To: CEPC  
Metropolitan Campus  

From: J. Dougherty  
School of Natural Sciences  

Subject: Proposal for a new Concentration:  
MS in Chemistry with a Concentration in Informatics  

The School of Natural Sciences currently offers a MS in Chemistry with a Concentration in Pharmaceutical Science. Enrollment in this concentration reached its peak of 37 graduates in 2010; last semester there were 10 graduates. This decline in the number of students is attributed, in part, to a general decline in the pharmaceutical industry. An informal survey of recent graduates shows that more have been successful in obtaining jobs related to “informatics” than in pharmaceutical research. This is a little surprising since our current concentration does not specifically address this area.

With that in mind, attached is a proposal for a new MS in Chemistry with a Concentration in Informatics. This concentration is an interdisciplinary program including training in not only chemistry and biology but also applied statistics and computer science; students will complete graduate coursework in CHEM, BIOL, and MATH. Most of the required courses are already being offered on the Metro campus. One additional course, Pharmaceutical Discovery Informatics, will have to be added (CAF and syllabi attached).

Graduates of this concentration will be able to use information technology to improve productivity and success rates in pharmaceutical research. They will develop and evaluate new chemical research strategies by analyzing, or mining, large amounts of data available in drug discovery, public health, clinical research, and genomics databases. Since informatics is a rapidly evolving field with job opportunities in the pharmaceutical industry as well as in academic research, we believe that this concentration will attract a diverse group of students, both domestic and international.
MS in Chemistry, Concentration in Discovery Informatics  (new concentration)

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<tr>
<th>Chemistry Core Requirements (12 credits)</th>
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<tr>
<td>CHEM 6525  Physical Chemistry</td>
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<td>CHEM 7713  Structural Inorganic Chemistry</td>
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<td>CHEM 6673  Physical Organic Chemistry</td>
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<td>CHEM 6781  Biochemistry</td>
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<td>CHEM 7737  Chemical Analysis of Pharmaceuticals</td>
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<td>CHEM 6752  Drug Design and Discovery</td>
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<td>MATH 6737  Applied Statistics I</td>
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<tr>
<td>MATH 6729  Statistical Programming</td>
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<tr>
<td>BIOL 6743  Topics in Bioinformatics</td>
<td>3</td>
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<td>BIOL 6744  LAB: Topics in Bioinformatics</td>
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<td>CHEM 6751  Pharmaceutical Discovery Informatics</td>
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Total Credits 33
### Check Sheet

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**Total Credits**: 33
FAIRLEIGH DICKINSON UNIVERSITY
COURSE AUTHORIZATION FORM

PLEASE CHECK:  ☑ NEW COURSE PROPOSAL   ☐ REVISE COURSE   ☐ DELETE COURSE

COLLEGE: UC   DEPARTMENT/SCHOOL: SONS   CAMPUS: Florham/Metro Vancouver Wroxton

SECTION I: NEW COURSE PROPOSAL

PLEASE NOTE: For appropriate inclusion of this course it is important to complete all items in this section.

Subject Area/Proposed Catalog No.: CHEM 6751   Credit Hours: 3   Contact Hours (if different):
Course Title: Pharmaceutical Discovery Informatics   Effective Semester: Fall 2014   IPEOS Code: 40.0501
Catalog Description: This course introduces how information systems and computer technology interrelate to collect, manipulate, and disseminate data and information within the context of Pharmaceutical and Biotechnology industries. The course examines the concepts, techniques and methods used in the description and analysis of data and in statistical inference.

Prerequisite Course(s): None   Co-requisite Course(s): None
Lab Fee (If Applicable): ____________________ (If a new course, attach separate sheet justifying fee request.)
Course Format: Lecture   Lab   Gym   Web   Other
Course Level: Undergraduate   Developmental   Freshman   Sophomore   Junior   Senior
Graduate   Prerequisite   1st year   2nd year   3rd year   Doctoral

Restrictions: for example, Executive MBA only, Accelerated Nursing only, Educational Leadership only, Video Majors only.
Message: for example, Adult Learners, Need Web Account, Sophomore Standing, Department Chair Approval.
Please Specify ____________________________________________________________

Course Replacement: ________________________________________________________ (Please complete Section 3 if this is a replacement for an active course.)

Course Equivalencies:
College: ____________________  Catalog No.: ____________________  Title: ____________________
College: ____________________  Catalog No.: ____________________  Title: ____________________
College: ____________________  Catalog No.: ____________________  Title: ____________________

SECTION 2: COURSE REVISION

Catalog No.: ____________________  Course: ____________________  Title: ____________________
Please check revision(s):
Revision(s):

SECTION 3: COURSE INACTIVATION

Catalog No.: ____________________  Course Title: ____________________  Effective Semester: ____________________
APPROVALS:
Chairperson/Director: ____________________  Date: ____________________

CEPC Chairperson: ____________________  Date: ____________________  Dean: ____________________  Date: ____________________

---THIS SECTION TO BE COMPLETED BY ENROLLMENT SERVICES---
Catalog Description Reviewed: ____________________  Date: ____________________
Catalog Course Authorization Entered: ____________________  Date: ____________________
Distribution: Chairperson/Director  Dean  Enrollment Services
Course Description

This course introduces how information systems and computer technology interrelate to collect, manipulate, and disseminate data and information within the context of Pharmaceutical and Biotechnology industries. The course examines the concepts, techniques and methods used in the description and analysis of data and in statistical inference.

Prerequisite: None

Course Objectives

- To introduce students to the basic concepts and techniques of data structure and mining
- To develop skills of using recent data mining software for solving practical problems
- To gain experience of doing independent study and research in this field

Learning Outcomes

After completion of this course, students should be able to

1. Extract information from different types of bioinformatics or cheminformatic data (gene, protein, chemical, disease, clinical trials etc.), including their biological characteristics and relationships
2. Apply the different approaches used for data mining, integration and data management, including data warehouse and wrapper approaches
3. Analyze processed data with the support of analytical and visualization tools
4. Interact with other professionals, such as environmentalists, biomedical researchers, material scientists to better understand their informatics needs for improved support and service delivery
5. Design and develop informatics solutions by adapting existing tools, designing new ones or a combination of both.

Grading Policy

- Assignments and Attendance: 20%
- Class Exam 40%
- Class Project/Independent Studies 40%
Tentative Schedule

Week 1: Discovery Informatics (DI)
- What is DI?
- What are different components of DI?
- Importance of DI: both field and career level
- Introduction to Labinformatics, Cheminformatics and Bioinformatics

Week 2: Software Development for DI
- SDLC (Software Development Life Cycle) stages
- Different phases for development to deployment
- A chemist's/biologist's perspective on software development
- Overview of components for software used in DI

Week 3: Introduction to Databases
- Oracle databases: Chemistry, Biology and Clinical
- Database components
- Relational model
- Database language (SQL)

Week 4: Data Analysis (Chemistry & Biology) and Management
- Data Aggregation
- Data virtualization
- Data analysis
- Chemistry data integration and migration

Week 5: Lab Informatics and Automation
- Overview of Labinformatics
- Difference between clinical and preclinical labinformatics
- Introduction to lab automation and importance
- Informatics for lead evaluation and lead optimization

Week 6: ELN and LIMS
- What is Electronic Lab Notebook? Example and screenshot of working
- What is Laboratory Information Management System? Workflow and importance

Week 7: Midterm
- Project Assignment and Discussion

Week 8: Basic computer Skills in Chemistry
- SMILES
- 2D and 3D chemical structures in computer
- Chemical structure drawings
- Online library for chemistry structures

Week 9: Cheminformatics
- History
- Storage and retrieval of chemical database
- Virtual library
- Virtual screening
- QSAR
Week 10: Basic computer skills in Biotechnology
  • The Protein Data Bank
  • Visualization with Rasmol & Chime
  • Basic geometry
  • Structure/Function assignment
  • Structure prediction
  • Protein folding
  • Protein/Ligand docking
  • Molecular dynamics

Week 11: BioInformatics
  • History
  • DNA Sequencing and Databases
  • Protein data bank
  • Multiple sequence alignments
  • BLAST Algorithm
  • GENSCAN

Week 12: Quality Management and QA
  • QbD Quality by design
  • Enterprise quality management
  • Six Sigma
  • Quality analysis of DI

Week 13: Regulatory Requirements for DI
  • GxP and CGAMP
  • Lab compliance
  • CFR Part 11 and Validation
  • Clinical laboratory compliance

Week 14: Final Project submission and presentation

Week 15: Final Exam

Please Note:

• **Academic Integrity:**
  Cheating, in any form, will not be tolerated. Students caught cheating will receive a zero for that particular assignment. Details regarding FDU’s Academic Integrity policy are readily available on-line at [http://fduinfo.com/studentlife/handbook/](http://fduinfo.com/studentlife/handbook/)

• **Electronic Devices:**
  All electronic devices including cell phones, MP3 players, etc. should be turned off during lecture and exam periods.
FAIRLEIGH DICKINSON UNIVERSITY
PROGRAM AUTHORIZATION FORM (PAF)

☐ New Academic Program  ☑ Academic Program Suspension  ☐ Academic Program Deletion

[ ] New Initiative  [ ] Academic Program Suspension  [ ] Academic Program Deletion

I. ACADEMIC PROGRAM INFORMATION:

Title of Program: MS in Chemistry with a Concentration in Informatics

List special provisions, if any:

II. ACADEMIC LEVEL DETAILS  Undergraduate  ☑ Graduate  Effective Term: Fall 2014

Complete all applicable details. (Please include a copy of New Jersey Presidents Council approval if this is a new major.)

College: University College  Start Date: Fall 2014

Campus: Metro  End Date if Temporary:

Major: Chemistry

Degree to be Awarded: Master of Science in Chemistry

Specializations (list all options): Concentration in Discovery Informatics

CIP Code:  Number of credits required to complete the program: 33

Certificate Program (Complete this section only for Certificate Programs)

[ ] Non Credit  [ ] Credit Requirements  Number of credits required to complete the program:

Consortium Agreement:

[ ] Check if program includes a Consortium Agreement (Please attach Consortium Agreement)

III. BILLING INFORMATION:

Check if applicable:  ☑ New Student Fee  [ ] Utility Fee  [ ] Technology Fee

[ ] Medical Insurance  [ ] Lab Fee  [ ] Other

Fill in the amounts to be billed:

Flat Rate Fee:  Per Credit Fee:

Per Module Fee:  Other Fee:

Tuition Discount Amount or %, if applicable:

Initiator of Request:  Date:  Dean:

Signatures of Approval:

Provost  Date

Vice President, Finance

IV. MARKETING INFORMATION:

Vice President, Enrollment and Career Mgmt  Date

V. MIS DEPARTMENT, CODES ASSIGNED:

Degree  LOC

Major  Level

Minor  Division

CCDS  Department

Spec  Student Type

Academic Program  Sched Type

Director of MIS  Date

MIS: Forward completed copies to: Dean, Enrollment Services, Finance Department, Financial Aid, Admissions

Revised June 2012