(2)

ROWAN COLLEGE
CURRICULUM COMMITTEE

ROPOSAL TITLE: CHEMICAL REACTION ENGINEERING *96-4/62

X UNDERGRADUATE ___ GRADUATE 3 CREDIT HOURS

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

DEPARTMENT & TELEPHONE# Chemical Engineering, x4631

CHECK ONE: X COURSE ___ MINOR PROGRAM ___ CONCENTRATION ___ SPECIALIZATION

___ ACHIEVEMENT CERTIFICATE ___ CERTIFICATION PROGRAM ___ MAJOR PROGRAM

STEP #1 (DEPARTMENT)

___ APPROVED/DATE:

___ NOT APPROVED/DATE:

DEPT. CURRICULUM CHR.

___ REVIEWED/DATE:

N/A
DEPT. CHR.

STEP #2 (RECEIPT)

SCC# 95-96-119

DATE RECEIVED: 2-21-96

SENATE CURRICULUM CHR.

STEP #3 (SCHOOL)

REVIEWED DATE:- 2-14-96

X RECOMMEND TO APPROVE

___ RECOMMEND NOT TO APPROVE

FORWARD FOR OPEN HEARING

X WITHOUT RESERVATIONS

___ WITH RESERVATIONS

COMMENTS:

SCHOOL COMMITTEE CHR.

STEP #4 (ACADEMIC DEAN)

✓ RECOMMEND

___ NOT RECOMMEND

___ CONDITIONALLY RECOMMEND (SEE COMMENTS)

COMMENTS:

DATE & SIGNATURE, DEAN OF SCHOOL 2/16/96

STEP #5 (SENATE CURRICULUM COMMITTEE)

DATE OF OPEN HEARING 9/23/96

APPROVED BY SENATE CURRICULUM COMMITTEE (DATE) 9/23/96

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

STEP #6 (SENATE)

DATE PRESENTED TO SENATE 9/25/96 ___ APPROVED ___ NOT APPROVED

NOTIFICATION TO EXECUTIVE VICE PRESIDENT/PROVOST (DATE) 9/30/96

SENATE CURRICULUM COMMITTEE CHAIR SIGNATURE/DATE 9/30/96

STEP #7 (EXECUTIVE VICE PRESIDENT/PROVOST)

DATE RECEIVED _____

APPROVED: ___YES ___NO

IF NO, REASONS ARE AS FOLLOWS:

STUDENT CREDIT HOURS _____

FACULTY LOAD HOURS _____

EQUALIZED CREDIT HOURS _____

OFFICIAL COPY & APPROVAL SHEET FILED (DATE) _____

SIGNATURE,EXECUTIVE VICE PRESIDENT/PROVOST_____

REGISTRAR

DATE APPROVED COURSE DESCRIPTION RECEIVED 14 Mar 97

HEGIS TAXONOMY AND COURSE NUMBER ASSIGNED 0906.402

DATE/SIGNATURE OF REGISTRAR B L Kelley

NOTIFICATION FORWARD:

___SENATE CURRICULUM COMMITTEE CHAIRPERSON

___DEPARTMENT CHAIRPERSON(S)

___ACADEMIC DEAN(S)

___REGISTRAR

___SPONSOR(S)

95-96 -119

\CURRIC4B.WPD\

Course Proposal

1. Details:

a) Course Title:	Chemical Reaction Engineering
b) Sponsor:	School of Engineering Curriculum Committee Dr. C. Stewart Slater, Chemical Engineering
c) Credit Hours:	3 credit hours
d) Course Level:	Senior (0906.402)
e) Curricular Effect:	Requirement for Chemical Engineering majors
f) Prerequisites:	Applied Chemical Thermodynamics, Transfer Processes I &II, Fluid Mechanics, Math for Engineering Analysis II
g) Suggested Time/ Scale of Implementation:	Fall 1999 1 section
h) Resources:	Faculty will be hired and laboratory equipment will be obtained consistent with Engineering School multi-year budget. Library acquisitions will be required.

2. Rationale:

The proposed course is part of the Engineering Curriculum Proposal approved by the College Senate in December 1994. The proposed course is consistent with the establishment of the School of Engineering approved by the Board of Trustees in February 1995.

The proposed course is a Chemical Engineering Program Criteria requirement of the Education and Accreditation committee (EAC) of the American Institute of Chemical Engineers (AIChE) for accreditation of the program by the Accreditation Board for Engineering and Technology (ABET). The course will advance the students knowledge in chemical kinetics beyond the basic principles learned in chemistry courses and apply the principles to the safe and economical design and operation of chemical reactors.

Reaction engineering represents one of the important areas of chemical processes. Reactions are necessary to carry out the conversion of raw materials into useful products either by chemical or biochemical means. Students in this course will understand how the basic chemical reaction equilibria learned in chemistry courses is applied on a larger scale for batch and continuous reactors. Various aspects of safety and accident prevention related to reactions will be described.

3. Essence of the Course:

a) Objectives:

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

1. Understand the basic principles of kinetics and how they are applied to reaction

engineering.

2. Determine the difference between batch and continuous flow reactors.

3. Perform scale-up and design calculations on isothermal batch and continuous reactors.

4. Use computer software to analyze reactor operation.

5. Design heterogeneous reactors and utilize catalysts effectively.

6. Perform design calculations on nonisothermal reactors and understand other nonideal behavior.

7. Collect and analyze rate data from a laboratory reaction experiment.

8. Work in groups 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.

- Introduction
  - Basic reaction theory
  - General mole balance
  - Classification of reactors
    - Batch
    - Continuous-flow: continuous-stirred tank and tubular
- Conversion and reactor sizing
  - Design equations - batch and flow systems
  - Reactors in series
- Rate laws and stoichiometry
  - Basic definitions; rate constants, reaction order, etc.
  - Stoichiometric table approach
  - Reactions with phase change
- Isothermal reactor design
  - Scale-up of liquid phase batch reactor to CSTR design
  - Tubular reactors
  - Pressure drop in reactors
  - Reversible reactions

Unsteady-state operation of reactors

Collection and analysis of rate data
- Batch reactor data
- Methodology; initial rates, half-lives, least squares
- Differential reactors
- Laboratory reactors and experimental design

Catalysis and catalytic reactors
- Catalysts
- Catalytic reactions
- Heterogeneous reactor design

Nonisothermal reactor design
- Energy balance
- Nonisothermal continuous-flow reactors at steady state
- Equilibrium conversion
- Unsteady-state operation

External diffusion effects on heterogeneous reactions
- Binary diffusion
- External resistance to mass transfer
- Parameter sensitivity

Diffusion and reaction in porous catalysts

Distributions and residence times for chemical reactors

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 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:

The proposed course is part of the Engineering Curriculum Proposal approved by the Faculty Senate in December 1994. Consultations were submitted with original proposal as specified by the Curriculum Committee. Consultations have been made with Chemistry faculty in the Department

of Chemistry and Physics who have provided a letter of support.

Catalog Description

Chemical Reaction Engineering (0906.402)

(Prerequisites: Fluid Mechanics, Transfer Processes I&II, Applied Chemical Thermodynamics, Math for Engineering Analysis II)

This course describes various topics related to homogeneous and heterogeneous reaction kinetics, idealized reactor models for batch and flow systems, corrections for non-ideal residence times and heat and mass transfer effects. An introduction will be made to homogeneous and heterogeneous catalytic processes and industrial catalytic reactors. Demonstrations and laboratory exercises will be integrated into the course.

Rowan College *of* New Jersey
Glassboro, NJ 08028-1701 • 609/256-4855

Department of Chemistry and Physics

To: Curriculum Committee
From: Robert Newland, Chairperson
Subject: Chemical Engineering Senior-level required courses
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 or the prerequisites require such courses and am convinced there are no additional resources required to meet this demand for our courses. We fully support these proposals.

Separation Processes
Process Dynamics and Control
Chemical Reaction Engineering
Chemical Plant Design