Fall 96

(2)

ROWAN COLLEGE
CURRICULUM COMMITTEE

ROPOSAL TITLE: Advanced Reactor Design

___UNDERGRADUATE X GRADUATE 3 CREDIT HOURS

SPONSOR(S): C. Stuart Sater and School of Engineering Curriculum Committee

DEPARTMENT & TELEPHONE# Chemical Engineering x453

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:

DEPT. CHR.

STEP #2 (RECEIPT)

SCC# 95-96-137

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)

COMMENTS:

✓ RECOMMEND

___NOT RECOMMEND

___CONDITIONALLY RECOMMEND (SEE COMMENTS)

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

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 4-24-96 X APPROVED ___NOT APPROVED

NOTIFICATION TO EXECUTIVE VICE PRESIDENT/PROVOST (DATE)

SENATE CURRICULUM COMMITTEE CHAIR SIGNATURE/DATE 5/3/96

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) 5/20/96

SIGNATURE, EXECUTIVE VICE PRESIDENT/PROVOST _____

REGISTRAR

DATE APPROVED COURSE DESCRIPTION RECEIVED 5/30/96

HEGIS TAXONOMY AND COURSE NUMBER ASSIGNED 0906.515

DATE/SIGNATURE OF REGISTRAR _____

NOTIFICATION FORWARD:

___SENATE CURRICULUM COMMITTEE CHAIRPERSON

___DEPARTMENT CHAIRPERSON(S)

___ACADEMIC DEAN(S)

___REGISTRAR

___SPONSOR(S)

\CURRIC6F.WPD\

Course Proposal

1. Details:

a) Course Title:	Advanced Reactor Design
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:	Graduate Engineering standing and approval of Grad. Advisor
g) Suggested Time/ Scale of Implementation:	Fall 1996 1 section
h) Resources:	Faculty will be hired 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 advanced engineering aspects of reactor design. The foundation provided by the required course Reaction Engineering will be expanded upon with more complex problems and industrial scenarios. The course will provide graduate students with the application of advanced mathematical techniques to novel reactor design thus enhancing their education beyond the required courses.

3. Essence of the Course:

a) Objectives:

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

1. Apply advanced concepts of kinetic to complex reactor design.

2. Determine models for heterogeneous catalytic processes.

3. Analyze physical/chemical characteristics of catalysts and their effect on transport and reaction.

4. Model and design multiphase reactors.

5. Use computer software to analyze complex reaction engineering problems.

6. 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.

Elements of reaction kinetics
- Review of basic principles
- Complex reactions
- Influence of temperature

Kinetics of heterogeneous catalytic reactions
- Adsorption on solid catalysts
- Rate equations
- Model discrimination and parameter estimation

Interfacial gradient effects and transport with reactions catalyzed by solids
- Reaction of a component of a fluid at a solid surface
- Mass and heat transfer resistances
- Concentration or partial pressure and temperature differences

Intraparticle gradient effects and transport with reactions catalyzed by solids
- Catalyst internal structure
- Pore diffusion
- Diffusion and reaction inside catalyst particle
- Complex reactions in the presence of diffusional limitations
- Nonisothermal particles

Noncatalytic gas-solid reactions
- General models for interfacial and intraparticle gradients
- Complex models

Catalyst deactivation
- Kinetics and catalyst poisoning
- Kinetics and catalyst deactivation by coking

Gas-liquid reactions
- Models for transfer at gas-liquid interface
- Two-film theory

Surface renewal theory
Experimental determination of the kinetics of gas-liquids reactions

Advanced analysis and design of chemical reactors
Mass, energy and momentum balances
Batch and semibatch reactor modeling
Plug flow reactor modeling
Perfectly mixed reactor modeling
Commercial development in the chemical industry

Fixed bed catalytic reactors
Fixed bed industrial catalytic process
Pseudohomogeneous models
Heterogeneous models
Industrial cases

Specialized cases
Fluidized bed and transport reactors
Multiphase flow reactors

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

Overview of chemical reaction types and ideal reactors. Catalysis and catalytic reactors; analogies for real reactors; fluid flow and heat and mass transfer effects on chemical reactions and reactor design; numerical analyses and simulation of reacting systems; applications in the chemical industry.

(Prerequisite: Graduate standing)

Rowan College *of* New Jersey
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Department of Chemistry and Physics

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