graduate Certificate in Bioinformatics Technology. These changes to the graduate curriculum are required to ensure that our students graduate with a common skill set, which includes current core technological competencies in our rapidly changing field. In conjunction with updating the program requirements, we propose to add four courses that will enhance the current offerings for students enrolled in our PSM and Ph.D. programs.

a. We propose to create the following new courses:

- BINF 6152 – Program and Professional Orientation
- BINF 6153 – Career Development
- BINF 6318/BINF 8318 – Computational Proteomics and Metabolomics
- BINF 6382/BINF 8382 – Accelerated Bioinformatics Programming

b. We propose to modify the catalog copy of the following courses:

- BINF 6151/GRAD 6151 – Professional Communication
- BINF 6203/BINF 8203/ITSC 8203 – Genomics
- BINF 6111/BINF 8111/ITSC 8111 – Bioinformatics Programming I
- BINF 6112/BINF 8112/ITSC 8112 – Bioinformatics Programming II
- BINF 6380/BINF 8380/ITSC 8380 – Bioinformatics Programming III (changed title and catalog copy)
- We will also remove ITSC course numbers from all courses; these were placeholder numbers created while BINF was still a track within ITSC, and are no longer needed.

c. We propose to change the core requirements of the PSM in Bioinformatics:

- The total number of required credit hours will increase to 40.
- All PSM students will be required to enroll in BINF 6152 – Program and Professional Orientation (1cr), BINF 6151 – Professional Communications (1cr) and BINF 6153 – Career Development (1cr). These courses, taken together, will provide ongoing support for PSM in Bioinformatics students to learn to recognize and use key resources and networks specific to their field, and to develop a professional self-presentation that will help them transition to jobs in business and industry environments.
- All PSM students will now be required to take a common core of seven BINF courses. Depending on their undergraduate training, students will enroll in either BINF 6100 – Biological Basis of Bioinformatics or BINF 6111 – Bioinformatics Programming I. Concurrently with and subsequently to these courses, all PSM students will enroll in BINF 6101 – Energy and Interaction in Biological Modeling, BINF 6111 – Bioinformatics Programming II, BINF 6200 – Statistics for Bioinformatics, BINF 6201 – Molecular Sequence Analysis, BINF 6203 – Genomics, and BINF 6211 – Design and Implementation of Bioinformatics Databases.

The remaining requirements of the PSM in Bioinformatics, including the PLUS Elective, internship requirement, and advanced elective requirements, will remain unchanged, resulting in a requirement of 40 total credit hours. The curriculum as modified can be completed by a full-time student in two years.

d. We propose to change the core curriculum of the Graduate Certificate in Bioinformatics Applications

All Bioinformatics Applications certificate students will now be required to take a common core of three BINF courses. All students will enroll in BINF 6200 – Statistics for Bioinformatics, BINF 6201 – Molecular Sequence Analysis, and BINF 6203 – Genomics, and will choose as their fourth course either BINF 6350 – Biotechnology and Genomics Laboratory, or BINF 6211 – Design and Implementation of Bioinformatics Databases.

e. We propose to change the core curriculum of the Graduate Certificate in Bioinformatics Technology

All Bioinformatics Technology certificate students will now be required to take a common core of four BINF courses. Depending on their undergraduate training, students will enroll in either BINF 6100 – Biological Basis of Bioinformatics or BINF 6111 – Bioinformatics Programming I. Concurrently with and subsequently to these courses, all students will enroll in BINF 6112 – Bioinformatics Programming II, BINF 6200 – Statistics for Bioinformatics, and BINF 6203 – Genomics, and will choose as their fifth course either BINF 6201 – Molecular Sequence Analysis or BINF 6211 – Design and Implementation of Bioinformatics Databases.

Catalog Copy

PROFESSIONAL SCIENCE MASTER'S IN BIOINFORMATICS

Additional Admission Requirements

In addition to the general requirements for admission to the Graduate School, the following are required for study toward the Professional Science Masters (PSM) in Bioinformatics:

Under most circumstances, students admitted to the program will have:

- 1) A baccalaureate degree from an accredited college or university in Biology, Biochemistry, Chemistry, Physics, Mathematics, Statistics, Computer Science, or another related field that provides a sound background in life sciences, computing, or both.
- 2) A minimum undergraduate GPA of 3.0 (4.0 scale) and 3.0 in the major.
- 3) A minimum combined score of 1000 on the verbal and quantitative portions of the GRE, and acceptable scores on the analytical and discipline-specific sections of the GRE.
- 4) A combined TOEFL score of 220 (computer-based), 557 (paper-based), or 83 (Internet-based) is required if the previous degree was from a country where English is not the common language.
- 5) Positive letters of recommendation.

Degree Requirements

The Professional Science Masters (PSM) in Bioinformatics degree requires a minimum of ~~37~~⁴⁰ graduate credit hours, and a minimum of ~~33~~³⁶ credit hours of formal coursework. A minimum of 24 credit hours presented toward a PSM in Bioinformatics must be from courses numbered 6000 or higher. A maximum of 6 hours of graduate credit may be transferred from other institutions.

Total Hours Required

The program requires ~~37~~⁴⁰ post-baccalaureate credit hours. Because of the interdisciplinary nature of this program, which is designed to provide students with a common graduate experience during their professional preparation for the PSM in Bioinformatics degree, all

students will be required to take a general curriculum that includes a two-year sequence of courses as described below:

Core Requirements

a) ~~Fundamentals Courses~~ Gateway Course

The ~~Fundamentals course sequences~~ Gateway courses are intensive graduate-level courses designed to provide accelerated training in a second discipline that complements the student's undergraduate training. Students entering the program are expected to have achieved proficiency in either Biological Sciences or Computing, and to ~~require at most two of the Fundamentals courses~~ take the Gateway course that is appropriate for their background. For students entering from computing backgrounds, BINF 6100 (Biological Basis of Bioinformatics), should be chosen, while students entering from biological science backgrounds should choose BINF 6111 (Bioinformatics Programming I).

~~**Fundamental Biology track:** This course sequence is designed for students entering with a degree in Computer Science or another quantitative science discipline. The Fundamental Biology course sequence provides accelerated training in Genetics, Cell and Molecular Biology, and Biochemistry for students entering Bioinformatics from computer science or a quantitative science. BINF 6100, 6101.~~

~~**Fundamental Computing track:** The Fundamental Computing track is designed for students entering with a degree in a life science discipline. The Fundamental Computing course sequence provides accelerated training in programming and data structures for students entering Bioinformatics from life sciences. BINF 6111, 6112.~~

b) ~~Core Bioinformatics Courses~~

~~Fundamentals~~ Gateway courses prepare students for the required **Core** courses. All students must take BINF 6101 (Energy and Interaction in Biological Modeling, BINF 6112 (Bioinformatics Programming II), BINF 6200 (Statistics for Bioinformatics). ~~In addition, students must take 6 additional credit hours of Core Genomics courses from among~~ BINF 6201 (Molecular Sequence Analysis), BINF 6203 (Genomics), ~~BINF 6205 (Computational Molecular Evolution) and BINF 6211 (Design and Implementation of Bioinformatics Databases).~~ A student who has previously taken a course with a syllabus that closely follows one of the course courses may test out of the core requirement by passing a written exam, and ~~BINF 6350 (Biotechnology and Genomics Laboratory) and 6 credit hours from the Core Computational courses from among BINF 6202 (Computational Structural Biology), BINF 6204 (Mathematical Systems Biology), BINF 6210 (Numerical Methods and Machine Learning for Bioinformatics), and BINF 6310 (Advanced Statistics for Genomics).~~ may then substitute an advanced elective for the required core course.

c) ~~Professional Preparation Requirement~~

Students are required to take at least ~~3~~ 6 credit hours of electives designed to prepare them to function effectively and ethically in a professional environment. ~~Some~~ All Bioinformatics PSM students are required to enroll in BINF 6152 (Program and Professional Orientation) (1cr), BINF 6151 (Professional Communications) (1cr) and BINF 6153 (Career Development) (1cr). The remaining PLUS credits may be chosen from a list of recommended electives ~~in this category,~~ which include BINF 5171 (Business of

Biotechnology), BINF 5191 (Biotechnology and the Law), ~~BINF 6151 (Professional Communications)~~, PHIL 6050 (Research Ethics), and ITIS 6362 (Information Technology Ethics, Policy, and Security). Additional elective choices that may fulfill this requirement can be identified by the student and the ~~student's~~ PSM Advisory Committee.

- d) The remaining credit hours of formal coursework can be completed in ~~additional Core Bioinformatics courses and/or other recommended program electives~~ elective coursework. The ~~student's~~ PSM Advisory Committee will review the student's plan of study each semester.

Bioinformatics Electives

Any courses with BINF numbers, with the exception of **Fundamentals** courses, which require approval, are open to PSM students seeking to complete their coursework requirements.

Recommended Electives Offered By Other Departments

A wide range of courses in Biology, Chemistry, Computer Science, Software and Information Systems, and other departments may be appropriate electives for PSM in Bioinformatics students. As course offerings change frequently, the Bioinformatics Program maintains a list of current recommended electives, which can be found online at bioinformatics.uncc.edu.

Formatted: Font color: Black

Elective Clusters

Students are encouraged to choose their electives with a topical focus that reflects their scientific and career interests. Courses from one of the following recommended clusters of advanced electives can be selected, or the student can design his or her own elective focus with the approval of the PSM Advisory Committee.

Genomic Biology Cluster

[BINF 6205 Computational Molecular Evolution](#)
[BINF 6305 Biotechnology and Genomics Laboratory](#)
[BINF 6310 Advanced Statistics for Genomics](#)
[BINF 6318 Computational Proteomics and Metabolomics](#)

Modeling and Simulation Cluster

[BINF 6202 Computational Structural Biology](#)
[BINF 6204 Mathematical Systems Biology](#)
[BINF 6210 Numerical Methods and Machine Learning in Bioinformatics](#)
[BINF 6311 Biophysical Modeling](#)

Computing and Technology Cluster

[BINF 6210 Numerical Methods and Machine Learning in Bioinformatics](#)
[BINF 6310 Advanced Statistics for Genomics](#)
[BINF 6380 Advanced Bioinformatics Programming](#)
[BINF 6382 Accelerated Bioinformatics Programming](#)

- e) **Other Requirements**
Bioinformatics Seminar

In addition to 33 hours formal coursework, students are required to enroll in the Bioinformatics Program seminar (BINF 6600) for at least one semester (1 credit hour) and to enroll in either an approved internal or external internship (BINF 6400) or a faculty-supervised original research project leading to a thesis (BINF 6900).

Grade Requirements

An accumulation of three C grades will result in suspension of the student's enrollment in the graduate program. If a student makes a grade of U in any course, enrollment in the program will be suspended.

Amount of Transfer Credit Accepted

A maximum of 6 credit hours of coursework from other institutions will count toward the PSM in Bioinformatics degree requirements. Only courses with grades of A or B from accredited institutions are eligible for transfer credit.

Formatted: Font: Not Bold

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

GRADUATE CERTIFICATE IN BIOINFORMATICS APPLICATIONS

The purpose of the Graduate Certificate in Bioinformatics Applications is to train individuals in the application of established bioinformatics methods for analysis of biological sequence, structure, and genomic data. The certificate requires twelve (12) credit hours of coursework. The certificate may be pursued concurrently with a related graduate degree program at UNC Charlotte or as a standalone program.

Admission Requirements

For admission into the certificate program, applicants must meet the following requirements:

- 1) A bachelor's degree in a life science discipline, that includes advanced coursework in molecular biology and genetics.
- 2) Practical experience and confidence with computers, for instance use of common web browsers, word processing, plotting, and spreadsheet applications.

Program Requirements

Students will take four courses that introduce core methods for analysis of molecular biological data:

BINF 6200 Statistics for Bioinformatics (3)

~~And three courses chosen from the following list of electives:~~

BINF 6201 -Molecular Sequence Analysis (3)

~~BINF 6202 -Computational Structural Biology (3)~~

~~BINF 6203 -Genomics (3)~~

And one of the following:

BINF 6211 -Design and Implementation of Bioinformatics Databases (3)

BINF 6350 ~~Genomic~~ Biotechnology (3) and Genomics Laboratory (3)

- If a student wishes to enter the program having completed coursework that is equivalent to one or more of the core requirements, the requirements may be waived at the discretion of the certificate coordinator. In this case, the required 12 credit hours may be selected from other advanced graduate courses offered by the Department of Bioinformatics and Genomics.

- Transfer credit may not be applied toward this certificate.

- It is suggested that students in the Graduate Certificate Program arrange formal co-mentorship by a Department of Bioinformatics and Genomics faculty member, if the student is concurrently enrolled in another thesis-based degree program on campus and intends to extend or enable their thesis research through the application of bioinformatic methods.

~~It is suggested that students in the Graduate Certificate Program arrange formal co-mentorship by a Department of Bioinformatics and Genomics faculty member, if the student is concurrently enrolled in another thesis-based degree program on campus and intends to extend or enable their thesis research through the application of bioinformatic methods.~~

GRADUATE CERTIFICATE IN BIOINFORMATICS TECHNOLOGY

The purpose of the Graduate Certificate in Bioinformatics Technology is to train individuals in method development for analysis of large-scale biological data and modeling of complex biological systems, with a focus on acquiring complementary skill sets in life sciences and in programming, statistical analysis, and database development. The certificate requires fifteen (15) credit hours of coursework. The certificate may be pursued concurrently with a related graduate degree program at UNC Charlotte.

Admission Requirements

For admission into the certificate program, applicants must meet the following requirements:

- 1) A bachelor's degree in related field, including, but not limited to, a life science, physical science, mathematics, or computing discipline.
- 2) Practical experience and confidence with computers, for instance use of common web browsers, word processing, plotting, and spreadsheet applications.

Program Requirements

Students will follow one of two pathways through the program, depending on their bachelor's degree field and previous experience. The following courses make up the required core:

If the bachelor's degree is in life sciences:

BINF 6200 Statistics for Bioinformatics (3)
BINF 6110 Bioinformatics Programming I (3)
BINF 6111 Bioinformatics Programming II (3)

[BINF 6203 Genomics \(3\)](#)

If the bachelor's degree is in computing or mathematics:

BINF 6200 Statistics for Bioinformatics (3)

BINF 6100 Biological Basis of Bioinformatics (3)

~~BINF 6101 Energy and Information in Biological Modeling~~ BINF 6111 Bioinformatics Programming II (3)

Formatted: Indent: Left: 0", First line: 0"

~~One advanced bioinformatics technology course from~~ BINF 6203 Genomics (3)

And one of the following list of electives is required courses:

BINF 6201 Molecular Sequence Analysis (3)

BINF 6211- Design and Implementation of Bioinformatics Databases (3)

~~BINF 6310 Advanced Statistics for Bioinformatics (3)~~

~~BINF 6380 Bioinformatics Programming III (3)~~

One bioinformatics applications course from the following list of electives is required:

~~BINF 6201 Molecular Sequence Analysis (3)~~

~~BINF 6202 Computational Structural Biology (3)~~

~~BINF 6203 Genomics (3)~~

If a student wishes to enter the program having completed coursework that is equivalent to the core course requirements, the core requirements may be waived at the discretion of the certificate coordinator. In this case, the required 15 coursework hours may be selected from the electives listed above, or from other advanced graduate courses offered by the Department of Bioinformatics and Genomics.

Transfer credit may not be applied toward this certificate.

It is suggested that students in the Graduate Certificate Program arrange formal co-mentorship by a Department of Bioinformatics and Genomics faculty member, if the student is concurrently enrolled in another thesis-based degree program on campus and intends to extend or enable their thesis research through the application of bioinformatic methods.

~~It is suggested that students in the Graduate Certificate Program arrange formal co-mentorship by a Department of Bioinformatics and Genomics faculty member, if the student is concurrently enrolled in another thesis-based degree program on campus and intends to extend or enable their thesis research through the application of bioinformatic methods.~~

Formatted: Font: 10 pt, Bold

COURSES IN BIOINFORMATICS (BINF)

Formatted: Don't adjust space between Latin and Asian text, Don't adjust space between Asian text and numbers

BINF 5171. Business of Biotechnology. (3) Prerequisite: Admission to a graduate program.

Introduces students to the field of biotechnology and how biotech businesses are created and managed. Students should be able to define biotechnology and understand the difference between a biotech company and a pharmaceutical company. Additional concepts covered will include platform technology, biotechnology's history, biotechnology products and development processes, current technologies used by biotech companies today, biotechnology business fundamentals, research and development within biotech companies, exit strategies, and careers in the biotech field. (*On demand*)

BINF 5191. Biotechnology and the Law. (3) Prerequisite: Admission to a graduate program. At the intersection of biotechnology and the law, an intricate body of law is forming based on constitutional, case, regulatory and administrative law.- This body of legal knowledge is interwoven with ethics, policy and public opinion.- Because biotechnology impacts everything in our lives, the course will provide an overview of salient legal biotechnology topics, including but not limited to: intellectual property, innovation and approvals in agriculture, drug and diagnostic discovery, the use of human and animal subjects, criminal law and the courtroom, agriculture (from farm to fork), patient care, bioethics, and privacy. The body of law is quite complex and it is inundated with a deluge of acronyms. The course will provide a foundation to law and a resource to help students decipher laws and regulation when they are brought up in the workplace.- (*On demand*)

BINF 6010.- Topics in Bioinformatics. (3)- Prerequisite: permission of the department. Topics in bioinformatics and genomics selected to supplement the regular course offerings. A student may register for multiple sections of the course with different topics in the same semester or in different semesters. (*On demand*)

BINF 6100.- Biological Basis of Bioinformatics. (3)- Prerequisites: Admission to graduate standing in Bioinformatics and undergraduate training in Computer Science or other non-biological discipline.- This course provides a foundation in molecular genetics and cell biology focusing on foundation topics for graduate training in bioinformatics and genomics. (*Fall*)

BINF 6101.- Energy and Interaction in Biological Modeling. (3) Prerequisite: Admission to graduate standing in Bioinformatics. This course covers: (a) the major organic and inorganic chemical features of biological macromolecules; (b) the physical forces that shape biological molecules, assemblies and cells; (c) the chemical driving forces that govern living systems; (d) the molecular roles of biological macromolecules and common metabolites; (e) and the pathways of energy generation and storage. Each section of the course builds upon the relevant principles in biology and chemistry to explain the most common mathematical and physical abstractions used in modeling in the relevant context. (*Spring*)

BINF 6111.- Bioinformatics Programming I.- (3)- Prerequisite:- Admission to graduate standing in Bioinformatics-or permission of instructor. Introduces fundamentals of programming for bioinformatics using a high-level object-oriented language such as ~~python~~.Java or Python. The ~~first weeks cover core data types, syntax, and functional~~course introduces object-oriented programming, focusing on construction analysis of programs from small, testable parts. algorithms and fundamental sequence alignment methods. Students will learn productive use of the Unix environment, focusing on Unix utilities that are particularly useful in bioinformatics. ~~The course covers object-oriented programming, introduce analysis of algorithms and sequence alignment methods, and introduce computational environments that are particularly useful in bioinformatics analyses such as R, BioPython, and Web services in bioinformatics. By the end of the semester, students will have gained the ability to analyze data within the python interpreter (for example) and write well documented, well organized programs.~~ (*Fall*)

BINF 6112.- Bioinformatics Programming II.- (3)- Prerequisite:- BINF 6111/~~ATSC 6111-~~ or permission of instructor. Continuation of BINF 6111.- In this second semester ~~course,~~ students practice and refine skills learned in the first semester.- New topics include: -(a) programming as part of a team, using sequence analysis algorithms in realistic settings; (b) writing maintainable and re-usable code; ~~(c) Web programming;~~ and ~~(d)~~ graphical user interface development. ~~At the end of the semester, students will be able to evaluate and deploy computer languages, tools, and software engineering techniques in bioinformatics research.~~ (Spring)

Formatted: Normal (Web), Line spacing: At least 7.3 pt, Font Alignment: Baseline

Formatted: Font: Italic

BINF 6151. Professional ~~Communications~~Communication. (1) Cross-listed as GRAD 6151. Principles and useful techniques for effective oral presentations, poster presentations, scientific writing, use of references, and avoiding plagiarism. Students in the course critique and help revise each other's presentations and learn how to avoid common pitfalls. In addition, students learn how to properly organize and run a meeting. ~~Students prepare a CV, job application letter, and job talk.~~ (Fall)

~~**BINF 6171. Business of Biotechnology. (3)** Introduces students to the field of biotechnology and how biotech businesses are created and managed. Students should be able to define biotechnology and understand the difference between a biotech company and a pharmaceutical company. Additional concepts covered include platform technology, biotechnology's history, biotechnology products and development processes, current technologies used by biotech companies, biotechnology business fundamentals, research and development within biotech companies, exit strategies, and careers in the biotech field. (Summer)~~

BINF 6200.

BINF 6152. Program and Professional Orientation. (1) Students in the course learn to identify key Bioinformatics skill sets and where they are applied in research and industry settings, join appropriate professional networks, use the major professional and research journals in the field, identify key organizations and companies driving intellectual and technology development in Bioinformatics, and achieve beginner-level proficiency with key molecular data repositories. (Fall)

BINF 6153. Career Development in Bioinformatics. (1) Students in the course will prepare intensively for the job search, from developing a resume, to identifying appropriate opportunities, to preparing for the interview. Students are expected to complete a final interview practicum with faculty and members of the PSM Advisory Board. (Fall)

BINF 6200. Statistics for Bioinformatics.- (3)- Introduces students to statistical methods commonly used in bioinformatics. Basic concepts from probability, stochastic processes, information theory, and other statistical methods will be introduced and illustrated by examples from molecular biology, genomics and population genetics with an outline of algorithms and software. R is introduced as the programming language for homework. (Fall)

BINF 6201.- Molecular Sequence Analysis.- (3)- Prerequisite:- BINF 6100 or equivalent.- Introduction to bioinformatics methods that apply to molecular sequence and to biological databases online. Sequence databases, molecular sequence data formats, sequence data preparation and database submission.- Local and global sequence alignment, multiple alignment, alignment scoring and alignment algorithms for protein and nucleic acids, genefinding and

feature finding in sequence, models of molecular evolution, phylogenetic analysis, comparative modeling. *(Fall)*

BINF 6202. Computational Structural Biology. (3) Prerequisites: BINF 6101 and BINF 6201 or their equivalents. This course covers: (a) the fundamental concepts of structural biology (chemical building blocks, structure, superstructure, folding, etc.); (b) structural databases and software for structure visualization; (c) Structure determination and quality assessment; (d) protein structure comparison and the hierarchical nature of biomacromolecular structure classification; (e) protein structure prediction and assessment; and (f) sequence- and structure-based functional site prediction. *(Fall)*

BINF 6203. Genomics. (3) Prerequisite: BINF 6100 or equivalent. Surveys the application of high-throughput molecular biology and analytical biochemistry methods and data interpretation for those kinds of high volume biological data most commonly encountered by bioinformaticians. The relationship between significant biological questions, modern genomics technology methods, and the bioinformatics solutions that enable interpretation of complex data is emphasized. Topics include: ~~(a)~~ genome sequencing and assembly, annotation, and comparison; ~~(b)~~ genome evolution and individual variation; ~~(c)~~ function prediction; ~~(d)~~ gene ontologies; ~~(e)~~ transcription assay design, data acquisition, and data analysis; ~~(f)~~ proteomics methods; ~~(g)~~ methods for identification of molecular interactions; and ~~(h)~~ metabolic databases, pathways and ~~models.~~ databases and their role in genome analysis. *(Spring)*

BINF 6204. Mathematical Systems Biology. (3) Prerequisites: BINF 6200 and BINF 6210 or equivalents. Introduces basic concepts, principles and common methods used in systems biology. Emphasizes molecular networks, models and applications, and covers the following topics: (a) the structure of molecular networks; (b) network motifs, their system properties and the roles they play in biological processes; complexity and robustness of molecular networks; (c) hierarchy and modularity of molecular interaction networks; kinetic proofreading; (d) optimal gene circuit design; and (e) the rules for gene regulation. *(Spring)*

BINF 6205. Computational Molecular Evolution. (3) Prerequisites: BINF 6201 and BINF 6200 or permission of the instructor. Covers major aspects of molecular evolution and phylogenetics with an emphasis on the modeling and computational aspects of the fields. Topics will include: models of nucleotide substitution, models of amino acid and codon substitution, phylogenetic reconstruction, maximum likelihood methods, Bayesian methods, comparison of phylogenetic methods and tests on trees, neutral and adaptive evolution and simulating molecular evolution. Students will obtain an in-depth knowledge of the various models of evolutionary processes, a conceptual understanding of the methods associated with phylogenetic reconstruction and testing of those methods and develop an ability to take a data-set and address fundamental questions with respect to genome evolution. *(On demand)*

BINF 6210. Numerical Methods and Machine Learning in Bioinformatics. (3) Prerequisites: Ability to program in a high-level language (Perl, Java, C#, Python, Ruby, C/C++) and Calculus. Focuses on commonly used numerical methods and machine learning techniques. Topics will include: solutions to linear systems, curve fitting, numerical

differentiation and integration, PCA, SVD, ICA, SVM, PLS. Time permitting, Hidden Markov Chains and Monte Carlo simulations will be covered as well. Students learn both the underlying theory and how to apply the theory to solve problems. *(Fall)*

BINF 6211. Design and Implementation of Bioinformatics Databases. (3) Students learn the necessary skills to access and utilize public biomedical data repositories, and are expected to design, instantiate, populate, query and maintain a personal database to support research in an assigned domain of bioinformatics. Topics include common data models and representation styles, use of open-source relational DBMS, and basic and advanced SQL. Focuses on how data integration is achieved, including the use of standardized schemas, exchange formats and ontologies. Examines large public biomedical data repositories such as GenBank and PDB, learn how to locate and assess the quality of data in Web-accessible databases, and look at representation, standards, and access methods for such databases. *(Spring)*

BINF 6310. Advanced Statistics for Genomics. (3) Prerequisite: BINF 6200 or equivalent. The first half of this course emphasizes canonical linear statistics (t-test, ANOVA, PCA) and their non-parametric equivalents. The second half of the course emphasizes Bayesian statistics and the application of Hidden Markov Models to problems in bioinformatics. Students should have fluency in a high-level programming language (PERL, Java, C# or equivalent) and will be expected, in assignments, to manipulate and analyze large public data sets. The course will utilize the R statistical package with the bioconductor extension. *(On demand)*

BINF 6311.- Biophysical Modeling. (3) This course covers: (a) overview of mechanical force fields; (b) energy minimization; (c) dynamics simulations (molecular and coarse-grained); (d) Monte-Carlo methods; (e) systematic conformational analysis (grid searches); (f) classical representations of electrostatics (Poisson-Boltzmann, Generalized Born and Colombic); (g) free energy decomposition schemes; and (h) hybrid quantum/classical (QM/MM) methods. *(On demand)*

BINF 6312.- Computational Comparative Genomics. (3) Prerequisite: BINF 6201 or equivalent. Introduces computational methods for comparative genomics analysis. Covers the following topics: (a) the architecture of prokaryotic and eukaryotic genomes; (b) the evolutionary concept in genomics; (c) databases and resources for comparative genomics; (d) principles and methods for sequence analysis; evolution of genomes; (e) comparative gene function annotation; (f) evolution of the central metabolic pathways and regulatory networks; (g) genomes and the protein universe; (h) cis-regulatory binding site prediction; (i) operon and regulon predictions in prokaryotes; and (j) regulatory network mapping and prediction. *(On demand)*

BINF 6313. Structure, Function, and Modeling of Nucleic Acids. (3) Prerequisites: BINF 6100 and BINF 6101 or their equivalents. Covers the following topics: (a) atomic structure, macromolecular structure-forming tendencies and dynamics of nucleic acids; (b) identification of genes which code for functional nucleic acid molecules, cellular roles and metabolism of nucleic acids; (c) 2D and 3D abstractions of nucleic acid macromolecules and methods for structural modeling and prediction; (d) modeling of hybridization kinetics and equilibria; and (e)

hybridization-based molecular biology protocols, detection methods and molecular genetic methods, and the role of modeling in designing these experiments and predicting their outcome. (On demand)

BINF 6318. Computational Proteomics and Metabolomics. (3) Prerequisites: BINF 6200 or equivalent. The aim of this 3-credit course is to introduce commonly used computational algorithms and software tools for analyzing mass spectrometry-based proteomics and metabolomics data. Chromatography and mass spectrometry will be covered at the beginning of the course to provide background information for the students to understand the nature of mass spectrometry data. (On demand)

BINF 6350. Biotechnology and Genomics Laboratory. (3) Teaches basic wet-lab techniques commonly used in biotechnology to generate genomics data. Lectures cover methods for sample isolation, cell disruption, nucleic acid and protein purification, nucleic acid amplification, protein isolation and characterization, molecular labeling methods and commonly used platforms for characterizing genome-wide molecular profiles. In particular, students discuss and learn to perform: tissue culture and LCM isolation of cells, DNA sequencing methods, DNA fingerprinting methods, RT-qPCR and microarrays of cDNA, 1D and 2D gels for protein separation, protein activity assays, and proteomics platforms. Lectures describe emerging methodologies and platforms, and discuss the ways in which the wet-lab techniques inform the design and use of bioinformatics tools, and how the tools carry out the processing and filtering that leads to reliable data. This course also discusses the commercial products beginning to emerge from genomics platforms. (Spring)

BINF 6380. Advanced Bioinformatics Programming-III. (3) Prerequisite: BINF 6112 or equivalent. Emphasizes or permission of instructor. Advanced algorithms in bioinformatics with an emphasis placed on the implementation of bioinformatics algorithms in the context of parallel processing. Topics covered depend on instructor expertise and student interest, but may include assembly of short read fragments from next-generation sequencing platforms, clustering algorithms, machine learning, development of multi-threaded applications, developing for multi-core processors and utilization of large clusters and “cloud” supercomputers. Students are expected to complete a significant independent project. (Fall) (On demand)

BINF 6382. Accelerated Bioinformatics Programming. (3) Prerequisite: BINF 6112 or equivalent. Prerequisite: BINF 6112 or equivalent or permission of instructor. Computationally intensive algorithms in bioinformatics with an emphasis placed on the implementation of bioinformatics algorithms in the context of parallel processing using modern hardware processor accelerators such as GPUs and FPGAs. Topics covered depend on instructor expertise and student interest but may include multi-threaded applications and developing for multi-core processors and for large clusters and other “cloud” computers. Students will be expected to complete a significant independent project. (On demand)

BINF 6400. Internship Project. (1-3) Prerequisite: Admission to graduate standing in Bioinformatics. Project is chosen and completed under the guidance of an industry partner, and results in an acceptable technical report. (Fall, Spring)

Formatted: Font: Bold, Not Italic

Formatted: No widow/orphan control, Don't adjust space between Latin and Asian text, Don't adjust space between Asian text and numbers

Formatted: Font: Bold

Formatted: Don't adjust space between Latin and Asian text, Don't adjust space between Asian text and numbers

BINF 6600.- Seminar. (1)- Prerequisite:- Admission to graduate standing in Bioinformatics. Weekly seminars are given by bioinformatics researchers from within the University and across the world.- (Fall, Spring)

BINF 6601.- Journal Club. (1) Prerequisite: Admission to graduate standing in Bioinformatics. Each week, a student in the course is assigned to choose and present a paper from the primary bioinformatics literature. (Fall, Spring)

BINF 6880. Independent Study. (1-3) Faculty supervised research experience to supplement regular course offerings.

BINF 6900. Master's Thesis. (1-3) Prerequisites: 12 graduate credits and permission of instructor. Project is chosen and completed under the guidance of a graduate faculty member, and will result in an acceptable master's thesis and oral defense. (On demand)

BINF 7999. Master's Degree Graduate Residency Credit. (1) (Fall, Spring, Summer)

BINF 8010. Topics in Bioinformatics. (3) Prerequisite: permission of department. Topics in bioinformatics and genomics selected to supplement the regular course offerings. A student may register for multiple sections of the course with different topics in the same semester or in different semesters. (On demand)

BINF 8100. Biological Basis of Bioinformatics.- (3) Prerequisites: Admission to graduate standing in Bioinformatics and undergraduate training in Computer Science or other non-biological discipline. This course provides a foundation in molecular genetics and cell biology focusing on foundation topics for graduate training in bioinformatics and genomics. (Fall)

BINF 8101. Energy and Interaction in Biological Modeling. (3) Cross listed as ITSC 8101.- (3) Prerequisites: Admission to graduate standing in Bioinformatics. ~~Covering: (a) This course covers: (i.) the major organic and inorganic chemical features of biological macromolecules; (b)ii.) the physical forces that shape biological molecules, assemblies and cells; (c)iii.) the chemical driving forces that govern living systems; (d)iv.) the molecular roles of biological macromolecules and common metabolites; (e)v.) and the pathways of energy generation and storage.~~ Each section of the course builds upon the relevant principles in biology and chemistry to explain the most common mathematical and physical abstractions used in modeling in the relevant context. (Spring)

BINF 8111. Bioinformatics Programming I. (3) Prerequisite:- Admission to graduate standing in Bioinformatics. ~~Introduction of or permission of instructor. Introduces~~ fundamentals of programming for bioinformatics using a high-level object-oriented language such as ~~pythonJava or Python.~~ The ~~first weeks cover core data types, syntax, and functional~~ course introduces object-oriented programming, focusing on construction ~~analysis~~ of programs from small, testable parts. ~~algorithms and fundamental sequence alignment methods.~~ Students will learn productive use of the Unix environment, focusing on Unix utilities that are particularly useful in bioinformatics. ~~Object-oriented programming, analysis of algorithms and sequence alignment methods, and computational environments that are particularly useful in bioinformatics analyses such as R, BioPython, and Web services in bioinformatics. By the end of~~

Formatted: Justified

Formatted: Font: Not Italic

Formatted: Font: Bold

Formatted: Font color: Auto

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Font color: Auto

Formatted: Font: Bold, Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font: 10 pt, Bold

Formatted: Font: 10 pt, Italic

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

~~the course, students will have gained the ability to analyze data within the python interpreter (for example) and write well documented, well organized programs. (Fall)~~

~~**BINF 8112. Bioinformatics Programming II. (3)** Prerequisite: BINF 8111 ~~or permission of instructor.~~ Continuation of BINF 6111. In this second semester of BINF 8111. Students will practice and refine skills learned in the first semester. New topics introduced will include: (a) programming as part of a team, using sequence analysis algorithms in realistic settings; (b) writing maintainable and re-usable code; ~~Web programming;~~ and (c) graphical user interface development. At the end of the semester, students will be able to evaluate and deploy computer languages, tools, and software engineering techniques in bioinformatics research. (Spring)~~

~~**BINF 8151. Professional Communications. (1)** Cross-listed as GRAD 8151. This course covers: Principles and useful techniques for effective oral presentations, poster presentations, scientific writing, use of references and avoiding plagiarism. Students in the class will critique and help revise each other's presentations and learn how to avoid common pitfalls. In addition, students will learn how to properly organize and run a meeting. Students will prepare a CV, job application letter, and job talk. (Fall)~~

~~**BINF 8171. Business of Biotechnology. (3)** Introduces students to the field of biotechnology and how biotech businesses are created and managed. Students should be able to define biotechnology and understand the difference between a biotech company and a pharmaceutical company. Additional concepts covered include platform technology, biotechnology's history, biotechnology products and development processes, current technologies used by biotech companies today, biotechnology business fundamentals, research and development within biotech companies, exit strategies, and careers in the biotech field. (Summer)~~

~~**BINF 8200. Statistics for Bioinformatics. (3)** This course aims to introduce statistical methods commonly used in bioinformatics. Basic concepts from probability, stochastic processes, information theory, and other statistical methods will be introduced and illustrated by examples from molecular biology, genomics, and population genetics with an outline of algorithms and software. R is introduced as the programming language for homework. (Fall)~~

~~**BINF 8201. Molecular Sequence Analysis. (3)** Prerequisite: BINF 8100 or equivalent. BINF 8100 or equivalent. Introduction to: (a) bioinformatics methods that apply to molecular sequence; (b) Intro to biological databases online; (c) sequence. Sequence databases, molecular sequence data formats, sequence data preparation and database submission; and (d) local. Local and global sequence alignment, multiple alignment, alignment scoring and alignment algorithms for protein and nucleic acids, genefinding and feature finding in sequence; models of molecular evolution, phylogenetic analysis, and comparative modeling. (Fall)~~

~~**BINF 8202. Computational Structural Biology. (3)** Prerequisites: Prerequisite: BINF 8101 and BINF 8201 or equivalents. This course covers: (a) the fundamental concepts of structural biology (chemical building blocks, structure, superstructure, folding, etc.); (b) structural databases and software for structure visualization; (c) structure determination and quality assessment; (d) protein structure comparison and the hierarchical nature of biomacromolecular structure classification; (e) protein structure prediction and assessment; and (f) sequence- and structure-based functional site prediction. (Fall)~~

Formatted ... [1]

Formatted: Font: 10 pt

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Font color: Auto

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted ... [2]

Formatted: Font: 10 pt

Formatted ... [3]

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Font: 10 pt

Formatted ... [4]

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Font: 10 pt

Formatted: Font color: Auto

Formatted ... [5]

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Font: 10 pt

Formatted: Font color: Auto

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted ... [6]

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Font: 10 pt

BINF 8203. Genomics. (3) Prerequisite: BINF 8100 or equivalent. Surveys the application of high-throughput molecular biology and analytical biochemistry methods, and data interpretation for those kinds of high volume biological data most commonly encountered by bioinformaticians. The relationship between significant biological questions, modern genomics technology methods, and the bioinformatics solutions that enable interpretation of complex data is emphasized. Topics include: ~~(a)~~ genome sequencing and assembly, annotation, and comparison; ~~(b)~~ genome evolution and individual variation; ~~(c)~~ function prediction; ~~(d)~~ gene ontologies; ~~(e)~~ transcription assay design, data acquisition, and data analysis; ~~(f)~~ proteomics methods; ~~(g)~~ methods for identification of molecular interactions; and ~~(h)~~ metabolic databases, pathways and ~~models~~ databases and their role in genome analysis. (Spring)

Formatted: Font color: Auto

Formatted

... [7]

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

BINF 8204. Mathematical Systems Biology. (3) Prerequisites: BINF 8200 and BINF 8210 or equivalents. ~~Introduces~~ This course introduces basic concepts, principles and common methods used in systems biology. ~~Emphasizes~~ The class emphasizes on molecular networks, models and applications, and covers the following topics: ~~(a)~~ the structure of molecular networks; network motifs, their system properties and the roles they play in biological processes; ~~(b)~~ complexity and robustness of molecular networks; ~~(c)~~ hierarchy and modularity of molecular interaction networks; kinetic proofreading; ~~(d)~~ optimal gene circuit design; and ~~(e)~~ the rules for gene regulation. (Spring)

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Font: 10 pt

Formatted: Font color: Auto

Formatted

... [8]

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

BINF 8205. Computational Molecular Evolution. (3) ~~Cross-listed as ITSC 8205.~~ Prerequisites: BINF 8200 Pre-requisites: BINF 8201 (Molecular Sequence Analysis) and BINF 8201, 8200 Statistics for Bioinformatics (or permission of the instructor. ~~Major~~). This course will cover major aspects of molecular evolution and phylogenetics with an emphasis on the modeling and computational aspects of the fields. Topics will include: models of nucleotide substitution, models of amino acid and codon substitution, phylogenetic reconstruction, maximum likelihood methods, Bayesian methods, comparison of phylogenetic methods and tests on trees, neutral and adaptive evolution and simulating molecular evolution. Students will obtain an in-depth knowledge of the various models of evolutionary processes, a conceptual understanding of the methods associated with phylogenetic reconstruction and testing of those methods and develop an ability to take a data-set and address fundamental questions with respect to genome evolution. (On demand)

Formatted: Font: 10 pt

Formatted

... [9]

BINF 8210. Numerical Methods and Machine Learning in Bioinformatics. (3) Prerequisite Prerequisites: Ability to program in a high-level language (Perl, Java, C#, Python, Ruby, C/C++), Calculus. ~~Focuses~~ This course focuses on commonly used numerical methods and machine learning techniques. Topics will include: solutions to linear systems, curve fitting, numerical differentiation and integration, PCA, SVD, ICA, SVM, PLS. Time permitting, hidden markov chains and Monte Carlo simulations will be covered as well. Students will learn both the underlying theory and how to apply the theory to solve problems. (Fall)

Formatted: Font: 10 pt

Formatted

... [10]

BINF 8211. Design and Implementation of Bioinformatics Databases. (3) ~~Students~~ In this course students will acquire skills needed to access and utilize public biomedical data repositories, and ~~are~~ will be expected to design, instantiate, populate, query and maintain a personal database to support research in an assigned domain of bioinformatics. The course content includes common data models and representation styles, use of open-source relational DBMS, and basic and advanced SQL. ~~Focuses~~ The course focuses on how data integration is achieved, including the use of standardized schemas, exchange formats and ontologies. ~~Examination of~~ We will examine large public biomedical data repositories such as GenBank and

Formatted: Font: 10 pt

Formatted

... [11]

PDB, learn how to locate and assess the quality of data in Web-accessible databases, and look at representation, standards and access methods for such databases. *(Spring)*

BINF 8310. Advanced Statistics for Genomics. (3) Prerequisite: BINF 8200 or equivalent. The first half of this course emphasizes canonical linear statistics (t-test, ANOVA, PCA) and their non-parametric equivalents. The second half of the course emphasized Bayesian statistics and the application of Hidden Markov Models to problems in bioinformatics. Students should have fluency in a high-level programming language (PERL, Java, C# or equivalent) and will be expected in assignments to manipulate and analyze large public data sets. Utilization of The course will utilize the R statistical package with the bioconductor extension. *(Spring)*

BINF 8311. Biophysical Modeling. (3) This course covers: (a) an overview of mechanical force fields; (b) energy minimization; (c) dynamics simulations (molecular and coarse-grained); (d) Monte-Carlo methods; (e) systematic conformational analysis (grid searches); (f) classical representations of electrostatics (Poisson-Boltzmann, Generalized Born and Coulombic); (g) free energy decomposition schemes; and (h) hybrid quantum/classical (QM/MM) methods. *(On demand)*

BINF 8312. Computational Comparative Genomics. (3) Prerequisite: BINF 8201 or ~~ITSC 8201~~ or equivalent. Introduces This course introduces computational methods for comparative genomics analyses. The course covers the following topics: ~~(a)~~ the architecture of prokaryotic and eukaryotic genomes; ~~(b)~~ the evolutionary concept in genomics; ~~(c)~~ databases and resources for comparative genomics; ~~(d)~~ principles and methods for sequence analysis; evolution of genomes; ~~(e)~~ comparative gene function annotation; ~~(f)~~ evolution of the central metabolic pathways and regulatory networks; genomes and the protein universe; ~~(g)~~ cis-regulatory binding site prediction; ~~(h)~~ operon and regulon predictions in prokaryotes; ~~and~~ ~~(i)~~ regulatory network mapping and prediction. *(On demand)*

BINF 8313. Structure, Function, and Modeling of Nucleic Acids. (3) Prerequisite: BINF 8100-8101 or equivalent. The course covers the following topics: ~~(a)~~ atomic structure, macromolecular structure-forming tendencies and dynamics of nucleic acids; ~~(b)~~ identification of genes which code for functional nucleic acid molecules, cellular roles and metabolism of nucleic acids; 2D and 3D abstractions of nucleic acid macromolecules and methods for structural modeling and prediction; ~~(c)~~ modeling of hybridization kinetics and equilibria; ~~and~~ ~~(d)~~ hybridization-based molecular biology protocols, detection methods and molecular genetic methods, and the role of modeling in designing these experiments and predicting their outcome. *(On demand)*

BINF 8318. Computational Proteomics and Metabolomics. (3) Prerequisites: BINF 8200 or equivalent. The aim of this 3-credit course is to introduce commonly used computational algorithms and software tools for analyzing mass spectrometry-based proteomics and metabolomics data. Chromatography and mass spectrometry will be covered at the beginning of the course to provide background information for the students to understand the nature of mass spectrometry data. *(On demand)*

BINF 8350. Biotechnology and Genomics Laboratory. (3) Prerequisite: none. This course teaches basic wet-lab techniques commonly used in biotechnology to generate genomics data. Lectures will cover methods for sample isolation, cell disruption, nucleic acid and protein purification, nucleic acid amplification, protein isolation and characterization, molecular labeling

Formatted ... [12]

Formatted: Indent: Left: 0.56", Keep with next, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Font: 10 pt

Formatted: Font color: Auto

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted ... [13]

Formatted: Font: 10 pt

Formatted ... [14]

Formatted: Font: 10 pt

Formatted ... [15]

Formatted: Font: 10 pt

Formatted ... [16]

Formatted: Font: 10 pt, Italic

Formatted: Justified, No widow/orphan control

Formatted ... [17]

methods and commonly used platforms for characterizing genome-wide molecular profiles. In particular, ~~students we~~ will discuss and learn to perform: tissue culture and LCM isolation of cells, DNA sequencing methods, DNA fingerprinting methods, RT-qPCR and microarrays of cDNA, 1D and 2D gels for protein separation, protein activity assays, and proteomics platforms. Lectures will describe emerging methodologies and platforms, and will discuss the ways in which the wet-lab techniques inform the design and use of bioinformatics tools, and how the tools carry out the processing and filtering that leads to reliable data. The course will also ~~discusses~~discuss the commercial products beginning to emerge from genomics platforms. *(Spring)*

BINF 8380. Advanced Bioinformatics Programming-III. (3) ~~Prerequisite: BINF 8112 or equivalent.~~ ~~Emphasizes~~ or permission of instructor. Advanced algorithms in bioinformatics with an emphasis placed on the implementation of bioinformatics algorithms in the context of parallel processing. Topics covered depend on instructor expertise and student interest, but may include assembly of short read fragments from next-generation sequencing platforms, clustering algorithms, machine learning, development of multi-threaded applications, developing for multi-core processors and utilization of large clusters and “cloud” supercomputers. Students are expected to complete a significant independent project. ~~(Fall)~~ *(On demand)*

BINF 8382. Accelerated Bioinformatics Programming. (3) ~~Prerequisite: BINF 8112 or equivalent~~ or permission of instructor. Computationally intensive algorithms in bioinformatics with an emphasis placed on the implementation of bioinformatics algorithms in the context of parallel processing using modern hardware processor accelerators such as GPUs and FPGAs. Topics covered depend on instructor expertise and student interest but may include multi-threaded applications and developing for multi-core processors and for large clusters and other “cloud” computers. Students will be expected to complete a significant independent project. *(On demand)*

BINF 8600. Seminar. (1) ~~Prerequisite:~~ Prerequisites: Admission to graduate standing in Bioinformatics. Departmental seminar. Cross-listed as BINF 6600. Weekly seminars will be given by bioinformatics researchers from within the university and across the world. This course may be repeated for credit. *(Fall, Spring)*

BINF 8601. Journal Club. (1) ~~Prerequisite:~~ Prerequisites: Admission to graduate standing in Bioinformatics. Each week, a student in the ~~course~~class is assigned to choose and present a paper from the primary bioinformatics literature. *(Fall, Spring)*

BINF 8911. Research Rotation I. (2), **BINF 8912 Research Rotation II (2).** Faculty supervised research experience in bioinformatics to supplement regular course offerings. *(Fall, Spring)*

BINF 8991. Doctoral Dissertation Research. (1-9) Individual investigation culminating in the preparation and presentation of a doctoral dissertation. A student may register for multiple sections of this course in the same semester or different semesters. *(Fall, Spring, Summer)*

BINF 9999. Doctoral Degree Graduate Residency Credit. (1) *(Fall, Spring, Summer)*

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font: 10 pt

Formatted: Font: Garamond-Bold, 10 pt, Italic

Formatted: Font: Bold, Font color: Auto

Formatted: Font: Bold, Font color: Auto

Formatted: Font: Bold, Font color: Auto

Formatted: Font color: Auto

Formatted: Font: Bold, 10 pt, Bold

Formatted: Font: 10 pt

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Justified, No widow/orphan control

Formatted: Font: Bold

Formatted: Font: Bold, Not Italic

Formatted: Font: 10 pt

Formatted: Font: 10 pt, Italic

Formatted: Justified, No widow/orphan control

Formatted: Font: 10 pt, Italic

Formatted: Font: 10 pt, Italic

Formatted: Justified, No widow/orphan control

Formatted: Font: Not Bold

Formatted: Font: 10 pt

Formatted: Justified, No widow/orphan control, Don't adjust space between Latin and Asian text, Don't adjust space between Asian text and numbers

Formatted: Font: Garamond, 10 pt

ECON 02-03-12 Establishment of an option within the Economics concentration of the MS Economics Degree

Summary and Catalog Copy

The purpose of the Economics Concentration is to provide students with the opportunity to acquire specialized skills related to their areas of interest and expertise. Two options are available in this concentration: (A.) the Quantitative Methods in Economics Option and (B.) the Individualized Study Option.

A. Quantitative Methods in Economics Option

The Quantitative Methods in Economics Option is designed for students who want to study quantitative methods in detail. It is an ideal option for those students interested in applying quantitative modeling and methods for economic analysis in their chosen field or pursuing an Economics Ph.D. after completion of the M.S. in Economics program. This option can be completed in one and a half years of study.

Students in this option must complete the core curriculum for the M.S. in Economics and the thesis or research project. In addition, they must complete:

ECON 6217: Advanced Microeconometrics

ECON 6219: Financial Econometrics

And two of the following:

ECON 6203: Financial Economic Theory

ECON 6206: Game Theory and Experiments

ECON 6235: Monetary and Financial Theory

ECON 6257: Applied Computational Economics

OR a combination of the above courses and approved electives that total 6 credit hours

B. Individualized Study Option

The Individualized Study Option is designed for students who wish to pursue a specialized course of study. This option can be completed in one full year of study if the student chooses the thesis option.

Students in this option must complete the core curriculum for the M.S. in Economics and the thesis or research project. In addition, they must complete 12 hours of electives chosen from the fields of macroeconomics and monetary policy, finance and banking, environmental economics, international trade and international finance, economic modeling and simulation, urban economics, public finance and cost/benefit analysis, or economic and business forecasting. The program also permits the development of individualized specializations in areas that are complementary to economic theory and analysis.

Proposed New Courses

ECON 6217. Advanced Microeconometrics (3) Prerequisites: ECON 6112 or ECON 6113. The focus is on underlying assumptions regarding the population, specification, estimation, and testing of microeconomic models. Students will become acquainted with a variety of extensions of conventional linear models for cross-sectional and panel data, including but not limited to the following: panel data models, instrumental variables models, and qualitative response models. (Annually)

ECON 6256. Public Economics. (3) Prerequisite: MATH 1241 (or equivalent) and permission of the program coordinator. Public economics is the study of the way governments choose spending, taxation, and regulatory policy; the ways such policies may affect economic welfare; and mechanisms to evaluate the economic effects of such policies. (Annually)

ECON 6257. Applied Computational Economics. (3) Prerequisites: ECON 6201 and ECON 6202 or permission of the program coordinator. This course introduces computational approaches for solving economic models. Topics include: interpolation and approximation techniques, numerical optimization, numerical solutions to systems of nonlinear equations, quadrature formulas for numerical integration, Monte Carlo simulation, and basic solution algorithms for economic dynamics. (On Demand)

ECON 6260. Economics of Health and Health Care. (3) Cross-listed as PPOL 8667 and HSRD 8004. Prerequisite: Admission to graduate program or permission of the instructor. This course will use economic theory and econometrics to analyze the functioning of the health care sector and appropriate public policy. Topics will include: how markets for medical care differ from other markets, the demand for medical care, the demand and supply of health insurance, the role of competition in medical markets, managed care, managed competition, and the role of the public sector in regulating and financing health care. The topic list is flexible and student input will be solicited and welcomed. (Alternate Fall)

MDSK 02-06-12 Creation of a New Interdisciplinary Minor: Urban Youth and Communities

Summary

An interdisciplinary group of faculty from the College of Education and the College of Liberal Arts and Sciences propose to add an interdisciplinary minor to the undergraduate curriculum: Urban Youth and Communities. The proposed Minor will require 15 hours of course work, including 2 new courses proposed here EDUC3200 (for Education majors only) and CUYC 3600(for all Majors). LBST 2215 will be a required course(for all Majors); and there will be 6 to 9 elective hours (6 if taking EDUC3200 and 9 otherwise), which will be selected from a menu of courses described in the attached Academic Program of Study. The Minor will accept 15 new students annually for the first 3 years, and subsequent growth will be determined by resources and demand.

Catalog Copy

The minor in Urban Youth and Communities is an interdisciplinary program focused on civic engagement and service learning designed to prepare UNC Charlotte students to become informed and engaged citizens by providing students an opportunity to be agents of change in their community. The minor is open to all majors who seek to explore the strengths, capabilities,

and issues of youth and communities in urban settings. Elective courses are concentrated in the areas of Urban Youth and Education, Communities, and Social Justice.

Admission and Program Requirements

No minimum GPA is required. No course pre-requisite is required for admission but some elective courses may have pre-requisites. In courses applied to the minor, students must maintain a GPA of 2.0 or higher.

The minor in Youth and Communities is open to all majors and can be declared at any time. The total required credits for this minor is 15, including two required courses for all students and an additional required course for Education majors. This minor will require a capstone project (CUYC 3600) completed after all other minor requirements have been completed or with enrollment in required courses simultaneously with enrollment in capstone course.

Required Courses:

All majors:

LBST 2215	Citizenship	3 hours
CUYC 3600	Community Engagement Capstone (Completed after all other requirements are met)	3 hours

Education majors only:

EDUC 3200	Service-Learning Teaching Methods for K-12 Educators	3 hours
-----------	--	---------

Electives:

6-9 elective hours are required. Six hours if taking EDUC 3200, required for Education majors, and 9 hours otherwise. One elective course (3 hours) must be chosen in each of the following areas: Urban Youth and Education, Communities, and Social Justice.

Urban Youth and Education (3 hours required from this area)

AFRS 2208	Education of African Americans
CHFD 2111	Child Study: Interpreting Children's Behavior
CJUS 2120	Juvenile Justice
EDUC 2100	Introduction to Education and Diversity in Schools
EDUC 3200	Service-Learning Teaching Methods for k-12 Educators
MDSK 2100	Diversity and Inclusion in Secondary Schools
PSYC 2120	Child Psychology
PSYC 2121	Adolescent Psychology
SOCY 4135	Sociology of Education

Communities (3 hours required from this area)

AFRS 2215	Black Families in the United States
AFRS 3280	Blacks in Urban America
ANTH 2125	Urban Anthropology
GEOG 2000	Social Inequality and Planning
GEOG 2200	Introduction to Urban Studies
GEOG 4220	Housing Policy
HIST 3281	American Cities
LTAM 1100	Introduction to Latin America

PSYC 3155 Community Psychology
RELS 3137 Religion in the African American Experience
SOCY 4124 Sociology of the Community

Social Justice (3 hours required from this area)

AFRS 3101 Perspectives on Race and Ethnicity in the US
ARSC 3480 Citizenship and Service Practicum
CJUS 3160 Domestic Violence
CJUS 4210 Gender, Race, and Justice
COMM 3136 Leadership, Service, and Ethics
HIST 3218 Racial Violence, Colonial Times to Present
PSYC 3806 Undergraduate Research Assistantship (summer only)
SOCY 3143 Social Movements
SOCY 4111 Social Inequality
SOCY 4125 Urban Sociology

SON 11-17-11 Revision of the Nurse Anesthesia Major and Post Masters Certificate in Nursing Anesthesia

Summary

The School of Nursing proposes to revise course descriptions and course objectives of the Nurse Anesthesia major and the Post Masters Certificate to reflect changes in the profession and to enhance focus on diversity, age, and genetics. This proposal applies to both MSN and Post Masters Certificate curricula since Post Masters Certificate students are required to complete the entire Nurse Anesthesia specialty courses (NUAN prefix) with the MSN students. Course objectives were modified to reflect advances in the field and an enhanced focus on diversity, age, and genetics.

Proposed Catalog Copy

NUAN 6151. Principles of Nurse Anesthesia I. (3) Co-requisite: ~~Prerequisite:~~ NUAN 6156. Overview of the principles, techniques and equipment necessary for the administration of anesthesia for the general surgical client. (*Fall; Day*)

NUAN 6152. Principles of Nurse Anesthesia II. (3) Prerequisite: NUAN 6151. ~~This course provides nurse anesthesia students with specific~~ ~~Specific~~ techniques of nurse anesthesia practice for selected clients. (*Spring; Day*)

NUAN 6153. Principles of Nurse Anesthesia III. (3) Prerequisite: NUAN 6152. Advanced nurse anesthesia practice for selected ~~patients.~~ ~~clients~~ (*Summer; Day*)

NUAN 6154. Pharmacology of ~~for~~ Non Anesthetic Agents. (4) Prerequisite: ~~NUAN 6156 or Permission of the department. Introduction to the pharmacology of anesthetic drugs and adjunctive agents, including general pharmacological principles, pharmacokinetics and pharmacodynamics.~~ An exploration of pharmacological concepts and clinical application of non-anesthetic drugs and adjunct agents commonly used in the anesthetic arena. (*Spring; Day*)

NUAN 6155. Pharmacology in Anesthetic Agents. (4) ~~Prerequisite: NUAN 6154. Co-requisite: Prerequisite: NUAN 6156~~ Continuation of Pharmacology I with emphasis on the clinical use of anesthetic agents and adjunctive drugs. ~~(Fall)~~ An exploration of the pharmacological concepts and clinical application of anesthetic drugs. *(Fall; Day)*

NUAN 6156. Applied Physics and Chemistry in Nurse Anesthesia. (3) Prerequisite: Admission to the major. ~~Permission of the department.~~ Basic laws and principles of physics, inorganic, organic, and biochemistry ~~chemistry and organic chemistry~~ as they apply to the clinical practice of nurse anesthesia. *(Fall; Day)*

NUAN 6157. Applied Pathophysiology in Nurse Anesthesia I. (3) Prerequisite: BIOL 6273. A study of basic concepts of the pathophysiologies of the nervous, respiratory, cardiac, renal, and endocrine systems with emphasis on their anesthetic implications. ~~Pathophysiology of the nervous and cardiovascular systems with emphasis on their anesthetic implications.~~ *(Spring; Day)*

NUAN 6158. Applied Pathophysiology in Nurse Anesthesia II. (3) Prerequisite: NUAN 6157. A study of advanced concepts of the pathophysiologies of the nervous, respiratory, cardiac, and hepatobiliary systems, emphasizing anesthetic implications and management. ~~Pathophysiology of the respiratory, endocrine, excretory and renal systems with emphasis on their anesthetic implications~~ *(Fall; Day)*

NUAN 6171. Professional Aspects of Nurse Anesthesia I. (1) Corequisites: NUAN 6153 and 6485. ~~Overview of the legal, ethical, and professional aspects regarding the practice of nurse anesthesia and information about the American Association of Nurse Anesthetists, including its history and Councils on Accreditation, Licensure, and Practice.~~ Overview of the professional aspects of nurse anesthesia practice including history of the profession and professional associations, legal aspects, risk management, and the professional role. *(Fall; Day)*

NUAN 6172. Professional Aspects of Nurse Anesthesia II. (1) Prerequisite: NUAN 6171. Corequisite: NUAN 6486. Overview of the professional aspects of nurse anesthesia practice including economic considerations, political challenges, evolving role in the health care system, administrative responsibilities, practice regulations, and ethical principles. ~~legal, ethical, and professional aspects regarding the practice of nurse anesthesia and information about the American Association of Nurse Anesthetists, including its history and Councils on Accreditation, Certification Licensure, and Practice.~~ *(Spring; Day)*

NUAN 6485. Clinical Residency in Nurse Anesthesia I. (5) Prerequisite: NUAN 6153 and satisfactory completion of Clinical Orientation. Clinical application of didactic material from the nurse anesthesia curriculum through beginning level practice in the role of a nurse anesthetist. Conferences during the clinical residency provide opportunities to review current research and practice issues. *Pass/Unsatisfactory* grading only. *(Fall; As Assigned)*

NUAN 6486. Clinical Residency in Nurse Anesthesia II. (5) Prerequisite: NUAN 6485. Continuation of the clinical application of didactic material from the nurse anesthesia curriculum with focus on utilization of additional anesthesia techniques and increased skills development. Conferences during the clinical residency provide opportunities to review current research and practice issues. *Pass/Unsatisfactory* grading only. *(Spring; As Assigned)*

NUAN 6487. Clinical Residency in Nurse Anesthesia III. (5) Prerequisite: NUAN 6486. Incorporation of the content of the nurse anesthesia curriculum with opportunities to begin synthesis of all didactic material and techniques for efficient clinical practice. [Conferences during the clinical residency provide opportunities to review current research and practice issues.](#) *Pass/Unsatisfactory* grading only. *(Summer; As Assigned)*

NUAN 6489. Clinical Residency in Nurse Anesthesia IV. (5) Prerequisite: NUAN 6487. ~~Non-credit clinical~~ **Final** residency for synthesis of all didactic material and techniques of nurse anesthesia clinical practice, promotion of professional practice, and preparation of the student for national certification ~~the licensure~~ examination. [Conferences during the clinical residency provide opportunities to review current research and practice issues.](#) *Pass/Unsatisfactory* grading only. *(Fall; As Assigned)*