

Announcement sent to SCC 10/10/05

409

PROCESS C

CURRICULUM PROPOSAL SCC #04-05-

NEW PROGRAMS - MAJOR PROGRAM REVISIONS - PROGRAM NAME CHANGES

Deadlines: October 9, 2004 to be implemented Fall 2005; February 11, 2005 to be implemented Spring 2006

PROPOSAL TITLE: Biological Engineering Specialization for the Chemical Engineering Curriculum

Sponsor's: Dr. Bruce White E-Mail: bruce.white@ru.edu Ext: 5338

DEPARTMENT: Chemical Engineering

COLLEGE: Engineering

If Liberal Arts & Sciences CHECK: History/Humanities Math/Sciences Social/Behavioral Sciences
 UNDERGRADUATE GRADUATE

THE ATTACHED NEW PROGRAM - MAJOR PROGRAM REVISION - PROGRAM NAME CHANGE IS BEST DESCRIBED BY THE ITEM(S) CHECKED

- New degree program
- Major changes (degree requirements/major/minor or certificate program)
- New Major
- Changes to College name, School, Department or Degree
- New Minor
- Qualification change
- New concentration, specialization, or track
- New Certificate of Graduate Study Program (COGS & COGA)

THE FOLLOWING SIGNATURES REPRESENT APPROVAL

Department Chair: Robert P. Hesbeth Date: 4/20/05

Department Curriculum Chair: Jan A. Murrell Date: 4/21/05

Academic Dean: Deanne Worland Date: 4/21/05

COLLEGE CURRICULUM COMMITTEE

CLOSED HEARING Date: 4/1/05 Approved Not Approved

COLLEGE CURRICULUM CHAIR: [Signature]

UNIVERSITY CURRICULUM COMMITTEE

OPEN HEARING Date: 5/5/05 Approved Not Approved

Senate Curriculum Chair Signature: [Signature] Date: Senate Announcement Date: 5/10/05

Comments: _____

EXECUTIVE VICE PRESIDENT/PROVOST Signature: Christy L. Hunt Date: 11/29/05

Approved Not Approved

REGISTRAR

Date: 1/31/06 Official Copy & Approval Sheet Filed

Date: _____ Course Description Received & Approved - Reg's Taxonomy & Course # _____

Course Description Received & Approved - Reg's Taxonomy & Course # _____

Registrar Signature: [Signature]

NOTIFICATION FORWARD

- SCC Chair
- Academic Dean
- Department Chair
- Registrar
- IR
- CAP
- VP Student Affairs
- VP Student Affairs
- Others

Tim 2/9/06

Bioengineering Specialization for the Chemical Engineering Curriculum

Sponsor: Dr. Brian Lefebvre and the chemical engineering faculty.

Details: The chemical engineering faculty proposes to create a new optional specialization for students graduating with B.S. degrees in chemical engineering, in biological engineering and one in materials.

A specialization is a cohesive set of courses that focus on a particular area within a major and requires at least 12 semester hours of credit. The proposed requirements to earn a specialization in biological engineering are as follows:

Course	Credits
Biological Systems and Applications 0401.210	4
Jr/Sr Clinic Bio-related project 0901.301, 302, 401 and 402	2 - 4
Electives – from approved list	4 - 6
TOTAL	12

The last page of this proposal is a summary of the current chemical engineering curriculum. Note that most students take Biological Systems and Applications in the fall of their sophomore year. Four years ago, chemical engineering students had the option of taking either Physics II or Biology I. This option was replaced with the new Biological Systems and Applications course in response to the growing national interest in biochemical engineering, described further in the rationale section. This course is prerequisite for all subsequent work towards a biological engineering specialization.

Junior/Senior Engineering Clinic is a required 2-credit course for students in all engineering disciplines. This course is a hallmark of the Rowan College of Engineering and provides undergraduate students with hands-on experience on practical engineering research and design problems, frequently in collaboration with local industrial sponsors. All engineering students are required to take four semesters (8 credits) of Junior/Senior Clinic. Students who wish to earn a specialization in biological engineering must select an approved Junior/Senior Clinic project for at least one of their four semesters. Note that students can also fulfill the project requirement through independent study on bio-related projects (Independent Study in Engineering 0901.391).

The chemical engineering faculty routinely supervise projects in the area of biological engineering as shown in the following table:

Semester	Number of Projects	# ChE students	# Out of Disc students
F04	5	13	3
F03	5	11	2
S03	8	18	8
F02	8	21	10
S02	3	7	8
F01	4	10	8
S01	4	11	10
F00	2	6	3

It is not unusual for a student to work on the same Junior/Senior Clinic project for all four semesters. However, because the department wishes to maintain a “depth and breadth” approach to the biological engineering specialization, a student will not be allowed to apply more than 4 credits worth of Junior/Senior Clinic to their specialization. Students must earn the balance of the 12 credits by taking any combination courses from the following list:

Approved list of electives – chemical engineering

- 0906.462	3	bioprocess engineering
- 0906.472	3	principles of biomedical processes
- 0906.476	3	principles of bioseparation processes
- 0906.482	3	principles of food engineering
- 0906.483	4	principles of engineering exercise physiology
- 0906.484	3	fundamentals of controlled release
- 0906.486	3	membrane processes
- 0906.490	3	approved special topics course

Approved list of electives – other engineering disciplines

- 0908.412	3	environmental treatment process principles
- 0909.404	3	principles of biomedical systems and devices

Approved list of electives with bio focus

- 0401.430	4	cell biology
- 0401.435	4	cell culture technology
- 0401.440	2	special topics in biological sciences
- 0411.405	4	environmental microbiology
- 0414.348	3	intro to biochemistry
- 0422.410	4	concepts in human genetics
- 0422.450	4	molecular genetics
- 1907.348	4	biochemistry
- 1907.410	3	medicinal chemistry
- 1908.305	4	biophysical chemistry

The current chemical engineering curriculum requires students to take two advanced chemical engineering electives and one advanced chemistry elective. Consequently, the biological engineering specialization is readily attainable under the current chemical engineering curriculum: it requires a focused selection of project work and electives but no “additional” courses.

Rationale:

The chemical engineering faculty is proposing two new specializations, one in biological engineering and one in materials. The proposed specializations require no changes to the existing chemical engineering curriculum (beyond the commitment to continue offering bio and materials electives regularly) and no new resources. Indeed, some recent chemical engineering graduates have met the requirements for the proposed specializations. This proposal simply provides a mechanism to give such students credit for their focused study in materials or bioengineering on their transcripts. Extending this opportunity to students is valuable to them because of growing industrial interest in these areas of chemical engineering.

In 1992, NIH defined “biomolecular engineering” as:

“Research at the interface of chemical engineering and biology
with an emphasis at the molecular level.”

Recent trends in chemical engineering research, the decisions of government agencies, and the opinions of leading academics were taken as the platform for the development of the bio-related specialization. Modern biology has emerged as an underlying fundamental science in chemical engineering.¹ Advances in biology are prompting new discoveries in the biotechnology, pharmaceutical, medical technology, and chemical industries. Developing commercial-scale processes based on these advances requires that new chemical engineers clearly understand the biochemical principles behind the technology, in addition to developing a firm grasp of chemical engineering principles.² Many jobs in the “Fast Company 25 Top Jobs for 2005” list are bio-related.³ Finally, New Jersey is a global and national leader in the biotechnology and pharmaceutical industries.^A

Instead of working at the “macro” scale, as traditional biochemical engineers have, there is a need for students to be able to work across scales – from the molecular level to the microscopic to the macroscopic. Traditional biochemical engineering focused on bioreactor design, agitation, and microbial cultures as a whole – macroscopic processes. Current and future applications will require students to be familiar with the molecular details of the product of interest, which help determine how to design and operate microscopic and macroscopic operations for production and purification. From the website of the school of chemical and biomolecular engineering at Cornell:

“Chemical engineers are taught formally to think across scales: from the molecular scale to the macroscopic scale, particularly in the presence of chemical change. No other discipline provides such emphasis on an integrated systems perspective across a wide range of scales. This unique educational component of chemical engineering provides chemical engineers a perspective that is well suited to attack problems of great interest in modern biology.”

From the website of the department of chemical and biomolecular engineering at the National University of Singapore:⁴

“The term “biomolecular” emphasizes the focus at the molecular level, either to manipulate or synthesize biological molecules with special functionalities or to relate the molecular-level properties to macroscopic and commercial aspects, a unique strength of chemical engineers. Biomolecular engineering will address the needs of bio/pharmaceutical and biomedical industries and will contribute to emerging areas such as systems biology, bioinformatics, genomics, etc.”

Results of Consultations:

We have consulted with the Chemistry and Biology departments and their letters are attached.

Footnotes and References

A In New Jersey: headquarters of 15 of the world's 20 largest pharmaceutical companies, 116 biotechnology companies (fourth largest in nation), 60,000 workers in the pharmaceutical industry (largest in nation), over \$12 billion in research & development expenditures, \$150 billion in sales from life science companies, and seven of the 17 new products approved by the FDA in 2002.^{5,6}

1 Varma, A. (2003). Future directions in che education: a new path to glory. Chem. Eng. Ed. 37, 284-289.

2 Lenhoff, A.M. (2003). A natural interaction: chemical engineering and molecular biophysics. AIChE J. 49, 806-812.

3 <http://biz.yahoo.com/special/bestjobs05.html>

4 <http://www.chee.nus.edu.sg/FAQs.html>

5 <http://www.locationnj.com/PDF/Biotech.pdf>

6 <http://www.locationnj.com/PDF/Pharmaceuticals.pdf>

CHEMICAL ENGINEERING DEGREE AUDIT - Class of 2008

Name:

SSN:

Indicate Grade for Rowan Course; Transfer Course/Off-campus = TR, Advanced Placement = AP

Indicate General Education courses = GenEd; History, Humanities, Language = HHL1, HHL2;

Social & Behavioral Sciences = SBS, Art, Music, Theatre, etc = ART;

Multicultural/Global = MG, Literature intensive = LIT, Senior Clinic II = Writing Intensive, WI

FIRST YEAR

FALL 2003

Composition I 1501.111
 Calculus I 1701.130
 Advanced College Chemistry I 1906.105
 Fresh. Engineering Clinic I 0901.101
 GE (World Reg Geo 2206.111 SBS/MG)

Total

SPRING 2004

3	<input type="text"/>	Calculus II 1701.131
4	<input type="text"/>	Computer Sci & Program. 0704.103
4	<input type="text"/>	Fresh. Engineering Clinic II 0901.102
2	<input type="text"/>	Physics I 1902.200
3	<input type="text"/>	GE (____)

16

Total

4	<input type="text"/>
4	<input type="text"/>
2	<input type="text"/>
4	<input type="text"/>
3	<input type="text"/>

17

SECOND YEAR

FALL 2004

Principles Chemical Processes I 0906.201
 Math for Engineering Anal I 1701.235
 Biological Systems & Apps 0401.210
 Advanced College Chemistry II 1906.106
 Soph. Engineering Clinic I 0901.201

Total

SPRING 2005

2	<input type="text"/>	Math for Engineering Anal II 1701.236
4	<input type="text"/>	Principles Chemical Processes II 0906.302
4	<input type="text"/>	Fluid Mechanics I 0901.341
4	<input type="text"/>	Soph. Engineering Clinic II 0901.202
4	<input type="text"/>	Organic Chemistry I 1907.200

18

Total

4	<input type="text"/>
2	<input type="text"/>
2	<input type="text"/>
4	<input type="text"/>
4	<input type="text"/>

16

THIRD YEAR

FALL 2005

Microeconomics 2204.102
 Process Fluid Transport 0906.309
 Transfer Processes I - Heat 0906.311
 Equilibrium Staged Oper- 0906.312
 Material Science 0901.281
 Physical Chemistry I 1908.400
 Junior Engineering Clinic I³ 0901.301

Total

SPRING 2006

3	<input type="text"/>	GE (____)
2	<input type="text"/>	Chem. Engineering Thermo. 0906.310
2	<input type="text"/>	Junior Engineering Clinic II ³ 0901.302
2	<input type="text"/>	Chemical Reaction Engineering 0906.316
3	<input type="text"/>	Separation Processes 0906.314
2	<input type="text"/>	

16

Total

3	<input type="text"/>
3	<input type="text"/>
2	<input type="text"/>
4	<input type="text"/>
4	<input type="text"/>

16

FOURTH YEAR

FALL 2006

Unit Operations Lab I 0906.403
 Transport Phenomena 0906.402
 Approved Chem. Eng. Elec. I² 0906.____
 Senior Engineering Clinic I³ 0901.401
 Chem. Process Component Design 0906.401
 Gen Ed (____)

Total

SPRING 2007

2	<input type="text"/>	Unit Operations Lab 0906.404
3	<input type="text"/>	Process Dynamics & Control 0906.405
3	<input type="text"/>	Approved Chem. Eng. Elec. II ² 0906.____
2	<input type="text"/>	Senior Engineering Clinic II ³ 0901.402
4	<input type="text"/>	Approved Chemistry Elective ¹
3	<input type="text"/>	Chemical Plant Design 0906.406

17

Total

2	<input type="text"/>
3	<input type="text"/>
3	<input type="text"/>
2	<input type="text"/>
3	<input type="text"/>
3	<input type="text"/>

16

TOTAL

132

Cumulative GPA

Notes:

ART
 LIT
 SBS
 HHL-1
 HHL-2
 M/G

5 February 2005

MEMO TO: Dept Chemical Engineering Curriculum Committee
From: Gregory Hecht, Interim Chairperson Biological Sciences

Re: Proposed Biological Engineering Specialization

I have shared your proposal entitled "Biological Engineering Specialization" with my Department. We are pleased to support the Specialization by allowing Chemical Engineering students to enroll in the following courses:

- Cell Biology
- Introduction to Biochemistry
- Concepts in Human Genetics
- Molecular Genetics
- Special Topics (WI)
- Environmental Microbiology
- Cell Culture Technology

For all of the above courses, we will allow Chemical Engineering students to enroll in the course by allowing them to use the course Biological Systems & Applications as a pre-requisite in lieu of Biology courses. The mechanism for this will be the Registrar's pre-requisite waiver form. We have used this mechanism successfully to enroll Chemical Engineering students into Human Genetics and Special Topics for the Spring '05 semester.

For Introduction to Biochemistry, students must still complete the additional Organic Chemistry II pre-requisite prior to enrollment.

For Cell Culture Technology, because the course enrollment is capped at only 8 students (the course is taught off-site by the Coriell Institute in Camden), Chemical Engineering students will need to go through the same petition process as our Biology majors prior to enrolling in the course.

Once again, we are pleased to support your proposed Specialization, and we look forward to seeing your students in our classes!



Department of Chemistry and Biochemistry

March 7, 2005

Curriculum Committee,

This letter is in response to the proposal 409 entitled Biological Engineering Specialization for Chemical Engineering Curriculum.

We would welcome Chemical Engineering students into our courses listed below provided they meet the prerequisites for those courses. It must also be recognized that some of these courses have strict enrollment limits since they are courses with a laboratory component. We only offer the Biophysical Chemistry course once a year and it is limited to an enrollment of 16. We have a similar limit on the Biochemistry course but we do offer it twice a year. If we discover the extra enrollment pressure requires us to add additional section then we reserve the right to ask for additional faculty lines.

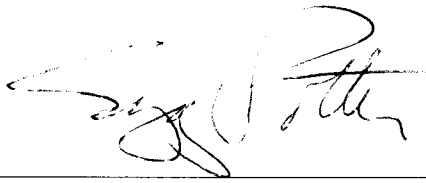
Biochemistry
Medicinal Chemistry
Biophysical Chemistry

Sincerely,

Robert Newland
Chair

Librarian remarks

Given the library's current book holdings and online journal access, this proposal can be supported.

A handwritten signature in black ink, appearing to read "Gregory C. Potter". The signature is written in a cursive style with a large, sweeping initial "G".

Gregory C. Potter
Library Liaison

March 29, 2005

Rowan University
Campbell Library

Library Resources Form

Department/School: College of Engineering/Chemical Engineering

Proposed by: Dr. Brian Lefebvre

Proposal Title: Biological Engineering Specialization for the Chemical Engineering Curriculum

See Appendix 5-4-07

Anticipated Date for Course/Program Offering: Fall 2006

Resources that should be acquired

No additional resources are needed at this time.

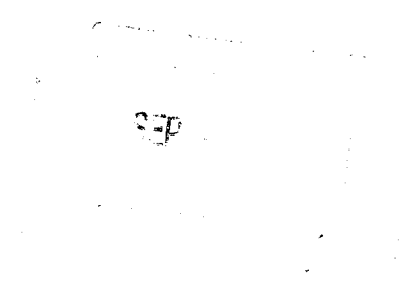
Resources available in Campbell Library

The library has basic holdings in the broad L.C. subject areas of Biological and Chemical Engineering. An engineering approval plan is utilized to provide current materials in the engineering disciplines.

List key periodical resources

Campbell Library is fortunate to have access to online journal databases in a large number of academic disciplines, including biology, chemistry and chemical engineering.

Of particular importance are the following journal subscription services: Applied Science and Technology, Biological and Agricultural Index, General Science Full-Text, and Elsevier Science Direct. More specifically related to engineering, the library subscribes to Engineering Village, the American Chemical Society Web Package and SciFinder Scholar. Also, MathSci + provides comprehensive coverage of international research in mathematics and mathematically related research in statistics, computer science, physics, operations research, engineering, biology, and related disciplines. Almost 2,000 journals are represented. Online journal subscriptions also are available in physics.



To: Brian LeFebvre, Chemical Engineering

From: Dianne Dorland, Dean of Engineering
Jay Harper, Dean of College of Liberal Arts and Sciences

Date: August 22, 2005

Re: Consultation on the Biological Engineering Specialization for the Chemical Engineering Curriculum

Thank you for your request for a consultation on the Biological Engineering Specialization for the Chemical Engineering Curriculum. We perceive that the specialization, utilizing existing courses, allows students' depth of knowledge with the area of biological engineering to be enhanced. The specialization avoids excessive additional course requirements in a curriculum that already requires 132 credits for degree completion. Biological Engineering is a model interdisciplinary research area between engineering and the sciences.

There are no resource implications for our Colleges inherent in this curriculum proposal. Biological Engineering is truly at the interface between engineering and biology.

Copy: Robert Hesketh, ChE Chair
Gregory Hecht, Biological Sciences chair

Sent to AIC
12/1/05

FORM B

ROWAN UNIVERSITY
BOARD OF TRUSTEES
ACADEMIC AFFAIRS SUBCOMMITTEE

Sharon C. ...
Robert ...
R

SCC Proposal # 04-05-409

Department/College: Engineering College
Chemical Engineering Department

Action Item: Biological Engineering Specialization for the Chemical Engineering Curriculum

Submitted by: Christy L. ...
(Provost)

Justification: The proposed specialization requires no changes to the existing chemical engineering curriculum but provides a mechanism to give students credit for focused study in bioengineering.

Approved: 11-22-05
(Date)

Signed: Ronald J. ...
(Committee Chair)

Notice of this action item will be announced at the full Board of Trustees meeting to be held on December 14, 2005 and will be forwarded to the Academic Issues Committee of the New Jersey Presidents' Council for notification.

	YES	DATE
AA/BOT	---	_____
FULL BOARD	---	_____
STATE	---	_____



November 30, 2005

Dr. Carlos Hernandez
Academic Issues Committee Chair
President, New Jersey City University
2039 Kennedy Blvd.
Jersey City, NJ 07305-1597

Dear Dr. Hernandez,

Rowan University is requesting a waiver to the new degree program review process in order to convert the existing specializations in the College of Communication into separate degree programs.

From: BA: Communication, Advertising Specialization
To: BA: Advertising

From: BA: Communication, Communication Studies Specialization
To: BA: Communication Studies

From: BA: Communication, Journalism Specialization
To: BA: Journalism

From: BA: Communication, Public Relations Specialization
To: BA: Public Relations

From: BA: Communication, Radio, Television & Film Specialization
To: BA: Radio, Television & Film

From: BA: Communication, Writing Arts Specialization
To: BA: Writing Arts

This is being presented to the Academic Issues Committee for approval. Twenty copies are enclosed.

The following two proposals are being presented to the Academic Issues Committee as informational items:

Materials Specialization for the Chemical Engineering Curriculum

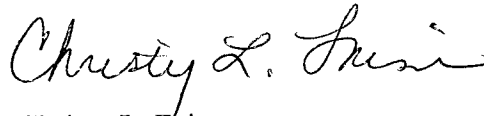
The proposed specialization requires no changes to the existing chemical engineering curriculum but provides a mechanism to give students credit for focused study in materials.

Biological Engineering Specialization for the Chemical Engineering Curriculum

The proposed specialization requires no changes to the existing chemical engineering curriculum but provides a mechanism to give students credit for focused study in bioengineering.

If you have any questions, please do not hesitate to contact me.

Sincerely,



Christy L. Faison,
Interim Provost

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Enclosures