ROWAN COLLEGE
CURRICULUM COMMITTEE

PROPOSAL TITLE: Biochemical Engineering

UNDERGRADUATE □ GRADUATE □ CREDIT HOURS □

SPONSOR(S): Stewart Slater and School of Engineering Curriculum Committee

DEPARTMENT & TELEPHONE#: Chemical Engineering 4631

CHECK ONE: □ COURSE □ MINOR PROGRAM □ CONCENTRATION □ SPECIALIZATION
□ ACHIEVEMENT CERTIFICATE □ CERTIFICATION PROGRAM □ MAJOR PROGRAM

STEP #1 (DEPARTMENT)
□ APPROVED/DATE:
□ NOT APPROVED/DATE:

□ DEPT. CURRICULUM CHR.

□ REVIEWED/DATE:

□ DEPT. CHR.

STEP #2 (RECEIPT)
SCC#: 05-96-136
DATE RECEIVED: 3-21-96

□ SENATE CURRICULUM CHR.

□ SCHOOL COMMITTEE CHR.

STEP #3 (SCHOOL)
□ REVIEWED DATE: 2-14-96
□ RECOMMEND TO APPROVE
□ RECOMMEND NOT TO APPROVE

FORWARD FOR OPEN HEARING

□ WITHOUT RESERVATIONS
□ WITH RESERVATIONS

COMMENTS:

STEP #4 (ACADEMIC DEAN)
□ RECOMMEND
□ NOT RECOMMEND
□ CONDITIONALLY RECOMMEND
(SEE COMMENTS)
DATE & SIGNATURE, DEAN OF SCHOOL:

STEP #5 (SENATE CURRICULUM COMMITTEE)
DATE OF OPEN HEARING

APPROVED BY SENATE CURRICULUM COMMITTEE (DATE)

□ RETURNED TO SPONSOR(S) FOR THE FOLLOWING REASONS:

□

STEP #6 (SENATE)
DATE PRESENTED TO SENATE □ APPROVED □ NOT APPROVED

NOTIFICATION TO EXECUTIVE VICE PRESIDENT/PROVOST (DATE)

SENATE CURRICULUM COMMITTEE CHAIR SIGNATURE/DATE
STEP #7 (EXECUTIVE VICE PRESIDENT/PROVOST)

DATE RECEIVED

APPROVED: \_ YES \_ NO

IF NO, REASONS ARE AS FOLLOWS:

STUDENT CREDIT HOURS 3

FACULTY LOAD HOURS 3

EQUALIZED CREDIT HOURS

OFFICIAL COPY & APPROVAL SHEET FILED (DATE) 5/24/94

SIGNATURE, EXECUTIVE VICE PRESIDENT/PROVOST

REGISTRAR

DATE APPROVED COURSE DESCRIPTION RECEIVED 5/30/94

HEGIS TAXONOMY AND COURSE NUMBER ASSIGNED 0966.510

DATE/SIGNATURE OF REGISTRAR B. J. KELLY

NOTIFICATION FORWARD:

\_ SENATE CURRICULUM COMMITTEE CHAIRPERSON

\_ DEPARTMENT CHAIRPERSON(S)

\_ ACADEMIC DEAN(S)

\_ REGISTRAR

\_ SPONSOR(S)
Course Proposal

1. Details:

a) Course Title: Biochemical Engineering
b) Sponsor: School of Engineering Curriculum Committee
   Dr. C. Stewart Slater, Chemical Engineering
c) Credit Hours: 3 credit hours
d) Course Level: Graduate
e) Curricular Effect: Technical Elective for Engineering Graduate students
f) Prerequisites: GraduateEngineering standingand approval of Grad. Advisor
g) Suggested Time/
   Scale of Implementation: Spring 1997
   1 section
h) Resources: Faculty will be hired and laboratory equipment obtained
   consistent with Engineering School multi-year budget.
   Library acquisitions will be required.

2. Rationale:

   The proposed course is a graduate elective in the School of Engineering and is consistent
   with the establishment of the School of Engineering approved by the Board of Trustees in February
   1995.

   The course will address the process aspects of biotechnology - one of the most widely
   recognized emerging multidisciplinary fields for the 21st century. Bioprocess engineering principles
   are critical in the research and development of new drug production, health care devices,
   bioremediation of hazardous waste, and specialty chemical/biochemical production. This course
   will allow chemical engineering students to broaden their career options.

3. Essence of the Course:

   a) Objectives:

   Upon completion of the course, students will be able to:

1. Understand the different fields of biotechnology.

2. Combine the essential aspects of biochemistry, microbiology, and genetics with
   engineering principles.

3. Understand how to mathematically model bioprocesses.

4. Perform design and scale-up calculations on bioreactors.
5. Select the proper purification and recovery process and design a series of processes.

6. Work in groups to solve open-ended design problems.

7. Collect and analyze laboratory data using experimental systems such as fermenters and microfiltration units.

b) Topical Outline:

The topics to be covered are listed below. The instructor will supply the students with a syllabus during the first week of classes. The instructor will assess any technology advances in the subject matter prior to the course and make topic changes as deemed appropriate to maintain the level and currency of instruction.

Introduction
   Biotechnology and biochemical engineering
   Interface between science and engineering

Overview of biotechnology basics necessary for processing
   Cells and microbial diversity
   Enzyme kinetics
   Cell function
   Metabolic pathways

Cell growth and product formation
   Batch growth and kinetics
   Continuous culture growth
   Stoichiometry of microbial growth and product formation

Process considerations for bioreactors for suspensions and immobilized cultures
   Batch and continuous reactors
   Immobilized cell systems
   Solid-state fermentations

Selection, scale-up, and control of bioreactors
   Scale-up difficulties
   Bioreactor instrumentation and control
   Sterilizing process fluids

Separation of insoluble products
   Filtration/microfiltration
   Centrifugation
   Cell disruption
Isolation/purification of soluble products
    Extraction
    Adsorption
    Chromatography
    Precipitation

Finishing steps for purification
    Crystallization
    Drying

Ancillary process operations
    Water quality
    Solvent recovery
    Waste disposal

Laboratory experiments and demonstrations will be integrated throughout the course.

c) Evaluation and Grading Procedure of Students:

Student grades will be based on examinations, homework and a required project. A course syllabus with a stated method of arriving the final grade, e.g., number of exams, projects, homework, percentage of grade, will be distributed to students the first week of classes.

d) Course Evaluation:

The proposed course will be evaluated on the basis of student evaluations and curriculum review by appropriate faculty.

4. Results of Consultations:

Consultations have been made with Chemistry faculty in the Department of Chemistry and Physics who have provided a letter of support.
Catalog Description

The fundamentals and engineering of bioprocess engineering with emphasis on applying biotechnology to industrial processes. Essential aspects of biochemistry, microbiology and kinetics. Discussion of bioreactor engineering, and recovery and purification processes. Processing applications of engineering kinetics and enzyme technology. Laboratory experiments and demonstrations will be integrated throughout the course.

(Prerequisite: Graduate standing)
To: Curriculum Committee
From: Robert Newland, Chairperson
Subject: Chemical Engineering Technical Electives
Date: February 15, 1996

I have examined the course proposals listed below and find them in accord with the previously submitted curriculum plan. I also have noted where courses require chemistry and/or physics prerequisites and am convinced there are no additional resources required to meet this demand for our courses. We fully support these proposals.

Electrochemical Engineering
Environmental Regulations in Technology Industries
Environmental Considerations in Process Design
Process Safety
Membrane Process Technology
Advanced Separation Technology
Process Heat Transfer
Fluid Flow in Processing and Manufacturing
Advanced Reactor Design
Bioprocess Engineering
Transport Phenomena