CURRICULUM PROPOSAL FORM

PROPOSAL NUMBER: 99-448

*DEADLINES:

PROPOSAL TITLE: Bioseparation Processes
SPONSOR/S: C. Stewart Slater and Chemical Engineering Curriculum Committee
DEPARTMENT: Chemical Engineering

CHECK ALL THAT APPLY:
___ UNDERGRADUATE  X GRADUATE

COLLEGE: Engineering
If LAS:
___ History/Humanities
___ Math/Sciences
___ Social/Behavioral Sciences

*********

TYPE OF PROPOSAL: (Check ALL that Apply)
___ General Education
___ New Course in _________ Bank
___ Existing course, Add To _________ Bank
___ Multicultural/Global Designation
___ Writing Intensive Designation
___ New Minor/Concentration/Specialization
___ New Major/Degree Program
___ Short Term Course Proposal
___ New Course (NOT Gen. Ed.)
___ Name Change (Dept., School, Major)
___ Changes in Degree Requirements
___ Changes Involve Gen. Ed. requirements
___ Minor Changes to Existing Courses
___ Course is NOT General Education
___ Course IS General Education

DEPARTMENT
(SIGNATURE INDICATES APPROVAL)

Robert L. Helkath 12/1/98
DEPT. CURRICULUM CHAIR / DATE

DEPT. CHAIRPERSON / DATE

COLLEGE CURRICULUM COMMITTEE
DATE OF OPEN HEARING (if necessary) 2/19/99
X APPROVED
___ NOT APPROVED

Comments:

Robert L. Helkoth 2/19/99
SIGNATURE DATE

ACADEMIC DEAN (& GRADUATE DEAN, for New Graduate Programs Only)

X APPROVED
___ NOT APPROVED

Comments:

Signature (Academic Dean) 12/2/98
SIGNATURE DATE

Signature (Graduate Dean) DATE
UNIVERSITY CURRICULUM COMMITTEE

DATE OF OPEN HEARING (if necessary) 2/1/99 (College Board only)

APPROVED
— NOT APPROVED

COMMENTS:

[Signature] 2/1/99

SIGNATURE DATE

SENATE

Date announced at Senate 2/13/99

Voted upon at Senate: Approved Not Approved Date:

EXECUTIVE VICE PRESIDENT/PROVOST

— Approved

— Not Approved If no, reasons are as follows:

STUDENT CREDIT HOURS FACULTY LOAD HOURS EQUALIZED CREDIT HOURS

OFFICIAL COPY & APPROVAL SHEET FILED (DATE):

DATE/SIGNATURE EXECUTIVE VICE PRESIDENT/PROVOST

REGISTRAR

DATE APPROVED COURSE DESCRIPTION RECEIVED

HEGIS TAXONOMY & COURSE NUMBER ASSIGNED CRN: 76

DATE/SIGNATURE OF REGISTRAR

NOTIFICATION FORWARD:

— SENATE CURRICULUM COMMITTEE CHAIRPERSON

— DEPARTMENT CHAIRPERSONS

— ACADEMIC DEAN(S)

— REGISTRAR

— SPONSOR(S)
Course Proposal

1. Details:

   a) Course Title: Bioseparation Processes (0906.576)
   b) Sponsor: Dr. C. Stewart Slater and
               Chemical Engineering Curriculum Committee
   c) Credit Hours: 3 credit hours
   d) Course Level: Graduate
   e) Curricular Effect: Technical Elective for chemical engineering majors
   f) Prerequisites: Graduate standing and approval of graduate advisor
   g) Suggested Time/ Scale of Implementation: Fall 1999
   h) Resources: Faculty will be hired consistent with the College of
                 Engineering multi-year budget. No computer software
                 beyond what is currently being acquired for approved
                 course will be necessary. Laboratory equipment will be
                 obtained consistent with the College of Engineering capital
                 budget. Library acquisitions will be required consistent
                 with current acquisition plan.

2. Rationale:

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

   The course will address the area of bioseparation process engineering that is important
   multidisciplinary topic relevant to many areas of engineering and science. The course will describe
   the basic principles of bioprocess separation unit operations and process systems and applications
   to downstream processing in the pharmaceutical and biotechnology industry.
3. **Essence of the Course:**

**a) Objectives:**

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

1. Understand the fundamentals of mass transfer, rate-controlled separations, physical separations, and thermodynamics as related to bioprocess separations.

2. Understand the critical physical, chemical and biological parameters in bioseparation process design.


4. Understand the role of unit processes in the removal of insolubles, isolation, product purification and polishing.

5. Understand bioseparation principles applied in commercial design case studies such as antibiotic production, enzyme production, citric acid manufacture, etc.

6. Use computer software to analyze bioseparation engineering problems.

7. Work in teams to solve open-ended design problems.

**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.

- Overview of bioseparations
  - Characteristics of bioseparations
  - Typical process schematics
- Filtration and Microfiltration
  - Equipment for conventional filtration
  - Pretreatment
  - Continuous rotary filters
  - Microfiltration
- Centrifugation
  - Settling of solids
  - Centrifuges
  - Scale-up of centrifugation

bioseparation processes GRAD 2
Cell disruption
    Chemical methods
    Mechanical disruption
Extraction
    Batch extraction
    Staged extraction
    Differential extraction
    Fractional extraction
Adsorption
    Batch adsorption
    Adsorption in fixed beds
Elution Chromatography
    Adsorbents
    Yield and purity
    Discrete stage analysis
    Kinetic Analysis
    Scale-up chromatography
Precipitation
    Precipitation with nonsolvents and salts
    Precipitation with temperature
    Large scale precipitation
Ultrafiltration and electrophoresis
    Ultrafiltration
    Electrophoresis
Crystallization
    Crystal size distribution
    Batch crystallization
Drying
    Drying theory and design considerations
    Drying equipment
    Conduction drying
Ancillary operations
    Water quality
    Solvent recovery
    Waste disposal
    Biosafety

c) Evaluation and Grading Procedure of Students:

Student grades will be based on examinations, homework and/or projects. A course syllabus with a stated method of arriving to 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:

bioseparation processes GRAD 3
The proposed course will be evaluated on the basis of student evaluations and curriculum review by appropriate faculty.

4. Results of Consultations:
The course is a technical elective for graduate chemical engineering students. The course does not impact any other program and therefore no consultations are required.
Catalog Description

Bioseparation Processes (0906.576)

Prerequisite: Graduate standing and approval of graduate advisor

This course will focus on the fundamental principles of bioseparation processes. The characteristics of bioseparations will be presented as applied to downstream processing in the pharmaceutical/ biotechnology and related industries. Theory and design of filtration, microfiltration, centrifugation, cell disruption, extraction, adsorption, chromatography, precipitation, ultrafiltration, crystallization, and drying will be presented as applied to biosystems. Commercial design considerations such as sanitary design/sterilization, water quality, solvent recovery, waste disposal and biosafety will be reviewed.
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