George Mason University  
Graduate Course Approval/Inventory Form  

Please complete this form and attach a copy of the syllabus for new courses. Forward it as an email attachment to the Secretary of the Graduate Council. A printed copy of the form with signatures should be brought to the Graduate Council Meeting. Complete the Coordinator Form on page 2, if changes in this course will affect other units.

Please indicate:  

_X_ NEW  
____ MODIFY  
____ DELETE

Local Unit: Environmental Science & Policy  
Graduate Council Approval Date:

Course Abbreviation: EVPP  
Course Number: 681

Full Course Title: Introduction to Bioinformatics

Abbreviated Course Title (24 characters max.): INTRO TO BIOINFORMATICS

Credit hours: 3  
Program of Record: Environmental Science and Policy

Repeatable for Credit?  
_D=Yes, not within same term  
_T=Yes, within the same term  
_X=Cannot be repeated for credit

Up to hours

Activity Code (please indicate):  
_X_ Lecture (LEC)  
Lab (LAB)  
Recitation (RCT)  
Studio (STU)  
Internship (INT)  
Independent Study (IND)  
Seminar (SEM)

Catalog Credit Format  3 : 3 : 0  
Course Level: GF(500-600)  
GA(700+)

Maximum Enrollment: 20  
For NEW courses, first term to be offered: A course in molecular biology or permission of instructor.

Catalog Description (35 words or less):  
Overview of methods and tools in bioinformatics including: internet interfaces to sequence databases, methods for performing searches of biological databases, sequence alignment, phylogenetic analysis, other types of DNA sequence analysis, web-based tools and databases in structural biology.

For MODIFIED or DELETED courses as appropriate:

Last term offered:  
Previous Course Abbreviation:  
Previous number:

Description of modification:

APPROVAL SIGNATURES:

Submitted by:  
email:________________________

Department/Program:  
Date:________________________

College Committee:  
Date:________________________

Graduate Council Representative:  
Date:________________________
GEORGE MASON UNIVERSITY  
Course Coordination Form  

Approval from other units:  

Please list those units outside of your own who may be affected by this new, modified, or deleted course. Each of these units must approve this change prior to its being submitted to the Graduate Council for approval.

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<td>John J. Grefenstette</td>
<td>2/18/04</td>
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Graduate Council approval: ___________________________ Date: __________
Graduate Council representative: ___________________ Date: __________
Provost Office representative: ______________________ Date: __________
Introduction to Bioinformatics  
EVPP 681

Instructor:  
Patrick Gillevet  
Associate Professor  
Department of Environmental Sciences and Policy  
George Mason University, MSN 4D4  
Manassas, VA 20110  
703-993-1057  
pgilleve@gmu.edu

Office Hours: TBA

Course Coordinator: TBA

Description: An overview of methods and tools in Bioinformatics including: internet interfaces to sequence databases; methods for performing searches of biological databases; sequence alignment; phylogenetic analysis; other types of DNA sequence analysis; web-based tools and databases in structural biology.

Course Goals: Give students the necessary training to be able to conduct and understand research in bioinformatics and to apply these skills to their own research.

Textbook: Bioinformatics: Sequence and Genome Analysis,  
David W. Mount, Cold Spring Harbor Laboratory Press, 2001  
Other readings will be selected from the literature and on-line sources.

Credits: This course carries 3 credits.

Grading: There will be four homework assignments and a final project. Grades will be based on class interaction (10%) homework assignments (60%), and a Final project (30%). Class interaction will be measured by participation in class meetings and by participation in on-line discussions. The Final Project will consist of the implementation of interface to an analytical software tool.

Late Policy: There will be a 5% deduction for each day late that a homework assignment is submitted.

Honor Code: Students may discuss homework assignments with others, but you must turn in your own work.

Methods of Instruction: This course will be delivered in the form of lectures, computer lab sessions, and homework problem sets.

Prerequisites: While no computer programming skills are required, prior exposure to personal computers, email and the internet will be assumed. Molecular Environmental Biology I or equivalent is required.

Computer resources: You will need to have access to email and the web to access assignments. All of these resources are available to GMU students at PWI and elsewhere. You may also need to read WWW documents in *.pdf (Adobe Acrobat) format or *.ps (Postscript) format. Readers are available for free for Windows, Macintosh and many unix platforms at the Adobe website and Ghostscript/Univ. of Wisconsin CS Dept.
SCHEDULE

**Lecture 1: Introduction to BIOINFORMATICS**

- Define Bioinformatics
- Explain focus of course
- Historical Overview
- Overview of Molecular Biology
- Chapter 1 in Mount

**Lecture 2: Computational Environment**

- UNIX commands
- UNIX Scripts
- Web Resources

**Lecture 3: Overview of Databases**

- Sequence Databases
- Information Databases
- Chapter 2 in Mount

**Lecture 4: Pairwise Sequence Alignment I**

- Dot Plots
- Dynamic programming
- Scoring Matrices
- Assessing Significance
- Chapter 3 in Mount

**Lecture 5: Pairwise Sequence Alignment II**

- ClustalW
- Pileup
- Chapter 3 in Mount

*HOMEWORK I: Dot Plots and Pairwise Alignment*

**Lecture 6: Multiple Sequence Alignment I**

- Profile Analysis
- Blocks
- Chapter 4 in Mount
Lecture 7: Multiple Sequence Alignment II

- Hidden Markov Models
- Expectation Minimization
- Gibbs Sampler
- Scoring Matrices
- Evaluation of Methods
- Chapter 4 in Mount

HOMEWORK II: Multiple Sequence Alignment

Lecture 8: Prediction of Secondary Structure

- RNA Structures
- Chapter 5 in Mount

Lecture 9: Phylogenetic Trees I

- Overview
- Metrics
- Fitch-Margoliash
- Neighbor joining
- UPGMA
- Chapter 6 in Mount

Lecture 10: Phylogenetic Trees II

- Parsimony
- Maximum Likelihood
- Evaluation of Methods
- Chapter 6 in Mount

HOMEWORK III: Phylogenetic Analysis

Lecture 11: Searching Sequence Database

- Scoring Matrixes
- FASTA
- BLAST
- Chapter 7 in Mount

Lecture 12: Gene Prediction
Lecture 13: Protein Classification

- Primary Structure prediction
- Classification
- Chapter 9 in Mount

HOMEWORK IV: Protein and Gene Prediction

Lecture 14: Genome Analysis

- Genome Projects
- Chapter 10 in Mount

Final Project Due