

ROWAN COLLEGE
CURRICULUM COMMITTEE

(R)

M I N O R C H A N G E

PROPOSAL TITLE: Curricular Revisions - Engineering Academic Programs

UNDERGRADUATE GRADUATE CREDIT HOURS

SPONSOR(S): Drs. Z. Otero Keil and C. S. Slater and the School of Engineering Curriculum Com.

DEPARTMENT & TELEPHONE# School of Engineering, x4670

CHECK ONE:

- CHANGES IN APPROVED ~~MINORS, SPECIALIZATIONS, CONCENTRATIONS~~ PROGRAMS
- CATALOGUE DESCRIPTIONS AND/OR PREREQUISITE CHANGES
- SMALL CHANGES IN COURSE CONTENT OF EXISTING COURSES WHICH DO NOT SUBSTANTIALLY VARY THE CURRICULUM
- CHANGES IN HEGIS NUMBER

<p>STEP #1 (DEPARTMENT) / <i>Programs</i></p> <p><input checked="" type="checkbox"/> APPROVED / DATE: <u>6-4-96</u></p> <p>NOT APPROVED / DATE: _____</p> <p style="text-align: center;"><i>N/A</i></p> <p>(DEPT. CURRICULUM CHR. / DATE)</p> <p style="text-align: center;"><i>Richard Myrtle</i></p> <p>DEPT. CHR./DATE</p> <p style="text-align: center;"><i>Chairs 6-4-96</i></p>	<p>STEP #2 (SCHOOL)</p> <p>DATE REVIEWED <u>6-4-96</u></p> <p><input checked="" type="checkbox"/> RECOMMEND TO APPROVE</p> <p><input type="checkbox"/> RECOMMEND NOT TO APPROVE</p> <p>COMMENTS:</p> <p style="text-align: center;"><i>[Signature]</i></p> <p>SCHOOL CURRICULUM CHR.</p>	<p>STEP #3 (ACADEMIC DEAN)</p> <p><input checked="" type="checkbox"/> RECOMMEND <input type="checkbox"/> NOT RECOMMENDED</p> <p>DATE REVIEWED: <u>6-5-96</u></p> <p style="text-align: center;"><i>[Signature]</i></p> <p>DEAN OF SCHOOL SIGNATURE</p>
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<p>STEP #4 (CURRICULUM COMMITTEE) <i>6-11-96</i></p> <p>SCC# <u>95-96-187</u></p> <p>DATE RECEIVED: _____</p> <p><input checked="" type="checkbox"/> APPROVED <input type="checkbox"/> NOT APPROVED</p> <p style="text-align: center;"><i>[Signature]</i> <u>6/11/96</u></p> <p>CURRICULUM COMMITTEE CHR. SIGNATURE</p>	<p>STEP #5 EXE. VP/PROVOST</p> <p><input checked="" type="checkbox"/> APPROVED</p> <p><input type="checkbox"/> NOT APPROVED</p> <p style="text-align: center;"><i>[Signature]</i> <u>6/18/96</u></p> <p>SIGNATURE/DATE</p>
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REGISTRAR'S SIGNATURE/DATE _____

Curriculum Revisions

Engineering Academic Programs

Title: Bachelor of Science in Engineering

Chemical Engineering
Civil Engineering
Electrical Engineering
Mechanical Engineering

Sponsors: Drs. Zenaida Otero Keil and C. Stewart Slater
and the Engineering Curriculum Committee

Rationale:

a. The curricula for the engineering academic programs were approved by the Senate in December, 1994. The curricula were approved with the proviso that course descriptions and revisions be submitted when faculty were hired. The four engineering program chairs were hired in September, 1995. These faculty and the engineering administration have reviewed the curricula and have made the proposed revisions. The proposed revisions are consistent with the School of Engineering mission statement approved by the College.

The Rowan School of Engineering has been designed from the outset to provide unique quality programs that are effectively responsive to regional aspirations, address the needs and changing characteristics of leading-edge engineers of the future, and are accessible and affordable to diverse students.

The proposed curriculum revisions are also consistent with the charge by the College to the School of Engineering to develop the most innovative, leading-edge engineering curricula possible. The proposed curriculum revisions include some of the most forward-thinking elements in engineering education. They give the engineering curricula the quality and flexibility to educate the engineers of the future who will serve as change agents in a diverse and technology oriented society. The proposed curriculum revisions will place the School of Engineering in a strong position to serve students, industry, the profession, and to impact the economic and

technical development of the region.

A major goal of the proposed curriculum revisions is to provide technical excellence in a well rounded academic experience. This is accomplished by increasing the number and degree of laboratory and "hands-on" experiences for students. In addition, a strong communications component is integrated in the project experiences within the Engineering Clinics. The latter revision involves integration of the English Composition II into the Engineering Clinics. This is consistent with the Accreditation Board of Engineering and Technology (ABET) guidelines to integrate communications and computer technology throughout the curriculum. It will provide students with the unique opportunity to learn communication skills in the context of a hands-on, team project oriented experience. The proposed curriculum revisions are consistent with the recommendations of the National Advisory Council for the Development of the School of Engineering. The Council, a group of internationally recognized experts in engineering education and business leaders, assisted in the development of the engineering curricula approved by the College Senate in December, 1994.

The proposed curriculum revisions include a general education model uniquely responsive to the needs of engineering students. This model recognizes that engineering degrees are professional degrees that must meet the ABET guidelines for accreditation. The College has recognized the unique needs of professional specialized degrees with the development of a specialized degree model for general education. The Bachelor of Music and the Bachelor of fine Arts are considered specialized degrees, and require 6 s.h. less in the mathematics and science general education bank than other degree models.

The proposed curriculum revisions strengthen the engineering curricula. They will provide students with the necessary experiences and educational background for technical excellence and skills that will make them valuable contributors to industry, the region and the profession. The proposed curriculum revisions are consistent with the ABET accreditation guidelines for engineering programs. The revisions also enhance the foundation elements of the engineering curricula.

- o *A broad set of mathematics and science core courses* to provide students with a strong foundation for engineering and a basic preparation for life-long independent learning.
- o *A strong engineering core program* to provide students with the inter/multidisciplinary experiences that will make them leading-edge engineers.
- o *A technology focus area approach* that allows students to add depth to their education in the technology focus areas identified by the School of Engineering.

- o *An integrated curriculum* emphasizing engineering applications beginning in the first semester.
- o *A "hands-on" project oriented approach* to engineering that will allow students to develop an in-depth understanding of engineering practice.
- o *Team work and cooperative learning* throughout the curricula. This will allow students to develop the skills necessary to work effectively in a diverse, global economic climate.
- o *Strong commitment to the Humanities, Social Sciences and the Arts* in recognition of the fact that engineers must be cognizant of the impact of engineering decisions on society. Students must develop a high standard of ethical behavior. They must be sensitive to environmental and societal concerns. They must also be able to integrate into engineering the constraints of government regulations and financial and political considerations. Students must have an appreciation for the diverse society in which they live.
- o *Strong commitment to integrate communications throughout the curricula* in recognition that communication skills are of critical importance to engineers. Engineering courses, i.e., Engineering Clinics, will include communications throughout. The English Composition II course has been integrated into the Engineering Clinics. The School of Engineering will work with the Department of Communications to develop communication module that will provide the necessary communication education for students.
- o *Extensive use of computers throughout the curricula* to assure that students are familiar with the analytic and design tools used in the practice of engineering.
- o *Exposure to business principles* in recognition that engineers need to integrate business in technical decisions. Students will be exposed to entrepreneurship in recognition that the majority of the jobs of the future will be created by small high technology companies.

The School of Engineering has consulted faculty from numerous departments in the College. These consultations gave the Engineering School the benefit of the expertise of faculty in a wide range of disciplines. These consultations were incorporated in the proposed revisions. The faculty consulted and written consultations can be found in the Consultations Section of this proposal.

Rationale:

b. Details of Curriculum Revisions

I. Curriculum Revisions Common to All Programs

Curriculum revisions common to all programs are described below. These proposed revisions include changes in

- ▶ General Education
- ▶ Mathematics
- ▶ Engineering Clinics
- ▶ Modification of selected engineering courses into 4 s.h. courses with 2 s.h. modules (2+2 modules)

General Education

The revisions pertaining to General Education are listed in the table below.

Revised	Original
Gen.Ed. 1 - Comunc., Composition I (3)	Gen.Ed. 1- Comunc. (3)
Gen.Ed. 2 - Comunc., Comp. II included in Clinics as 2 x 1.5 s.h components for 3 effective s.h.	Gen.Ed. 2 - Comunc. (3)
Gen.Ed. 3 - Comunc., Public Speaking (3)	Gen.Ed. 3 - Comunc. (3)
Gen.Ed. 4 - Math/Science, Calculus I (4)	Gen.Ed. 4- Math/Science (4)
Gen.Ed. 5 - Math/Science, Calculus II (4)	Gen.Ed. 5- Math/Science (4)
Gen.Ed. 6 - Math/Science, Chemistry I (4)	Gen.Ed. 6 - Math/Science (4)
Gen. Ed. 7 - Math/Science, Physics I (4)	Gen.Ed. 7 - Social/Behavioral Sci (3)
Gen. Ed. 8 - Math/Science, Physics II (4), Biology I (4), or Chemistry II (4)	Gen.Ed. 8 - Social/Behavioral Sci (3)
Gen. Ed. 9 - Math/Science, Comp. Sci. Prog. (4)	Gen.Ed. 9 - Social/Behavioral Sci (3)
Gen. Ed. 10 - Social/Behavioral Sci., Microecon. (3)	Gen.Ed. 10 - Social/Behavioral Sci (3)
Gen. Ed. 11 - Social/Behavioral Sci. (3)	Gen.Ed. 11 -Hum/Hist/Lang (3)
Gen. Ed. 12 - Social/Behavioral Sci. (3) or Hum./Hist./ Lang. (3)	Gen.Ed. 12 -Hum/Hist/Lang (3)
Gen. Ed. 13 - Hum./Hist./Lang. (3)	Gen.Ed. 13 -Hum/Hist/Lang (3)
Gen. Ed. 14 - Hum/Hist/Lang (3)	Gen.Ed. 14 -Hum/Hist/Lang (3)
Gen. Ed. 15 - Arts (3)	Gen. Ed. 15 - Arts (3)

The general education model proposed above recognizes that engineering is a specialized, professional degree as presented in the Rationale (a) Section of this proposal. The general education model included in the proposed curricula is listed in Table I. This general education model is consistent with the general education requirements in competing engineering schools. Tables 2a-d are a comparison of the existing Rowan B.S. general education model with those at competing engineering schools.

Adherence to the existing general education model and to ABET requirements will result in excessive semester hour requirements for the engineering programs. Current ABET requirements are for 16 s.h. of Humanities & Social Sciences which includes the three banks of Social/Behavioral Science, History/Humanities/Language, and Arts. The proposed total semester hours for these categories is 18 s.h. The School of Engineering requires Microeconomics (3 s.h.) in the Fall semester of the Junior year.

The proposed revisions include the integration of the Communications component of general education into the curriculum. Students will take Composition I (3 s.h.) in the Fall semester of the Freshman year. The remainder of the written communications experience, Composition II, will be integrated into the Engineering Clinics. Within the Engineering Clinics, an equivalent of 1.5 s.h. will be dedicated to communications during the Spring of the Freshman year and Fall of the Sophomore year. Faculty from the Communications Department and Engineering School are presently working on implementing this teaching approach. Public Speaking (3 s.h.) will be taught in the Spring semester of the Sophomore year.

Advanced Mathematics

The revisions in the mathematics component of the engineering curricula are listed below.

Revised	Original
Mathematics for Engineering Analysis I (4)	Introduction to Eng. Anal. (3) (some math components in this course)
Mathematics for Engineering Analysis II (4)	Differential Equations/Sys (4)
	Advanced Engineering Math (3)

Minor changes were made to the mathematics sequence in the revised curriculum. The revised curriculum has two advanced mathematics courses in the Fall and Spring of the Sophomore year, Mathematics for Engineering Analysis I (4 s.h.) and II (4 s.h.), respectively. These courses take components from the original curriculum courses: Introduction to Engineering Analysis (3 s.h., Fresh., Fall), Differential Equations/Systems (4 s.h. Soph., Spring),

and Advanced Engineering Mathematics (3 s.h. Junior, Fall). There have been positive discussions with the Mathematics faculty on how to combine all the topics necessary for engineers into these course. The Mathematics Department will submit proposals for these courses by next Fall. Topics on engineering statics from the original Introduction to Engineering Analysis course appear in other courses in specific programs and are described in those sections.

Engineering Clinics

The table below details the revisions in the Engineering Clinics component of the engineering curricula.

Revised	Original
Freshman Engineering Clinic I (3)	Engineering Workshop (Fresh., Fall) (1)
Freshman Engineering Clinic I (3)	Engineering Workshop (Fresh., Spr.) (1)
Sophomore Engineering Clinic I (3)	Engineering Workshop (Soph., Fall) (1)
Sophomore Engineering Clinic II (3)	Engineering Workshop (Soph. Spr.) (1)
Junior Engineering Clinic I (3)	Sophomore (Fall) Project Lab (2)
Junior Engineering Clinic II (3)	Sophomore (Spr.) Project Lab (2)
Senior Engineering Clinic I (3)	Junior Clinic (3)
Senior Engineering Clinic II (3)	Senior (Fall)Clinic (3)
	Senior (Spr.)Clinic (3)

The original curricula included four 1 s.h. Engineering Workshops in the Freshman and Sophomore year, two 2 s.h. Project Laboratories in the Sophomore year and three 3 s.h. Clinics in the Junior and Senior year. The revised curricula has 3 s.h. clinics throughout the eight semester sequence. This is an important revision and was instituted to enhance the multidisciplinary, "hands-on", team project aspects of the curricula. Potential students have found the proposed Engineering Clinics to be a highly attractive aspect of the curricula. The clinics will immerse students into engineering, one of the most important factors in retaining students in engineering programs today. The clinics start by providing a broad multidisciplinary base to the engineering experience. Depth and technology focus is built into the clinics as students progress in their studies. Business entrepreneurship will be integrated into the clinics to underscore the important role that entrepreneurship plays in engineering businesses. The upper-level clinics serve as a vehicle to import projects from industry and for applied funded research. The hands-on team oriented projects that will be conducted in the clinics are the hallmark of Rowan engineering program.

Engineering 4 s.h. Modular Courses

The revisions regarding the modular 2+2 4 s.h. courses are listed below. These courses are program specific and are discussed further in those sections of this proposal.

Revised	Original
Engineering Course A - I & II (2 + 2)	Core Requirement, Eng. Matl. (3)
Engineering Course B - I & II (2 + 2)	Core Requirement/Elective (3)
Engineering Course C - I & II (2 + 2)	Core Requirement/Elective (3)
or any combination of 2 s.h. components of various other Engineering courses	Core Requirement/Elective (3)

The revised engineering curricula include a set of 4 s.h. courses taught in 2 s.h. modules. These are the courses formerly referred to as 3 s.h. Core/Core Electives. This modular approach gives students the flexibility to add breath to their engineering education. It will provide a mix of basic engineering science topics that can be offered to different engineering disciplines within a reasonable number of semester hours. This concept is another highly innovative feature of the program and is described in relation to individual program curricula in the following sections. The core requirement of Engineering Materials specified for all programs in the original proposal is no longer required.

Other Changes

The other revisions that have been made and are common to all programs. Computer Science & Programming (4 s.h.) originally in the Fall semester of the Sophomore year is moved to the Spring semester of the Freshman year.

The following sections describe individual changes that have been made by each respective program. These have been to address individual ABET Program Criteria and to maintain a leading-edge innovative engineering programs.

Table 2: General Education Model Proposed
 Bachelor of Science in Engineering

General Education Banks	Semester Hours
Communication	6*
Science and Mathematics	24
Social and Behavioral Sciences	9 ^a /6 ^b
History, Humanities and Language	6 ^a /9 ^b
Arts	3
Total	48

* An Additional 3 s.h. of Composition II will be included in the Freshman and Sophomore Engineering Clinics

** a/b students must either take (a) 9 s.h. in Soc/Behav. Science and 6 s.h. in History/Hum/Lan. or (b) 6 s.h. Soc/Behav. Science and 9 s.h. History/Hum/Lan.

Comparison of General Education Requirements in Competing Institutions (excluding science and mathematics)

Table 1a: Chemical Engineering Curriculum

Banks	Rowan B.S.	University of Delaware	NJIT	Rutgers	Drexel
Comm.	9	3	3	3	3
Social/ Behavioral	12 - 15	18	15	15	12
Hum/His/ Lan	12 - 15	***	9	***	15 [#]
Arts	3 - 6	***	***	***	***
Total	minimum:36	21	27	18	30

Table 1b: Civil Engineering Curriculum

Banks	Rowan B.S.	University of Delaware	NJIT	Rutgers	Drexel
Comm.	9	6	3	3	3
Social/ Behavioral	12 - 15	18	15	15	12
Hum/His/ Lan	12 - 15	***	9	***	15 [#]
Arts	3 - 6	***	***	***	***
Total	minimum:36	24	27	18	30

[#] indicates liberal studies

*** indicates that total credits listed in cell above can be combined among banks

**Comparison of General Education Requirements in Competing Institutions
(excluding Science and Mathematics)**
(continued)

Table 1c: Electrical Engineering Curriculum

Banks	Rowan B.S.	University of Delaware	NJIT	Rutgers	Drexel
Comm.	9	6	3	3	3
Social/ Behavioral	12 - 15	18	15	18	12
Hum/His/ Lan	12 - 15	***	9	***	15 [#]
Arts	3 - 6	***	***	***	***
Total	minimum:36	24	27	21	30

Table 1d: Mechanical Engineering Curriculum

Banks	Rowan B.S.	University of Delaware	NJIT	Rutgers	Drexel
Comm.	9	3	3	3	3
Social/ Behavioral	12 - 15	18	15	15	12
Hum/His/ Lan	12 - 15	***	9	***	15 [#]
Arts	3 - 6	***	***	***	***
Total	minimum:36	21	27	18	30

[#] indicates liberal studies

*** indicates that total credits listed in cell above can be combined among banks

II. Curriculum Revisions for Chemical Engineering Program

The Chemical Engineering curriculum shown on the following page differs from the original Curriculum Proposal in several ways. It has been modified according to the generic program changes as previously mentioned. It has been strengthened to meet specific program accreditation guidelines of the Education and Accreditation Committee (EAC) of the American Institute of Chemical Engineers (AIChE). Above all it provides for the innovative character of the Rowan engineering experience.

The revisions specific to the Chemical Engineering Program are listed below.

Sophomore and Junior Years

The proposed revisions to the Chemical Engineering Program include the 4 s.h. courses taught in 2 s.h. modules (2+2 modular courses) as discussed in the Rationale (a) Section of this proposal.

<u>Revised</u>	<u>Original</u>
Principles of Chemical Processes I (2 s.h.) Soph., Spring	Principles of Chemical Processes (3 s.h.) Soph., Spring
Principles of Chemical Processes II (2 s.h.) Soph., Spring	
Fluid Mechanics I (2 s.h.) Junior, Fall	Fluid Mechanics (3 s.h.) Junior, Spr.
Engineering Materials I (2 s.h.) Junior, Fall	Engineering Materials (3 s.h.) Senior, Spring
Transfer Processes I - Heat (2 s.h.) Junior, Spring	Transfer Processes (3 s.h.) Junior, Spring
Transfer Processes II - Mass (2 s.h.) Junior, Spring	

The total number of semester hours for the above topics are not increased. The original program included the same 12 s.h. for four 3 s.h. courses in the above topics. The revised curriculum more accurately balances the topics needed as required by the Education and Accreditation Committee of the AIChE. For example it was difficult to include all the topics needed for the original Transfer Processes course in 3 s.h. Conversely, the original 3 s.h. Fluid Mechanics course had topics on aerodynamics not relevant to chemical engineers. The effective allocation of s.h. at the lower level strengthens the program. The 2 s.h. sequence also allows for other programs such as Mechanical and Civil Engineering to take 2 s.h. modules in topics such as Transfer Processes I and Fluid Mechanics without having to take additional semester hours. The original version 3 s.h. courses listed above were approved by the Senate Curriculum Committee last Fall.

Students may take either Physics II or Biology I in the first semester of the Sophomore year. This change accommodates the diverse interests of the students desiring future specializations such as biotechnology or medicine. Many chemical engineering programs are allowing students the option to take more life sciences in the curriculum.

Senior Year

<u>Revised</u>	<u>Original</u>
Separation Processes (4 s.h.) Senior, Fall	Mass Transfer/Separations (4 s.h.) Senior, Fall
Process Dynamics and Control (3 s.h.) Senior, Spring	Control Systems (3 s.h.) Junior, Spring
Chemical Plant Design (3 s.h.) Senior, Spring	

The Mass Transfer/Separations (Senior-Fall) course in the original curriculum was renamed to Separation Processes to more effectively reflect content. There is no change in semester hours or in its implementation.

The course Control Systems (3 s.h.) Junior, Spring, was revised and renamed Process Dynamics & Control (3 s.h.). In the proposed curriculum it is taught in the Spring semester of the Senior year. The course was modified from the original proposal in response to chemical engineering accreditation concerns. This course now focuses on process dynamics and control of process systems and follows Chemical Reaction Engineering and Separation Processes in the program. This change was recommended by ABET program reviewers at the ABET training session at the AIChE Annual Meeting.

A required course Chemical Plant Design (3 s.h.) is in the Spring semester of the Senior year in response to accreditation concerns and to allow the Senior Clinic experience flexibility for the type of industrial projects foreseen. This change was recommended by ABET program reviewers at the ABET training session at the AIChE Annual Meeting.

There are still two required Chemical Engineering Technical Electives in the Senior year and some additional courses have been proposed to allow for student interest in Technology Focus groups in the areas of Environmental Engineering and Processing Engineering. Some examples of the new courses added are Process Safety and Bioprocess Engineering. These course proposal have had positive consultations from the Department of Chemistry and Physics and have been submitted to the Senate Curriculum Committee.

All of the chemical engineering course proposals have been submitted to the Senate Curriculum Committee. The proposals show minor changes in course title and course descriptions in addition to indicating their exact placement in the curriculum. All proposals for chemical engineering courses have received positive consultations by the Department of Chemistry and Physics.

Chemical Engineering Curriculum^P

FIRST YEAR

Composition I	3	Fresh. Engineering Clinic II	3
Fresh. Engineering Clinic I	3	Computer Science & Prog.	4
Calculus I	4	Calculus II	4
Chemistry I	4	Physics I (Mech/Dyn)	4
General Education	3	General Education	3
Total units	17	Total units	18

SECOND YEAR

General Education	3	Public Speaking	3
Math. for Engineering Analysis I	4	Math. for Engineering Analysis II	4
Physics II (E&M) or Biology I	4	Principles of Chemical Processes I	2
Soph. Engineering Clinic I	3	Principles of Chemical Processes II	2
Chemistry II	4	Soph. Engineering Clinic II	3
		Organic Chemistry I (w/lab)	4
Total units	18	Total units	18

THIRD YEAR

General Education	3	General Education	3
Microeconomics	3	Transfer Processes I -Heat	2
Fluid Mechanics	2	Transfer Processes II - Mass	2
Engineering Materials	2	Applied Chemical Thermo.**	3
Physical Chemistry I	3	Junior Engineering Clinic II	3
Junior Engineering Clinic I	3	Approved Chemistry Elective I ¹	3
Total units	16	Total units	16

FOURTH YEAR

Health and Wellness	3	Process Dynamics & Control	3
Approved Chemical Eng. Elec. I ²	3	Approved Chemical Eng. Elec. II ²	3
Senior Engineering Clinic I ³	3	Senior Engineering Clinic II ³	3
Separation Processes (w/lab)	4	Approved Chemistry Elective II ¹	3
Chemical Reaction Engineering	3	Chemical Plant Design	3
Total units	16	Total units	15

Total units 134

Notes:

** New Chemistry course team taught with Chemical Engineering.

1. Required/Approved Courses taken to satisfy ABET categories. Approved Chemistry Electives must total 6 credits and must come from a list of approved courses provided by the Ch.E. Program Chair. Currently the list includes: Physical Chemistry II (3), Organic Chemistry II (4), Intro. to Polymer Chemistry (3), Physical Chemistry I Lab (2), Advanced Inorganic Chemistry (4), Intro to Biochemistry (3 or 4), Microbiology (4). Chemistry and Chemical Engineering Electives may be taken in either semester of Senior year.

2. Required/Approved courses taken to satisfy ABET categories/Tech Focus Group. Courses must be taken from a list of approved courses provided by the Ch. E. Program Chair. Currently these are: Advanced Separation Process Technology (3), Transport Phenomena (3), Special Topics in Chemical Engineering (3), Process Safety (3), Fluid Flow in Processing and Manufacturing (3), Environmental Regulations in Technology Industries (3), Environmental Considerations in Process Design (3), Advanced Reactor Design (3), Bioprocess Engineering (3), Approved courses in Env. Eng. Program (TBD). Chemistry and Chemical Engineering Electives may be taken in either semester of Senior year.

3. Senior Clinics in Chemical Engineering must include chemical process design with economic analysis and evaluation of alternatives subject to environmental, safety, and other constraints. Courses are writing intensive courses. 6-3-96

ORIGINAL
CHEMICAL ENGINEERING PROGRAM

FIRST YEAR

Composition I	3	Public Speaking	3
Engineering Workshop	1	Engineering Workshop	1
Calculus I	4	Calculus II	4
Intro Engineering Analysis	3	Composition II: Technology Focus	3
Chemistry I	4	Physics I (Mechanics/Dynam)	4
		Health/Physical Education (either semester)	3
		Total Units for 1st Year	33

SECOND YEAR

General Education Course	3	General Education Course	3
Computer Science & Programming	4	Differential Eqs/Systems	4
Physics II (E&M)	4	Chemical Process Principles (Core 1)	3
Sophomore Project Lab	2	Sophomore Project Lab	2
Engineering Workshop	1	Engineering Workshop	1
Chemistry II	4	Organic Chemistry I(w/lab)	4
Total units	18	Total units	17

THIRD YEAR

General Education Course	3	General Education Course	3
Microeconomics	3	Transfer Processes (Core 3)	3
Fluid Mechanics (Core 2)	3	Applied Chemical Thermodynamics ¹	3
Clinic ² or Control Systems (Core 4)	3	Control Systems (Core 4) or Clinic ²	3
Advanced Engineering Math	3	Chemistry Elective ³	3
Physical Chemistry I	3	General Education Course	3
Total units	18	Total units	18

FOURTH YEAR

General Education Course	3	General Education Course	3
Approved Tech. Elective I	3	Approved Tech. Elective II	3
Clinic ²	3	Clinic ²	3
Mass Transfer/Separations (with lab)	4	Chemistry Elective ³	3
Chemical Reaction Engineering	3	Engineering Materials	3
		General Education Course	3
Total units	16	Total units	18

Total Units 138

Notes: 1. New chemistry course, possibly team taught with ChE faculty. 2. Senior Clinics for Chemical Engineers must include chemical process design with economic analysis and evaluation of alternatives subject to environmental, safety, and other constraints. Course will be proposed as a writing intensive course. 3. Recommended courses include Quantitative Analysis (4), Physical Chemistry II (3), Organic Chemistry II (4), Introduction to Polymer Chemistry (3), Physical Chemistry Lab I (2), Advanced Inorganic Chemistry (4), Introduction to Biochemistry (3), or Environmental Chemistry and Pollution. MUST TOTAL AT LEAST 6 HOURS.

II. Curriculum Revisions for Civil Engineering Program

There are three categories of revisions that are proposed specifically for the Civil Engineering Program: Overall Civil Engineering Program changes, Infrastructure (General Civil) Engineering Option changes, and Environmental Engineering Option changes.

OVERALL CIVIL ENGINEERING PROGRAM CHANGES

1. The statics portion of the Introduction to Engineering Analysis course (Fall Semester of Freshman Year) has been separated into an independent two-credit, seven-week course called Statics (Fall Semester of Sophomore Year) which includes an introduction to solid mechanics.
2. Solid Mechanics (Fall Semester of Sophomore Year for the Infrastructure Engineering Option and Spring Semester of Sophomore Year for the Environmental Engineering Option) has been changed from a three-credit, 14-week course to a two credit, seven-week course called Strength of Materials (Fall Semester of Sophomore Year) which serves as a follow-on course to the two-credit, seven-week Statics course (Fall Semester of Sophomore Year).
3. Structural Analysis I (Fall Semester of Junior Year for the Infrastructure Engineering Option and Fall or Spring Semester of Junior Year for the Environmental Engineering Option) has been revised to incorporate the basic elements of reinforced concrete analysis and design and is now called Structural Engineering I (Spring Semester of Sophomore Year for all Civil Engineering majors).
4. Fluid Mechanics (Fall Semester of Junior Year) has been changed from a three-credit, 14-week course to a two-credit, seven-week course called Fluid Mechanics I (Fall Semester of Junior Year) which focuses on closed system (pipe) flow.
5. Engineering Materials (Fall Semester of Junior Year) has been changed from a three-credit, 14-week course to a two-credit, seven-week course called Engineering Materials I (Fall Semester of Junior Year) which focuses on the basic properties of materials and the properties of metals.
6. The two-credit, seven-week Civil Engineering Materials course (Fall Semester of Junior Year), which focuses on two critical civil engineering materials - concrete and asphalt, has been added as a follow-on course to the two-credit, seven-week Engineering Materials I course (Fall Semester of Junior Year).
7. Hydraulics and Hydrology (Spring Semester of Junior Year) has been renamed Water Resources Engineering (Spring Semester of Junior Year).
8. Soil Mechanics and Foundations I (Fall Semester of Senior Year for the Infrastructure Engineering Option), which was required for the Infrastructure Engineering Option, has been revised to focus on the soil mechanics aspects of geotechnical engineering. The course is now

called Geotechnical Engineering (Spring Semester of Junior Year) and is required for all Civil Engineering majors.

9. Transportation Systems (Spring Semester of Senior Year for the Infrastructure Engineering Option), which was an elective for the Infrastructure Engineering Option, has been renamed Transportation Engineering (Fall Semester of Senior Year) and is now a required course for all Civil Engineering majors.

10. One three-credit, 14-week engineering core elective course (Spring Semester of Junior Year for the Infrastructure Engineering Option and Spring Semester of Senior Year for the Environmental Engineering Option) has been changed to a two-credit, seven-week engineering core elective course (Spring Semester of Senior Year).

11. A three-credit, 14-week technical elective course (Spring Semester of Senior Year) has been added to allow students to take related courses in other departments and schools such as Geography and Business.

12. Advanced Structural Analysis I (Senior Elective and Graduate Course) has been revised to focus on the finite element method of civil engineering analysis and is now called Finite Element Analysis in Civil Engineering.

13. Advanced Structural Analysis II (Senior Elective and Graduate Course) has been deleted.

14. Advanced Hydraulics and Hydrology (Senior Elective and Graduate Course) has been renamed Advanced Water Resources Engineering.

15. Engineering Estimating, Prestressed Concrete, Advanced Reinforced Concrete, and Bridge Engineering (Senior Electives and Graduate Courses) have been added.

The number of civil engineering courses that will serve as both senior electives and graduate courses will continue to grow as the number of students and the number of faculty increase.

INFRASTRUCTURE (GENERAL CIVIL) ENGINEERING OPTION CHANGES

The name of the General Civil Engineering Option has been changed to the Infrastructure Engineering Option to more-directly associate this option with the emerging technology focus area of infrastructure engineering. In addition, the following changes have also been made to the Infrastructure Engineering Option:

1. Elements of Geology (Spring Semester of Sophomore Year), which does not exist at Rowan College, has been replaced by Chemistry II (Fall Semester of Sophomore Year).

2. Physics II (Fall Semester of Sophomore Year) has been replaced by Organic Chemistry I

(Spring Semester of Sophomore Year). Students who choose the Infrastructure Engineering Option will be allowed to substitute Physics II in place of Organic Chemistry I, however.

3. The second three-credit, 14-week engineering core elective (Spring Semester of Sophomore Year) has been replaced by the two-credit, seven-week Dynamics course (Fall Semester of Junior Year).

4. Structural Analysis II (Spring Semester of Junior Year) has been revised to incorporate the basic elements of structural steel analysis and design. The course is now called Structural Engineering II (Fall Semester of Junior Year).

5. Structural Design (Spring Semester of Senior Year) has been revised to incorporate the analysis and design of composite structures (concrete, steel, and wood). The course is now called Structural Engineering III (Spring Semester of Junior Year).

6. Engineering Planning (Spring Semester of Senior Year), which was a Senior Elective for the Infrastructure Engineering Option, has been revised to focus on land surveying. The course is now called Surveying and Planning (Fall Semester of Senior Year) and is a required course for the Infrastructure Engineering Option.

7. Soil Mechanics and Foundations II (Spring Semester of Senior Year) has been changed to a Senior Elective and Graduate Course that focuses on foundations and is now called Foundation Engineering.

8. Geotechnical Engineering (Senior Elective and Graduate Course) has been revised to focus on earth retaining systems and is now called Earth Retaining Systems.

9. Problems in Transportation and Urban Planning (Senior Elective and Graduate Course) has been revised to focus on advanced topics in transportation engineering and is now called Advanced Transportation Engineering.

10. Two infrastructure engineering electives (Fall and Spring Semesters of Senior Year) have been added to reinforce the program option in this important and emerging technology focus area.

ENVIRONMENTAL ENGINEERING OPTION CHANGES

The following changes have been made to the Environmental Engineering Option in the Civil Engineering Program:

1. The three-credit, 14-week Thermodynamics course (Fall Semester of Junior Year) has been changed to a two-credit, seven-week Thermodynamics I course (Fall Semester of Junior Year).

2. Transportation Engineering (Fall Semester of Senior Year) and Geotechnical Engineering

(Spring Semester of Junior Year) have been added to the Environmental Engineering Option. This change was made in order to provide the diversity of civil engineering science and design courses that is required for ABET accreditation (i.e., to meet the ABET requirement for science and design courses in at least four different areas of civil engineering).

3. Physics II (Fall Semester of Sophomore Year) and Biology I (Spring Semester of Sophomore Year) have been deleted from the Environmental Engineering Option to make room for the additional civil engineering science and design courses that are required for ABET accreditation (see item #2 above).

4. Organic Chemistry I, which was in the Spring Semester of the Junior Year, has been moved to the Spring Semester of the Sophomore Year.

5. Pollution and Waste Management (Spring Semester of Senior Year) has been renamed Solid Waste Management (Fall Semester of Senior Year).

6. Two environmental engineering electives (Fall and Spring of Senior Year) have been added to reinforce the program option in this important technology focus area for the School of Engineering.

7. Groundwater Remediation and Advanced Solid Waste Management (Senior Electives and Graduate Courses) have been added to the Environmental Engineering Option.

CIVIL ENGINEERING PROGRAM - ENVIRONMENTAL OPTION - 131 SH

FIRST YEAR:

Freshman Engineering Clinic I	3	Freshman Engineering Clinic II	3
Calculus I	4	Calculus II	4
Chemistry I	4	Physics I	4
Composition I	3	Computer Science and Prog.	4
General Education Course	3	General Education Course	3

Total	17	Total	18

SECOND YEAR:

Sophomore Engineering Clinic I	3	Sophomore Engineering Clinic II	3
Math. for Engineering Analysis I	4	Math. for Engineering Analysis II	4
Chemistry II	4	Organic Chemistry I	4
Statics	2*	Structural Engineering I	3
Strength of Materials	2*	Public Speaking	3
General Education Course	3	-----	

Total	18	Total	17

THIRD YEAR:

Junior Engineering Clinic I	3	Junior Engineering Clinic II	3
Engineering Materials I	2*	Geotechnical Engineering	3
Civil Engineering Materials	2*	Environmental Engineering I	3
Fluid Mechanics I	2*	Water Resources Engineering	3
Thermodynamics I	2*	General Education Course	3
Microeconomics	3	-----	
General Education Course	3	Total	15

Total	17		

FOURTH YEAR:

Senior Engineering Clinic I	3	Senior Engineering Clinic II	3
Environmental Engineering Elective	3	Environmental Engineering Elective	3
Environmental Engineering II	3	Engineering Core Elective	2*
Solid Waste Management	3	Technical Elective	3
Transportation Engineering	3	Health and Wellness	3

Total	15	Total	14

* seven-week quarter courses

TOTAL = 131 SH

CIVIL ENGINEERING PROGRAM - INFRASTRUCTURE OPTION - 131 SH

FIRST YEAR:

Freshman Engineering Clinic I	3	Freshman Engineering Clinic II	3
Calculus I	4	Calculus II	4
Chemistry I	4	Physics I	4
Composition I	3	Computer Science and Prog.	4
General Education Course	3	General Education Course	3

Total	17	Total	18

SECOND YEAR:

Sophomore Engineering Clinic I	3	Sophomore Engineering Clinic II	3
Math. for Engineering Analysis I	4	Math. for Engineering Analysis II	4
Chemistry II	4	Organic Chemistry I	4*
Statics	2*	Structural Engineering I	3
Strength of Materials	2*	Public Speaking	3
General Education Course	3	-----	
Total	18	Total	17

THIRD YEAR:

Junior Engineering Clinic I	3	Junior Engineering Clinic II	3
Structural Engineering II	3	Structural Engineering III	3
Fluid Mechanics	2*	Water Resources Engineering	3
Dynamics	2*	Geotechnical Engineering	3
Engineering Materials I	2*	General Education Course	3
Civil Engineering Materials	2*	-----	
Microeconomics	3	Total	15
Total	17		

FOURTH YEAR:

Senior Engineering Clinic I	3	Senior Engineering Clinic II	3
Infrastructure Engineering Elective	3	Infrastructure Engineering Elective	3
Surveying and Planning	3	Engineering Core Elective	2*
Transportation Engineering	3	Technical Elective	3
General Education Course	3	Health and Wellness	3

Total	15	Total	14

* seven-week quarter courses

+ Physics II may be substituted for Organic Chemistry I

TOTAL = 131 SH

ORIGINAL
CIVIL ENGINEERING PROGRAM
GENERAL OPTION

FIRST YEAR

Composition I	3	Public Speaking	3
Engineering Workshop	1	Engineering Workshop	1
Calculus I	4	Calculus II	4
Intro Engineering Analysis	3	Comp II: Technology Focus	3
Chemistry I	4	Physics I (Mechanics/Dynam)	4
		Health/Physical Education (either semester)	3
		Total Units for 1st Year	33

SECOND YEAR

General Education Course	3	General Education Course	3
Computer Science & Programming	4	Differential Eqs/Systems	4
Physics II (E&M)	4	Elements of Geology	4
Sophomore Project Lab	2	Sophomore Project Lab	2
Engineering Workshop	1	Engineering Workshop	1
Solid Mechanics (Core 1)	3	Core Elective 2	3
Total units	17	Total units	17

THIRD YEAR

General Education Course	3	General Education Course	3
Structural Analysis I	3	Structural Analysis II	3
Fluid Mechanics (Core 3)	3	Core Elective 4	3
Adv. Eng. Math or Clinic ¹	3	Adv. Eng. Math or Clinic ¹	3
Engineering Materials	3	Hydraulics and Hydrology	3
General Education Course	3	General Education Course	3
Total units	18	Total units	18

FOURTH YEAR

General Education Course	3	General Education Course	3
Clinic ¹	3	Clinic ¹	3
Microeconomics	3	Structural Design	3
Soil Mechanics and Foundations I	3	Soil Mechanics and Foundations II	3
Approved Major Elective	3	Transportation or Engineer Planning ²	3
Total units	15	Total units	15

Total units for four years: 133

Notes: 1. To be proposed as a writing intensive course 2. To be proposed as a general education course.

ORIGINAL
CIVIL ENGINEERING PROGRAM
ENVIRONMENTAL OPTION

FIRST YEAR

Composition I	3	Public Speaking	3
Engineering Workshop	1	Engineering Workshop	1
Calculus I	4	Calculus II	4
Intro Engineering Analysis	3	Comp II: Technology Focus	3
Chemistry I	4	Physics I (Mechanics/Dynam)	4
		Health/Physical Education (either semester)	3
		Total Units for 1st Year	33

SECOND YEAR

General Education Course	3	General Education Course	3
Computer Science & Programming	4	Differential Eqs/Systems	4
Physics II (E&M)	4	Biology I	4
Sophomore Project Lab	2	Sophomore Project Lab	2
Engineering Workshop	1	Engineering Workshop	1
Chemistry II	4	Solid Mechanics (Core 1)	3
Total units	18	Total units	17

THIRD YEAR

General Education Course	3	General Education Course	3
Clinic ¹ or Structural Analysis I	3	Structural Analysis I or Clinic ¹	3
Engineering Thermo (Core 2)	3	Advanced Engineering Math	3
Fluid Mechanics (Core 3)	3	Organic Chemistry	4
Engineering Materials	3	Hydraulics and Hydrology	3
General Education Course	3		
Total units	18	Total units	16

FOURTH YEAR

General Education Course	3	General Education Course	3
Clinic ¹	3	Clinic ¹	3
Microeconomics	3	Core Elective 4	3
Environmental Engineering I	3	Environmental Engineering II	3
Approved Major Elective	3	Pollution & Waste Management	3
General Education Course	3		
Total Units	18	Total Units	15

Total Units for four years: 135

Note: 1. To be proposed as a writing intensive course.

III. Curriculum Revisions for Electrical Engineering Program

The revisions proposed for the Electrical Engineering Program are listed below. The revisions are listed in two categories: Broadening Engineering Science and Electrical Engineering Science.

1. Broadening Engineering Science. These are courses that impart specific knowledge in engineering sciences outside the electrical engineering area. These courses strengthen students' comprehension of other engineering disciplines which have a relation to classical electrical engineering applications. These courses are consistent with the multidisciplinary/interdisciplinary nature of the Rowan Engineering Programs.

Original		Revised	
(F-1) Introduction to Engr. Anal	3	(So-1) Core ME-Statics	2
(So-2) Engineering Materials	3	(So-1) Core ME-Dynamics	2
(So-2) Core Elective	3	(Sr-1) Non-EE	2
(Sr-2) Core Elective	3		
Total	12		6

The proposed revisions will provide the necessary broadening experience for students within a reasonable number of semester hours. These revisions include the 2 + 2 s.h. modular courses discussed in the Rationale (a) Section of this proposal.

2. Electrical Engineering Science. These are courses that develop the core knowledge base in electrical engineering.

Original		Current	
(So-2) Electrical Circuits	3	(So-2) Digital Systems A,B	4
(J-1) Electronics II	3	(J-1) Electronics A,B	4
(J-1) Controls	3	(J-2) Lin. Sys. & Controls	4
(J-2) Electromechanical Sys.	3	(J-1) Electromagnetics A,B	4
		(So-2) Networks A,B	4
(J-2) Major Elective	3	(J-2) Communication & DSP	4
(Sr-1) Major Elective	3	(Sr-1) EE Elective B	2
(Sr-1) Major Elective	4	(Sr-2) EE Elective A,B	4
(Sr-2) Major Elective	3	(Sr-2) EE Elective	3
(Sr-1) Tech Elective	3	(Sr-1) Tech Elective	3
(Sr-2) Tech Elective	3	(Sr-2) Tech Elective	3
		(Sr-1) Tech Focus Elective A,B	4
		(Sr-2) Tech Focus Elective	3
	31		46

The programs share several foundation EE courses (circuits/networks, electronics, controls, and electromechanical/electromagnetics), but the current program adds courses that are fundamental components of modern electrical engineering: linear systems, digital systems, communication, and digital signal processing (DSP). These provide more breadth for students and prepares them to pursue additional course work in the technology focus areas.

3. Others. The proposed revisions include two, 3-hour elective courses in technology focus areas. While the original program would allow such an elective, it was considered important to designate at least two courses explicitly as technology focus courses. These are important because they assume the role of providing "state-of-the-art" redirection in the curriculum to respond to technology changes, and they also provide opportunities for formal, interdisciplinary course work.

ELECTRICAL ENGINEERING PROGRAM

FIRST YEAR

Freshman Engineering Clinic I	3	Freshman Engineering Clinic II	3
Composition I	3	Computer Science & Programming	4
Calculus I	4	Calculus II	4
Chemistry I	4	Physics I	4
General Education I	3	General Education II	3
Total Units	17	Total Units	18

SECOND YEAR

Sophomore Engineering Clinic I	3	Sophomore Engineering Clinic II	3
Math for Engineering Analysis I	4	Math for Engineering Analysis II	4
Physics II	4	Public Speaking	3
Core ME Engr. Sci. I-A (Statics)	2	Core ME Engr. Sci. I-B (Dynamics)	2
Core EE Engr. Sci. I-A (Network I)	2	Core EE Engr. Sci. I-B (Network II)	2
General Education III	3	Core EE Engr. Sci. II-A (Dig. I)	2
		Core EE Engr. Sci. II-B (Dig. II)	2
Total Units	18	Total Units	18

THIRD YEAR

Junior Engineering Clinic I	3	Junior Engineering Clinic II	3
Core EE Engr. Sci. III-A (Elect. I)	2	Core EE Engr. Sci. V-A (Lin. Sys.)	2
Core EE Engr. Sci. III-B (Elect. II)	2	Core EE Engr. Sci. V-B (Controls)	2
Core EE Engr. Sci. IV-A (E&M I)	2	Core EE Engr. Sci. VI-A (Comm.)	2
Core EE Engr. Sci. IV-B (E&M II)	2	Core EE Engr. Sci. VI-B (DSP)	2
General Education IV	3	Elective I	3
General Education V (Microecon.)	3	Engineering Science Elective I-A	2
Total Units	17	Total Units	16

FOURTH YEAR

Senior Engineering Clinic I	3	Senior Engineering Clinic II	3
General Education VI	3	Elective IV-A	2
Elective II-B	2	Elective IV-B	2
Technology Focus Elective I-A	2	Elective V	3
Technology Focus Elective I-B	2	Technology Focus Elective II	3
Elective III	3	Health and Wellness	3
Total Units	15	Total Units	16

Total Credits: 135

- Notes:
1. Up to 3 hours of Engineering Clinic at the 3rd/4th year may be satisfied by a summer internship experience.
 2. General Education courses and Electives chosen with consent of advisor to meet student and program goals.

ORIGINAL
ELECTRICAL ENGINEERING PROGRAM

FIRST YEAR

Composition I	3	Public Speaking	3
Engineering Workshop	1	Engineering Workshop	1
Calculus I	4	Calculus II	4
Intro Engineering Analysis	3	Comp II: Technology Focus	3
Chemistry I	4	Physics I (Mechanics/Dynam)	4
		Health/Physical Education (either semester)	3
		Total Units for 1st Year	33

SECOND YEAR

General Education Course	3	General Education Course	3
Computer Science & Programming	4	Engineering Materials	3
Physics II (E&M)	4	Elect & Electron Ckts & Devices (Core 1)	3
Sophomore Project Lab	2	Sophomore Project Lab	2
Engineering Workshop	1	Engineering Workshop	1
Differential Eqs/Systems	4	Core Elective ¹ (2)	3
Total units	18	Total units	15

THIRD YEAR

General Education Course	3	General Education Course	3
Electronics II	3	Electromech & En Trans Devices (Core 3)	3
Advanced Engineering Math	3	Mathematics/Science Elective	3
Clinic ¹ or Microeconomics	3	Microeconomics or Clinic ¹	3
Control Systems	3	Approved Major Elective I	3
General Education Course	3	General Education Course	3
Total units	18	Total units	18

FOURTH YEAR

General Education Course	3	General Education Course	3
Clinic ¹	3	Clinic ¹	3
Approved Technical Elective I	3-4	Core Elective ² (4)	3
Approved Major Elective II	3	Approved Major Elective IV	3
Approved Major Elective III	3	Approved Technical Elective II	3-4
Total units	15-16	Total units	15-16

Total units for four years: 132-134

Notes: 1. To be proposed as a writing intensive course. 2. Must be chosen from a field outside Electrical Engineering. Fluid Mechanics and Transfer Processes are highly recommended.

IV Curriculum Revisions for Mechanical Engineering Program

The proposed revisions for the Mechanical Engineering Program are listed below:

<u>ORIGINAL</u>		<u>REVISED</u>	
<u>Course (Sem)</u>	<u>s.h</u>	<u>Course (Sem#)</u>	<u>s.h.</u>
Strength of Materials (Soph. 1)	3	Statics (Soph. 1)	2
		Mechanics of Solids (3) (Soph. 1)	2
Engineering Materials (Soph. 2)	3	Engineering Materials I (Soph. 2)	2
		Engineering Materials II (Soph. 2)	2
Dynamics (Soph. 2)	3	Dynamics (Soph. 2)	2
		Vibrations (Soph. 2)	2
Engineering Thermo. (Jr. 1)	3	Engineering Thermo I (Jr. 1)	2
		Engineering Thermo II (Jr. 1)	2
Electri. & Electro. Ckts (Jr. 1)	3	EE Networks I (Jr. 2)	2
		EE Electronics I (Sr. 1)	2
Transfer Processes (Sr. 1)	3	Transfer Processes I (Jr. 1)	2
Science/Math Elective (Sr. 1)	3	Science/ Math Elective (Sr. 1)	4

The proposed revisions include the 2 + 2 modular courses discussed in the Rationale (a) Section of this proposal. The proposed revisions strengthen the program and are consistent with the innovative nature of Rowan Engineering Program.

1. Statics covered in Physics is not adequate for an engineering program. A 2 s.h. module in Statics is combined with a 2 s.h. module in Strength of Materials, which was previously 3 s.h.. This is introduced in the first semester of the sophomore year.
2. Engineering Materials (previously 3 s.h.) is divided into two 2 s.h. modules. One module deals with engineering materials and the second one stresses the processing of materials. This enhances the manufacturing focus in the program.
3. Dynamics and vibrations go hand in hand. Vibrations is a necessary area for mechanical engineering and was not included earlier. By providing a 2 s.h. module in Dynamics combined with a 2 s.h. module in Vibrations, it provides the flexibility needed. Electrical engineering students can take the Dynamics module and the mechanical engineering students can take the two modules.
4. Engineering Thermodynamics is divided into two 2 s.h. modules. Students from other branches of engineering will take the first part dealing with laws of thermodynamics and internal combustion engines. The second part will cover combustion, airconditioning, and refrigeration.
5. The 2 s.h. module Transfer Processes I (Heat Transfer) of the two module sequence offered by chemical engineering will be taken by mechanical engineering. The second module dealing with mass transfer is not required for the mechanical engineering program.
6. Fluid Mechanics is divided into two parts, each of 2 s.h.. The rationale is that the first part deals with incompressible flow and the second part deals with compressible flow.
7. The Electrical course requirement recommended by ABET is enhanced by two 2 s.h. modules EE Networks I (in Junior II) and EE Electronics I (in Senior I) offered by electrical engineering.
8. Following the ABET guidelines, the Mathematics/Science Elective (3 s.h.) is changed to 4 s.h. Science Elective.

MECHANICAL ENGINEERING PROGRAM

FIRST YEAR

Composition I	3	Physics I	4
Fr. Eng Clinic I	3	Fr. Eng Clinic II	3
Calculus I	4	Calculus II	4
GenEd	3	Comp Sc Prog	4
Chemistry I	4	General Ed	3
Total	17	Total	18

SECOND YEAR

Math. for Eng. Analysis I	4	Math. for Eng. Analysis II	4
Physics II	4	Engineering Materials I*	2
Statics*	2	Engineering Materials II*	2
Strength of Materials*	2	Dynamics*	2
So. Eng Clinic I	3	Vibrations*	2
General Ed.	3	So. Eng. Clinic II	3
		Public Speaking	3
Total	18	Total	18

THIRD YEAR

Microeconomics	3	General Ed.	3
Jr. Eng Clinic I	3	Jr. Eng Clinic II	3
Eng. Thermo. I*	2	Fluid Mechanics I*	2
Eng. Thermo. II*	2	Fluid Mechanics II*	2
Mech. Des. & Syn.(w/lab)	4	Mechanical System Dyn.	3
Transfer Processes I	2	EE Networks I*	2
Total	16	Total	15

FOURTH YEAR

General Ed	3	Health and Wellness	3
Sr. Eng Clinic I	3	Sr. Eng Clinic II	3
Science/Math Elective	4	Approved Maj. Elec. II	3
Approved Maj. Elec. I	3	Approved Maj. Elec. III	3
EE Electronics I	2	Technical Elec.	3
Total	15	Total	15

Total credits for the program 132

ORIGINAL
MECHANICAL ENGINEERING PROGRAM

FIRST YEAR

Composition I	3	Public Speaking	3
Engineering Workshop	1	Engineering Workshop	1
Calculus I	4	Calculus II	4
Intro Engineering Analysis	3	Comp II: Technology Focus	3
Chemistry I	4	Physics I (Mechanics/Dynam)	4
Health/Physical Education (either semester)			3
Total Units for 1st Year			33

SECOND YEAR

General Education Course	3	General Education Course	3
Computer Science & Programming	4	Differential Eqs/Systems	4
Physics II (E&M)	4	Engineering Materials	3
Sophomore Project Lab	2	Sophomore Project Lab	2
Engineering Workshop	1	Engineering Workshop	1
Solid Mechanics (Core 1)	3	Dynamics	3
Total units	17	Total units	16

THIRD YEAR

General Education Course	3	General Education Course	3
Microeconomics or Clinic ¹	3	Clinic ¹ or Microeconomics	3
Engineering Thermo (Core 2)	3	Advanced Engineering Math	3
Mech Design & Synthesis (w/lab)	4	Fluid Mechanics (Core 4)	3
Elect & Electron Ckts & Dev(Core 3)	3	Mechanical System Dynamics	3
		General Education Course	3
Total Units	16	Total Units	18

FOURTH YEAR

General Education Course	3	General Education Course	3
Clinic ¹	3	Clinic ¹	3
Transfer Processes	3	Approved Major Elective	3
Mathematics/Science Elective	3	Approved Major Elective	3
Approved Major Elective	3	Technical Elective ²	3
General Education Course	3		
Total units	18	Total units	15

Total units for four years: 133

Notes: 1. To be proposed as a writing intensive course. 2. Must be chosen from a field outside Mechanical Engineering.

Consultations:

The School of Engineering has consulted with numerous members of the faculty and administration. In addition, the School of Engineering has presented its curriculum proposal to the Senate Curriculum Committee and the Liberal Arts and Sciences Chairpersons Committee. The following members of the faculty and administration have been consulted directly. Written consultations are attached.

Dr. Pearl Bartelt
Dr. Robert Newland
Dr. Don Stone
Dr. Ben Hitchner
Dr. Dick Scott
Dr. Gary Itzkowitz
Dr. Janice Rowan
Dr. David Cromie
Dr. Ed. Streb



ROWAN

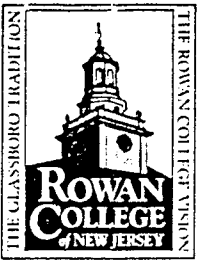
To: Curriculum Committee
From: Robert Newland, Chairperson
Subject: General education in the engineering programs
Date: April 5, 1996

The Department of Chemistry and Physics supports the Engineering School's proposed change in the general education requirements for their students. The curriculum of each discipline has been difficult to construct while meeting the major goals. Each discipline must meet ABET accreditation requirements so that the graduates will meet certification requirements. This task dictates a great many hours of instruction in each discipline and in chemistry, physics, mathematics and other supporting areas. Some of us were involved in this part of the process and were impressed with how quickly the number of semester hours added up. The curriculum must also train graduates to prepare for the flexible nature of the engineering environment. This latter goal is not a simple one to meet. The faculty has been particularly clever to meet this goal by devising a series of experiences beginning in the freshman year. The clinics that have been developed give the students a taste of engineering their first semester. This is not common in engineering curricula. These clinics also provide many other useful and general experiences. Problems are attacked, solutions sought, papers written and presented. The engineers have worked with the Communications' faculty to fold Composition II and Public Speaking into the first four of these clinics. Thus, engineering students take the traditional Composition I and get the other six communications credits in this integrated fashion.

ABET speaks to the issue of general education and calls for both breadth and depth and specifies that this be accomplished in 16 semester hours. In fact they specify that "the courses selected [in humanities and social sciences] must provide both breadth and depth and not be limited to a selection of unrelated introductory courses." Our current general education model is contradictory to this goal since it does not only permit the selection of a group of unrelated introductory courses but encourages this action. Our current requirement is 24 semester hours in the humanities and social sciences and even with that many hours it would be difficult to say we attain this goal of breadth and depth.

Engineering curricula are rigorous. Each of the engineering fields we have targeted has lead to curricula with over 130 semester hours assuming the full general education requirements are met. The other curricula on this campus which lead to a BS Degree have from 120 to 128 semester hours of credits. The engineering load is so high because of the ABET requirements combined with our general education requirements and the innovations that have been devised. Clearly these program are going to be very difficult to complete in four years by even the very best students. And yet we must market these programs as four year programs and of course see that students can be successful in them.

The conclusion we draw from all this is that something must give. It will certainly not be ABET and we do not want it to be the curricular innovations that have been built in so it has to be general education.



Rowan College of New Jersey

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Computer Science Department

To: C. Stewart Slater, School of Engineering Curriculum Committee
From: Don Stone, Chair, Computer Science Department *Don Stone*
Date: April 16, 1996
Re: Proposed engineering curricula

I want to commend you and the engineering curriculum committee for your work on the proposed engineering curricula. I think you have done an excellent job in fleshing out various innovative ideas of the National Advisory Council and in handling a set of almost contradictory constraints on the new programs. In particular, given the goals of the programs and the accreditation requirements that they must meet, I think that the proposed General Education requirements are plausible.

I strongly support the proposed engineering curricula. I think they will serve our engineering students (and their potential employers) well.



Rowan College of New Jersey

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Department of Economics

March 28, 1996

Dr. James Tracey
Dean, School of Engineering
Campus

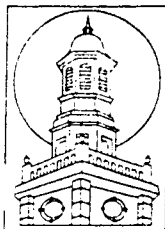
Dear Dr. Tracey:

The Department of Economics discussed the question of our recommendation of Introduction to Macroeconomics or Introduction to Microeconomics for the engineering curriculum at its meeting, March 27. It was unanimously resolved that the Department of Economics recommends Introduction to Microeconomics. So the Economics Department supports the the Engineering Curriculum Committee Summary Report which includes Microeconomics Thank you.

Yours truly,

Ben Hitchner
Ben Hitchner,
Chair

cc: Dean Bartelt



ROWAN

School of Liberal Arts and Sciences

Office of the Dean

(609) 256-4850

Fax: (609) 256-4921

MEMORANDUM

TO: James H. Tracey, Dean
School of Engineering

FROM: Pearl W. Bartelt, Dean

DATE: March 28, 1996

SUBJECT: General Education - Engineering

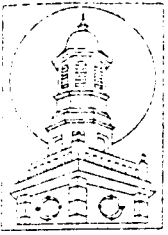
The general education recommendations proposed by the Engineering Curriculum Committee have been the major agenda item of the past three meetings of the Liberal Arts and Sciences chairpersons.

At the meeting today a motion was made and seconded that the School Liberal Arts and Sciences support the general education model for a specialized degree in Engineering which includes 3 semester hours of communications, 9 semester hours of social/behavioral sciences, 6 semester hours of history/humanities/language, and 3 semester hours of arts. The motion included the statement that the School of Engineering work out procedures with the Communications Department regarding College Composition II and Speech.

The vote of the above motion was: 7 for, 6 against, 1 abstention

When the curriculum reaches the Curriculum Committee, chairpersons and department members will be free to state their individual opinions.

c. C. Matteson
R. Czochoz
Chairpersons, Liberal Arts and Sciences



ROWAN

May 3, 1996

Dr. Stu Slater
School of Engineering
Rowan College of New Jersey
Glassboro, NJ 08012

Dear Dr. Slater:

I am writing to express my support for the curriculum proposals that the School of Engineering now has before the Curriculum Committee. As a former member of the Engineering Advisory Committee and a faculty member who has followed the proposal's progress quite closely, I know that the effort that you and your colleagues have put into forming the curriculum for the new school has been remarkable.

The opportunity to develop a new program without the inertia characteristic of programs that have been in place for a while is unusual. Even more rare is the opportunity to carry out such development with the support and resources available at Rowan. I admire the way you have attacked this task looking far and wide for new and better ways of doing things and yet attempting, to the degree possible, to fit your program into the structure existing at Rowan.

The result of this effort is now before us and I want to congratulate you on the development of a curriculum that requires students to work across the engineering disciplines. I believe that the curriculum has the potential of creating graduates with enough specialization to get a running start in their careers. At the same time the focus on cross disciplinary collaborative learning and problem solving will provide the critical thinking and problem solving skills that will serve these graduates as they move into a future of rapid and accelerating technical change that will require the solution of problems we can not now foresee.

I offer my support, my help, and best wishes for success.

Sincerely yours,

Richard A. Scott, Ph.D.
Professor and Chairperson of Geography and Anthropology



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Mathematics Department

April 22, 1996

T. R. Chandrupatla
School of Engineering
Library

Dear TR,

As Chair of the Mathematics Department I have gone over the engineering curriculum and heartily support it. I think I can state on behalf of all of the Math Faculty that we are looking forward to the Fall semester and the first Freshman Engineering class.

Best wishes,

Gary Itzkowitz

GI\bc

c: Ron Czocho