

ROWAN UNIVERSITY CURRICULUM PROPOSAL

(12)

PROPOSAL TITLE: Chemical Process Component Design (0906.314)

CHECK APPROPRIATE:  UNDERGRADUATE     GRADUATE    4 SEMESTER HOURS

SPONSOR(S): Dr. C. Stewart Slater and the Chemical Engineering Curriculum Committee

DEPARTMENT/TELEPHONE # Chemical Engineering X 4631

CHECK ONE:  COURSE     MINOR PROGRAM     CONCENTRATION     SPECIALIZATION

ACHIEVEMENT CERTIFICATE     CERTIFICATION PROGRAM     MAJOR PROGRAM

<p>Step #1 (Department)</p> <p><input checked="" type="checkbox"/> Approved (Date) <u>10-20-97</u></p> <p><input type="checkbox"/> Not Approved (Date)</p> <p><u>[Signature]</u> Dept. Curriculum Chr.</p> <p><u>10-20-97</u> Reviewed (Date)</p> <p><u>[Signature]</u> Dept. Chr.</p>	<p>Step #2 (Receipt)</p> <p>SCC# <u>97-98-72</u></p> <p><u>10-21-97</u> Date Received Senate</p> <p>_____ Senate Curriculum Chr.</p>	<p>Step #3 (School)</p> <p>Reviewed Date: <u>10-20-97</u></p> <p><input checked="" type="checkbox"/> Recommend to Approved</p> <p><input type="checkbox"/> Recommend NOT to Approve</p> <p>Forward for Open Hearing:</p> <p><input checked="" type="checkbox"/> WITHOUT Reservations</p> <p><input type="checkbox"/> WITH Reservations:</p> <p>Comments:</p> <p><u>Robert P. Heeketh</u> School Committee Chr.</p>
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Step #4 (Academic Dean):  Recommended     NOT Recommended     Conditionally Recommended (See Comments)

Comments:

Dean Signature/Date [Signature] 10-27-97

Step #5 (Senate Curriculum Committee):    Open Hearing Date: 11-4-97    Approved by Curriculum Committee Date 11-4-97

Returned to Sponsor(s) for the following reason:

Step #6 (Senate)    Date announced/voted on at Senate 11-25-97 If voted on:     Approved     NOT Approved

Date forwarded to Executive Vice President/Provost 11-25-97

Senate Curriculum Committee chair Signature/Date: \_\_\_\_\_

Step #7 (Executive Vice President/Provost): Date Received DEC 1997

Approved

NOT Approved If no, reasons are as follows:

Student Credit Hours 4

Faculty Load Hours 4

Equalized Credit Hours \_\_\_\_\_

Official Copy & Approval Sheet Filed (Date) \_\_\_\_\_

Executive Vice President/Provost Signature [Signature]

Registrar

Date Approved Course Description Received 8 Jan 98

Regis Taxonomy and Course Number Assigned C906.314

Date/Signature of Registrar BZ Kelley

Notification Forward:

Senate Curriculum Committee Chairperson

Department Chairpersons

Academic Dean(s)

Registrar

Sponsor(s)

*Transmittal  
1/23/98*

## *Course Proposal*

### *1. Details:*

- a) **Course Title:** Chemical Process Component Design (0906.314)  
 b) **Sponsor:** Dr. C. Stewart Slater, and Chemical Engineering  
 Curric. Com. (C. S. Slater, Z. Otero-Keil, R. P. Hesketh)  
 c) **Credit Hours:** 4 credit hours  
 d) **Course Level:** Junior  
 e) **Curricular Effect:** Requirement for Chemical Engineering students  
 f) **Prerequisites:** Transfer Processes I & II, Fluid Mechanics I, Process Fluid  
 Transport  
 g) **Suggested Time/** Spring 1999  
**Scale of Implementation:** 1 section  
 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 requirement 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 proposed course is part of the Chemical Engineering Program and meets requirements of the Education and Accreditation Committee (EAC) of the American Institute of Chemical Engineers (AIChE) for accreditation of programs by the Accreditation Board for Engineering and Technology (ABET).

The course will introduce students to chemical process design. Students will investigate the process design parameters of transport processes: momentum, heat and mass transfer. This course will be the transition from the principles taught in the 2 s.h. lecture courses, i.e. Transfer Processes I & II to the Plant Design course taught in the senior year.

### *3. Essence of the Course:*

#### **a) Objectives:**

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

1. Solve open-ended problems in the economic design of chemical process components used in the synthesis of chemical processes.
2. Understand the principles of "quick-sizing" and scale-up as related to process

- component design.
3. Design parameters of momentum, heat and mass transfer processes as related to the overall plant synthesis.
  4. Design parameters of batch and continuous flow reactor systems related to overall plant synthesis.
  5. Design parameters of chemical equilibria systems related to overall plant synthesis.
  6. Apply the economic aspects of engineering including evaluating alternative courses of action, depreciation, replacement analysis, and process optimization
  7. Use computer software (from CACHE and other sources) to analyze and design momentum, heat and mass transfer processes.
  8. Understand the impact of safety and environmental issues on process component design.
  9. 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.

Introduction to process component design

Vessels – design and cost

- Basic design features
- Size, hold-up time, materials of construction
- Baffling, packing, etc.
- Vessel costs

Heat exchangers and furnaces – design and costs

- Review of basic concepts – individual and overall coefficients
- Considerations in selection of equipment
- Operating concerns – layouts, fouling, etc.
- Heat transfer equipment costs
- Optimum design of heat exchangers and networks

Mass Transfer equipment – design and cost

- Finite-stage contactors
- Bubble-cap, sieve tray, valve tray
- Factors influencing plate and column efficiencies
- Continuous contactors
- Correlations of design parameters
- Mass transfer equipment cost

Chemical Thermodynamics - design and cost

Advanced design topics  
Dryers and evaporators

Reactors - design and cost  
Equations for reactor-design application  
Mechanical features of design  
Estimation of costs for reactor equipment components

Safety and environmental considerations in process design  
Flammability of liquids and vapors  
Hazards identification  
Process hazards survey  
Hazard and operability studies (HAZOP)  
Safety reviews

**c) Evaluation and Grading Procedure of Students:**

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

This course is neither a requirement or elective in any other program, and does not impact on required prerequisite course offerings of any other program. Therefore, no consultations have been sought.

*Catalog Description*

**Chemical Process Component Design (0906.314)**

*Prerequisite: Transfer Processes I & II, Process Fluid Transport, Co-requisite: Chemical Engineering Thermodynamics, Chemical Reaction Engineering*

This course addresses the problems in economic design of chemical process components used in the synthesis of overall chemical processes. Economic aspects of engineering, including evaluating alternative course of action, cost factors, and process optimization are presented. Safety and environmental considerations in process selection will be discussed.