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:  SCS  
Graduate Council Approval Date:  

Course Designation:  BINF  
Course Number:  751  

Full Course Title:  Biochemical and Cellular Systems Modeling  

Abbreviated Course Title (24 characters max.):  Cellular Systems Modeling

Credit hours:  3  
Program of Record:  Bioinformatics Ph.D.

Repeatable for Credit?  
___ D=Yes, not within same term  Up to hours  
___ T=Yes, within the same term  Up to  hours  
___ N=N=Cannot be repeated for credit

Activity Code:  
___ 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+) ___X___

Maximum Enrollment:  20  
For NEW courses, first term to be offered:  Fall 2005

Prerequisites:  Calculus and knowledge of a programming language, BINF 690 and 701, or Permission of Instructor. Knowledge of differential equations is helpful.

Catalog Description (35 words or less):  
Mathematical and computational methods for the analysis of cellular and subcellular processes. Topics may include: ion channels, whole cell models, intracellular signaling, biochemical oscillations, pathway modeling, parameter estimation and sensitivity analysis.

For MODIFIED or DELETED courses as appropriate:  
Last term offered:  Previous Course Abbreviation:  Previous number:

APPROVAL SIGNATURES:  
Submitted by:  ________________________________ email: ________________  
Department/Program:  ________________________________ Date: ________________  
College Committee:  ________________________________ Date: ________________  
Graduate Council Representative:  ________________________________ Date: ________________
### 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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Graduate Council approval: _______________________________ Date: __________
Graduate Council representative: __________________________ Date: __________
Provost Office representative: ____________________________ Date: __________
1. COURSE NUMBER AND TITLE:

BINF 751 – Cellular and Biochemical Systems Modeling

Prerequisites: Intermediate calculus and knowledge of a programming language, BINF 690 (Numerical Methods for Bioinformatics) and BINF 701 (Biochemical Systematics) or permission of instructor. Knowledge of differential equations is helpful.

Catalog Description: Mathematical and computational methods for the analysis of cellular and subcellular processes. Topics may include: ion channels, whole cell models, intracellular signaling, biochemical oscillations, pathway modeling, parameter estimation and sensitivity analysis.

2. COURSE JUSTIFICATION:

Course objectives: The student will learn concepts and techniques that will enable them study cellular and subcellular processes using computational and mathematical methods. They will learn to describe a cellular or subcellular process by mathematical equations and analysis this system using mathematical and computational methods in order to get insight into cellular function in normal and diseased organisms.

Course Necessity: There is no such course in SCS or in GMU addressing the cellular and biochemical systems modeling on the graduate level. This area lays the foundations for a very important area of bioinformatics and computational biology

Course Relationship to Exiting Programs: This course is currently offered (Fall 04, 05, 06) as BINF 739 Special Topics. It will be an elective course for students in the Ph.D. or the MS in Bioinformatics Programs. It will also serve students in the Neuroscience PhD program.

Course Relationship to Existing Courses: There is no similar course at GMU.

3. APPROVAL HISTORY: NA

4. SCHEDULING AND PROPOSED INSTRUCTORS:

Semester of Initial Offering: Fall 2005

Proposed instructors: Dr. M. Saleet Jafri

5. TENTATIVE SYLLABUS: See attached.

Course Description:
The student will learn concepts and techniques that will enable them study cellular and subcellular processes using computational and mathematical methods. They will learn to describe a cellular or subcellular process by mathematical equations and analysis this system using mathematical and computational methods in order to get insight into cellular function in normal and diseased organisms.

Prerequisites: Intermediate calculus and knowledge of a programming language, BINF 690 (Numerical Methods for Bioinformatics) and BINF 701 (Biochemical Systematics) or permission of instructor. Knowledge of differential equations is helpful.

Grading Policy:
Homework 60%
Final Project 40%

Homework assignments will be assigned several times during the semester. They will be due two weeks after they are assigned. Late homework will not be accepted. A final project will be assigned near the end of the semester.

Academic Honesty Policy: Academic dishonesty will not be tolerated. This includes cheating, plagiarism, and falsification of academic records. That being said, you can help each other out on the homework (this does not mean that you can copy each other's homework).

Course Schedule:

Week 1 – Voltage Gated Ion Channels
Week 2 – Transporters and Pumps
Week 3 – Fast and Slow Time Scales
Week 4 – Whole Cell Models
Week 5 – Intracellular Communication
Week 6 – Spatial Modeling
Week 7 – Modeling Calcium Waves and Sparks
Week 8 – Biochemical Oscillations
Week 9 – Cell Cycle Controls
Week 10 – Modeling the Stochastic Gating of Ion Channels
Week 11 – Biochemical Pathway Modeling
Week 12 – Metabolic Control Theory and S-Systems Analysis
Week 13 – Parameter Estimation and Sensitivity Analysis
Week 14 - Final Project Due