

UNIVERSITY FACULTY SENATE FORMS

Academic Program Approval

This form is a routing document for the approval of new and revised academic programs. Proposing department should complete this form. For more information, call the Faculty Senate Office at 831-2921.

Submitted by: Paul T. Imhoff phone number X0541

Department: Civil and Environmental Engineering email address imhoff@udel.edu

Date: 4/1/2011

Action: change in curriculum for Bachelor of Environmental Engineering

(Example: add major/minor/concentration, delete major/minor/concentration, revise major/minor/concentration, academic unit name change, request for permanent status, policy change, etc.)

Effective

term 12F
(use format 04F, 05W)

Current degree Bachelor of Environmental Engineering
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

Proposed change leads to the degree of: Bachelor of Environmental Engineering
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

Proposed name: name of major remains same. One new concentration within the major is proposed – Environmental Biological and Chemical Processes
Proposed new name for revised or new major / minor / concentration / academic unit
(if applicable)

Revising or Deleting:

Undergraduate major / Concentration: Environmental Engineering/ Environmental Facilities Design and Construction; Environmental Engineering/ Contaminant Transport and Control Processes; Environmental Engineering/ Environmental Engineering Biotechnology; Environmental Engineering/ Water Resources and Water Quality
(Example: Applied Music – Instrumental degree BMAS)

Undergraduate minor: _____
(Example: African Studies, Business Administration, English, Leadership, etc.)

Graduate Program Policy statement change: _____
(Must attach your Graduate Program Policy Statement)

Graduate Program of Study: _____
(Example: Animal Science: MS Animal Science: PHD Economics: MA Economics: PHD)

Graduate minor / concentration: _____

Note: all graduate studies proposals must include an electronic copy of the Graduate Program Policy Document, highlighting the changes made to the original policy document.

List new courses required for the new or revised curriculum. How do they support the overall program objectives of the major/minor/concentrations)?

(Be aware that approval of the curriculum is dependent upon these courses successfully passing through the Course Challenge list. If there are no new courses enter “None”)

No new courses.

Explain, when appropriate, how this new/revised curriculum supports the 10 goals of undergraduate education: <http://www.ugs.udel.edu/gened/>

Identify other units affected by the proposed changes:

(Attach permission from the affected units. If no other unit is affected, enter “None”)

The proposed changes will affect the Department of Chemistry and Biochemistry. An email from the Associate Chair of this Department, John Burmeister, gives us permission to make the proposed changes and is shown in the attachment to the memo to Michael Keefe and Michael Vaughn, Co-Chairs, College of Engineering Educational Activities Committee.

Describe the rationale for the proposed program change(s):

(Explain your reasons for creating, revising, or deleting the curriculum or program.)

The reasons for the proposed program changes are described in the attached memo to Michael Keefe and Michael Vaughn, Co-Chairs, College of Engineering Educational Activities Committee.

Program Requirements:

(Show the new or revised curriculum as it should appear in the Course Catalog. If this is a revision, be sure to indicate the changes being made to the current curriculum and **include a side-by-side comparison** of the credit distribution before and after the proposed change.)

The existing and proposed curricula are shown in the attachment to the memo to Michael Keefe and Michael Vaughn, Co-Chairs, Educational Activities Committee. All changes are highlighted in yellow. Changes include the removal of two existing concentrations in environmental engineering and the addition of one new concentration.

ROUTING AND AUTHORIZATION: (Please do not remove supporting documentation.)

Department Chairperson _____ Date _____

Dean of College _____ Date _____

Chairperson, College Curriculum Committee _____ Date _____

Chairperson, Senate Com. on UG or GR Studies _____ Date _____

Chairperson, Senate Coordinating Com. _____ Date _____

Secretary, Faculty Senate _____ Date _____

Date of Senate Resolution _____ Date to be Effective _____

Registrar _____ Program Code _____ Date _____

Vice Provost for Academic Affairs & International Programs _____ Date _____

Provost _____ Date _____

Board of Trustee Notification _____ Date _____

Revised 02/09/2009 /khs

Memorandum



April 1, 2011

TO: Michael Keefe and Michael Vaughn, Co-Chairs, College of Engineering Educational Activities Committee

FROM: Paul T. Imhoff, Dept. Of Civil and Environmental Engineering

RE: Proposed revisions to Bachelor's Degree in Environmental Engineering

The College of Engineering Educational Activities Committee (EAC) reviewed proposed changes to the undergraduate major in environmental engineering in November 2010. In that proposal we recommend combining two of our four existing concentrations, the concentrations in *Contaminant Transport and Control* and *Environmental Biotechnology*, into a new concentration *Environmental Biological and Chemical Processes*. This change was proposed because of the small number of students in recent years enrolled in both concentrations, the difficulty scheduling courses for four separate concentrations, particularly as program enrollment increases, and feedback from students and alumni regarding the number of concentrations.

Two concerns were raised in the November EAC meeting. First, the organic chemistry course proposed in the concentration *Environmental Biological and Chemical Processes* was at too high of a level for students taking the standard CHEM 103/104 sequence. We addressed this concern by changing the recommended organic chemistry courses from CHEM 331/333 (4 credits) to CHEM 321 (4 credits), as recommended by Professor John Burmeister of the Department of Chemistry and Biochemistry. While CHEM 321 is taught at a lower level than CHEM 331/333, the content of these courses is comparable and will cover the content needed by students.

The second concern was that when combining the two concentrations we eliminated CHEG 342 Heat and Mass Transfer as a required course. Because of the need to maintain 125 total credits for each concentration, it was necessary to eliminate four previously required courses: three from the concentration in *Contaminant Transport and Control* and three from *Environmental Biotechnology*. We believe all of the proposed courses in the new *Environmental Biological and Chemical Processes* are essential for student training and satisfying ABET requirements. We are reluctant to eliminate any other courses to make room for CHEG 342. Instead, students in

Environmental Biological and Chemical Processes will be encouraged to consider CHEG 342 as a technical elective.

We are submitting a revised proposal to the College of Engineering EAC that is attached. The first page describes the proposed curriculum changes followed by justification for the changes. Appended to this memorandum is a revised description for this major that would appear in the Undergraduate Catalog should the changes be approved, followed by a side-by-side comparison of the current and proposed curricula, with changes highlighted in yellow. Following this comparison is an email from Professor John Burmeister, Associate Chair Department of Chemistry and Biochemistry, allowing environmental engineering students into the Chemistry courses proposed in the new concentration.

Please contact me with any questions about our proposal.

Proposed Curriculum Changes for Bachelor of Science Degree in Environmental Engineering

The Department of Civil and Environmental Engineering proposes that the concentrations of *Contaminant Transport and Control* and *Environmental Biotechnology* for the Bachelor of Science Degree in Environmental Engineering be combined to form the new concentration *Environmental Biological and Chemical Processes*.

This new concentration differs from the previous concentrations in *Contaminant Transport and Control* and *Environmental Biotechnology* as follows:

1. **Computer Applications Elective removed:** In the previous concentrations a Computer Elective could be selected from either of the following: FREC 480 Geographic Information Systems in Natural Resource Management (GIS, 4 credits) or BREG 209 Technical and Computer Aided Drafting (AutoCAD, 3 credits). This elective was removed.
2. **CIEG 436 Recycling and Waste Management removed:** This was a 3-credit required course in both concentrations.
3. **PLSC 319 Environmental Soil Microbiology removed:** This was a 4-credit required course for the concentration in *Environmental Biotechnology*.
4. **CHEG 342 Heat and Mass Transfer removed:** This was a 3-credit required course for the concentration in *Contaminant Transport and Control*.
5. **CHEM 527 Introduction to Biochemistry replaces CHEM 342 Introduction to Biochemistry.** CHEM 342 was a 3-credit required course for the concentration in *Environmental Biotechnology*.
6. **CHEM 321 Organic Chemistry replaces CHEM 331/333 Organic Chemistry and Organic Chemistry Majors Laboratory I.** Because most students in our curriculum take CHEM 103/104, the Department of Chemistry and Biochemistry recommends CHEM 321 as a more appropriate course than CHEM 331/333.

These proposed changes stem from careful assessment of our existing curriculum in light of the revised ABET criteria for environmental engineering programs and input from environmental faculty, alumni, and current students in the program. Below the justifications for the revisions summarized above are presented. Appended to this document is the complete tabulation of the curriculum as it should appear with the enactment of these revisions. Following this tabulation are emails from those departments affected by our curriculum changes approving the proposed revisions.

1. Combine two existing concentrations (*Contaminant Transport and Control* and *Environmental Biotechnology*) to create a new concentration *Environmental Biological and Chemical Processes*.

With increasing enrollments in the environmental engineering program, it has become more difficult to schedule required courses for the four concentrations while preventing course conflicts. The challenge of managing four concentrations for the bachelors program in environmental engineering was raised as a potential problem in the previous ABET review of the program. While this was not a significant issue five years ago, it has now become a problem with our larger enrollments. More students in the program make it more difficult to adjust course times such that all students can attend the required courses in their chosen concentration.

Program review meetings with alumni from the environmental engineering program and graduating seniors in 2009 and 2010 have shown alumni and student willingness to reduce the number of concentrations. Environmental engineering faculty reviewed this input in their November 2010 meeting. An assessment of student enrollments at this meeting indicated that greater than 80% of students have selected the *Environmental Facilities Design and Construction* and *Water Resources and Water Quality* concentrations in the last five years. Given the much lower enrollments in *Contaminant Transport and Control* and *Environmental Biotechnology*, environmental faculty recommended that these be combined into the new concentration in *Environmental Biological and Chemical Processes* described below.

2. Remove Computer Applications Course in new concentration.

The current curriculum requires a computer applications course for all four concentrations. We propose to remove this requirement in the new *Environmental Biological and Chemical Processes* concentration. In the existing curriculum this computer elective could be FREC 480 Geographic Information Systems in Natural Resource Management (GIS, 4 credits) or BREG 209 Technical and Computer Aided Drafting (AutoCAD, 3 credits). While training in one of these computer applications is important for *Environmental Facilities Design and Construction* and *Water Resources and Water Quality*, such training is much less important for students focusing on *Environmental Biological and Chemical Processes*. Because of the desire to include other courses in this concentration, we propose that the required Computer Applications course be removed.

3. Remove CIEG 436 Recycling and Waste Management in new concentration.

In the current curriculum, CIEG 436 is required for all four concentrations. The new ABET requirements for environmental engineering programs are less prescriptive than previous requirements. There is no longer an explicit requirement for students to have abilities to critically analyze and interpret data in solid waste management. Thus, there is no longer a need to require our students to take this course. Because of the desire to include other courses in the new *Environmental Biological and Chemical Processes* concentration, we propose that CIEG 436 be removed as a required course.

4. Remove PLSC 319 Environmental Microbiology and CHEG 342 Heat and Mass Transfer.

In the current curriculum, CHEG 342 Heat and Mass Transfer and PLSC 319 Environmental Microbiology are required courses in the *Contaminant Transport and Control* and *Environmental Biotechnology* concentrations, respectively. To combine the two concentrations and keep 125 credit hours, three courses must be removed from each concentration. The Computer Applications course and CIEG 436 are common to both concentrations and are recommended for removal, based on the justifications presented above. One additional course must be removed from each concentration, and environmental faculty deem CHEG 342 and PLSC 319 the least important of the remaining required courses in the *Contaminant Transport and Control* and *Environmental Biotechnology* concentrations, respectively. Thus, we recommend these courses not be included in the new *Environmental Biological and Chemical Processes* concentration.

5. CHEM 527 Introduction to Biochemistry replaces CHEM 342 Introduction to Biochemistry.

In the current *Environmental Biotechnology* concentration, CHEM 342 is the introductory biochemistry course. A primary goal of CHEM 342 is for students to “gain an understanding of what a biochemist does” and “perspective on the history of biochemistry.” On the other hand, CHEM 527 is more rigorous with a goal of providing “a one-semester survey of the fundamentals of biochemistry.” CHEM 527 is required for biology, chemistry, and chemical engineering undergraduates. Because students in the new *Environmental Biological and Chemical Processes* concentration will have the required background and prerequisites for CHEM 527 and since this course will provide a more rigorous introduction to biochemistry, we recommend CHEM 527 replace CHEM 342 in the new concentration.

6. CHEM 321 Organic Chemistry replaces CHEM 331/333 Organic Chemistry and Organic Chemistry Majors Laboratory I.

In the current *Environmental Biotechnology* concentration, CHEM 331/333 is the required organic chemistry course sequence. However, the Department of Chemistry and Biochemistry, recommends that students with CHEM 103/104 training take CHEM 321 instead for organic chemistry. While the topics covered in the 4-credit CHEM 321 are comparable to those in CHEM 331 (3 credits) and CHEM 333 (1 credit), students taking the CHEM 331/333 sequence are recommended to have CHEM 111/112/220/221 as prerequisites. Based on recommendations from Professor John Burmeister of the Department of Chemistry and Biochemistry, we propose replacing CHEM 331/333 with CHEM 321. Students entering the program with strong chemistry backgrounds will be encouraged to take the CHEM 111/112/220/221/331/333 sequence, which includes higher level introductory chemistry and the CHEM 331/333 sequence.

Revised Description of Environmental Engineering Curriculum in Catalog

Telephone: (302) 831-2442

(302) 831-2442

<http://www.ce.udel.edu>

Faculty Listing: <http://www.ce.udel.edu/directories/faculty.html>

The Civil and Environmental Engineering Department offers programs which lead to the degrees of Bachelor of Civil Engineering and Bachelor of Environmental Engineering, both with Honors Degree options, as well as minors in Civil Engineering and Environmental Engineering.

Traditionally, civil engineering has been identified with the planning and design of constructed facilities such as dams, bridges, buildings, roads, waterways, and tunnels. Modern civil engineering now addresses larger segments of societal infrastructure such as mass transportation systems, water resource exploration and management, environmental protection, coastal management, and off-shore structures. The Civil Engineering curriculum includes specialization options in structural engineering, geotechnical engineering, environmental engineering, hydraulic and ocean engineering, and transportation and construction engineering as shown by the listed Technical Electives.

The Educational Objectives of the Civil Engineering degree program are as follows:

1. Graduates will be prepared with a solid foundation in mathematics, sciences, and technical skills needed to analyze and design civil infrastructure systems.
2. Graduates will possess strong written, oral, and graphical communications skills, and will be able to function on multi-disciplinary teams.
3. Graduates will be familiar with current and emerging socioeconomic issues and the global context in which civil engineering is practiced.
4. Graduates will have an understanding of professional ethics and their societal responsibilities as a practicing engineer.
5. Graduates will have the ability to obtain professional licensure, will recognize the need for engaging in life-long learning, and will have the ability to assume leadership roles in and outside of the profession.
6. Graduates will have the necessary qualifications for employment in civil engineering and related professions and for entry into advanced studies.

Areas concerned with pollution control, water supply, and water resource management are now considered to comprise the distinct discipline of Environmental Engineering. The Environmental Engineering curriculum is focused on environmental facilities design and construction; chemical, biological and microbial aspects of contaminant behavior in natural and engineered systems; and providing, maintaining, and improving the supply and quality of surface and groundwaters.

The Educational Objectives of the Environmental Engineering degree program are as follows:

1. Graduates will be prepared with a solid foundation in mathematics, sciences, and technical skills needed to analyze and design environmental engineering systems.
2. Graduates will possess strong written and oral communications skills.
3. Graduates will be familiar with current and emerging environmental engineering and global issues, and have an understanding of ethical and societal responsibilities.
4. Graduates will have the ability to obtain professional licensure, and will recognize the need for engaging in life-long learning.
5. Graduates will have the necessary qualifications for employment in environmental engineering and related professions, for entry into advanced studies, and for assuming eventual leadership roles in their professions.

DEPARTMENTAL POLICES

In general, 300- and 400-level CIEG courses are open only to students majoring in civil or environmental engineering. Students who have declared a civil engineering or an environmental engineering minor and students enrolled in other departments of the College of Engineering may be enrolled in 300- and 400-level courses with the approval of their home department advisor. In some instances, other students may be permitted to enroll in selected 300 and 400-level courses, but they must have the permission of both the course instructor and the chair of the Civil and Environmental Engineering Department.

The Department has developed standards that require minimum grades in certain courses. These standards are intended to promote success in the sequential development of the curriculum. The requirements for the civil and environmental engineering majors are as follows:

CIVIL ENGINEERING

- A minimum grade of C- in [MATH 241](#) and [MATH 242](#)
- A minimum grade of C- in [CHEM 103](#).
- A minimum grade of C- in [PHYS 207](#).

ENVIRONMENTAL ENGINEERING

- A minimum grade of C- in [MATH 241](#), [MATH 242](#), and [MATH 243](#)
- A minimum grade of C- in [CHEM 111](#) and [CHEM 112](#) or [CHEM 103](#) and [CHEM 104](#)
- A minimum grade of C- in [PHYS 207](#)
- A minimum grade of C- in [CIEG 233](#)

BACHELOR OF CIVIL ENGINEERING - CIVIL ENGINEERING

TECHNICAL ELECTIVES

HONORS BACHELOR OF CIVIL ENGINEERING

MINOR IN CIVIL ENGINEERING

BACHELOR OF ENVIRONMENTAL ENGINEERING: ALL CONCENTRATIONS

TECHNICAL ELECTIVES FOR CONCENTRATIONS

HONORS BACHELOR OF ENVIRONMENTAL ENGINEERING

MINOR IN ENVIRONMENTAL ENGINEERING

4+1 BACHELOR OF CIVIL ENGINEERING / MASTER OF CIVIL ENGINEERING and 4+1 BACHELOR OF ENVIRONMENTAL ENGINEERING / MASTER OF CIVIL ENGINEERING

UNIVERSITY, COLLEGE, AND MAJOR REQUIREMENTS FOR ALL ENVIRONMENTAL ENGINEERING BACHELORS DEGREE CONCENTRATIONS

CURRICULUM

CREDITS

Superior figures indicate year (1 = freshman, 2 = sophomore, 3 = junior, 4 = senior) and semester (F = fall, S = spring) in which the course should be taken.

UNIVERSITY REQUIREMENTS

ENGL 110	Critical Reading and Writing (minimum grade C-)	3
First Year Experience	(FYE)	0-4
Breadth Requirements		12
Discovery Learning Experience	(DLE)	3
Multi-cultural Courses		3

COLLEGE REQUIREMENTS

Breadth Requirements 21

The College of Engineering requires 21 total credits, which includes 9 additional credits above and beyond the 12 University Breadth Requirement credits. Coursework may include courses from the University Breadth Requirement list and the [College of Engineering Supplemental Course list](#). See [College of Engineering Breadth Requirements](#) for a detailed description. For timely progress toward degree completion, 3 credits must satisfy the University Multicultural Requirement. All courses must be passed with a minimum grade of C-.

MAJOR REQUIREMENTS

Core Courses for the Major:

ENGL 410	Technical Writing	3 ^{2F}
MATH 241	Analytic Geometry and Calculus A	4 ^{1F}
MATH 242	Analytic Geometry and Calculus B	4 ^{1S}
MATH 243	Analytic Geometry and Calculus C	4 ^{2F}
MATH 351	Engineering Math I	3 ^{2S}
PHYS 207	Fundamentals of Physics	4 ^{1S}
BISC 207	Introductory Biology I	4 ^{2S}
CISC 106	General Computer Science for Engineers	3 ^{1F}
CHEG 231	Chemical Engineering Thermodynamics	3 ^{3F}
EGGG 101	Introduction to Engineering	2 ^{1F}
CIEG 211	Statics	3 ^{2F}
CIEG 233	Environmental Engineering Processes	3 ^{2F}
CIEG 305	Fluid Mechanics	3 ^{3F}
CIEG 306	Fluid Mechanics Laboratory	1 ^{3S}
CIEG 315	Probability and Statistics for Engineers	3 ^{3S}
CIEG 337	Environmental Engineering Laboratory	3 ^{3S}
CIEG 434	Air Pollution Control	3 ^{4S}
CIEG 437	Water & Wastewater Quality	3 ^{4S}
CIEG 438	Water and Wastewater Engineering	3 ^{3F}
CIEG 440	Water Resources Engineering	3 ^{3F}
CIEG 461	Senior Design Project	4 ^{4F,S}

Beyond these core courses, one of the three concentrations listed below must also be chosen (see curricula at bottom of page.):

- Environmental Biological and Chemical Processes
- Environmental Facilities Design and Construction
- Water Resources and Water Quality

Each concentration also requires additional technical elective courses to provide the desired focus at the intermediate and advanced levels. Beyond the set of specific core technical electives for the concentration, the remaining technical electives can then be chosen to further pursue this direction of study, or to provide a more diversified environmental engineering education. All technical electives must be upper level courses in engineering, the sciences, computer science, or mathematics and approved by a faculty advisor.

The chemistry courses and the core technical electives are listed below for each concentration.

CREDITS TO TOTAL A MINIMUM OF

125

BACHELOR OF ENVIRONMENTAL ENGINEERING - ENVIRONMENTAL
ENGINEERING (ENVIRONMENTAL BIOLOGICAL AND CHEMICAL PROCESSES)

BACHELOR OF ENVIRONMENTAL ENGINEERING - ENVIRONMENTAL
ENGINEERING (ENVIRONMENTAL FACILITIES DESIGN AND CONSTRUCTION)

BACHELOR OF ENVIRONMENTAL ENGINEERING - ENVIRONMENTAL
ENGINEERING (WATER RESOURCES AND WATER QUALITY)

DEGREE: BACHELOR OF ENVIRONMENTAL ENGINEERING
MAJOR: ENVIRONMENTAL ENGINEERING
**CONCENTRATION: ENVIRONMENTAL BIOLOGICAL AND CHEMICAL
PROCESSES**

Chemical, biological and microbial aspects of contaminant behavior in natural and engineered systems.

CURRICULUM

CREDITS

See University and College requirements.

<u>CHEM 103</u> **	General Chemistry	4
<u>CHEM 104</u> **	General Chemistry	4
<u>CHEM 321</u> **	Organic Chemistry	4
<u>BISC 300</u>	Introduction to Microbiology	4
<u>CHEM 443</u>	Physical Chemistry I	3
<u>CHEM 527</u>	Introduction to Biochemistry	3
<u>CHEG 325</u>	Thermodynamics II	3
<u>CHEG 332</u>	Chemical Engineering Kinetics	3
Additional technical electives, including 3 cr. of engineering topics and 3 cr. of earth science*		10

*Advisor should be consulted to ensure that the engineering topic and earth science requirement is met through appropriate technical electives.

**Students with sufficient Chemistry background should replace these courses with CHEM 111/112/220/221/331/333.

DEGREE: BACHELOR OF ENVIRONMENTAL ENGINEERING
MAJOR: ENVIRONMENTAL ENGINEERING
CONCENTRATION: ENVIRONMENTAL FACILITIES DESIGN AND CONSTRUCTION

Engineering and constructing the systems for air, water, and wastewater purification.

CURRICULUM

CREDITS

[See University and College requirements.](#)

<u>CHEM 103</u>	General Chemistry	4
<u>CHEM 104</u>	General Chemistry	4
<u>CIEG 212</u>	Solid Mechanics	3
<u>CIEG 213</u>	Civil Engineering Materials Lab	1
<u>CIEG 301</u>	Structural Analysis	4
<u>CIEG 302</u>	Structural Design	4
<u>CIEG 320</u>	Soil Mechanics	3
<u>CIEG 323</u>	Soil Mechanics Laboratory	1
<u>CIEG 436</u>	Processing, Recycling, Management of Solid Waste	3
Computer Elective	(one of the following two courses must be taken)	
<u>BREG 209</u>	Technical and Computer Aided Drafting	3
<u>FREC 480</u>	Geographic Info Systems in Natural Resource Mgmt	4
Additional technical electives, including 3 cr. of Earth Science*		8

*Advisor should be consulted to ensure that the Earth Science requirement is met through an appropriate technical elective.

DEGREE: BACHELOR OF ENVIRONMENTAL ENGINEERING
MAJOR: ENVIRONMENTAL ENGINEERING
CONCENTRATION: WATER RESOURCES AND WATER QUALITY

Technical issues associated with providing, maintaining, and improving the supply and quality of surface and groundwaters.

CURRICULUM

CREDITS

[See University and College requirements.](#)

<u>CHEM 103</u>	General Chemistry	4
<u>CHEM 104</u>	General Chemistry	4
<u>EGTE 321</u>	Storm Water Management	4
<u>CIEG 436</u>	Processing, Recycling, Management of Solid Waste	3
<u>CIEG 468</u>	Principles of Water Quality Criteria	3
<u>CIEG 498</u>	Groundwater Flow and Contaminant Transport	3
<u>CIEG 430</u>	Water Quality Modeling	3
Computer Elective	(one of the following two courses must be taken)	
<u>BREG 209</u>	Technical and Computer Aided Drafting	3
<u>FREC 480</u>	Geographic Info Systems in Natural Resource Mgmt	4
Additional technical electives		11

Current		Revised	
DEGREE: BACHELOR OF ENVIRONMENTAL ENGINEERING		DEGREE: BACHELOR OF ENVIRONMENTAL ENGINEERING	
MAJOR: ENVIRONMENTAL ENGINEERING		MAJOR: ENVIRONMENTAL ENGINEERING	
CURRICULUM	CREDITS	CURRICULUM	CREDITS
Superior figures indicate year (1 = freshman, 2 = sophomore, 3 = junior, 4 = senior) and semester (F = fall, S = spring) in which the course should be taken.		Superior figures indicate year (1 = freshman, 2 = sophomore, 3 = junior, 4 = senior) and semester (F = fall, S = spring) in which the course should be taken.	
UNIVERSITY REQUIREMENTS		UNIVERSITY REQUIREMENTS	
ENGL 110 Critical Reading and Writing (minimum grade C-)	3	ENGL 110 Critical Reading and Writing (minimum grade C-)	3
First Year Experience (FYE)	0-4	First Year Experience (FYE)	0-4
Breadth Requirements	12	Breadth Requirements	12
Discovery Learning Experience (DLE)	3	Discovery Learning Experience (DLE)	3
Multi-cultural Courses	3	Multi-cultural Courses	3
Major Requirements		Major Requirements	
Breadth Requirements	21	Breadth Requirements	21
The College of Engineering requires 21 total credits, which includes 9 additional credits above and beyond the 12 University Breadth Requirement credits. Coursework may include courses from the University Breadth Requirement list and the College of Engineering Supplemental Course list. See College of Engineering Breadth Requirements for a detailed description. For timely progress toward degree completion, 3 credits must satisfy the University multi-cultural requirement. All courses must be passed with a minimum grade of C-.		The College of Engineering requires 21 total Breadth Requirement credits (essentially 9 credits in addition to the University Breadth Requirement.) If chosen carefully, up to 3 credits from each of the University Breadth Requirement categories may be used to simultaneously satisfy the College of Engineering Breadth Requirements for this major. Of the 21 credits, 6 credits must be at the Upper Level (usually 300-level or higher) as designated on the College of Engineering Breadth Requirement list. Of the 21 credits, 3 credits may be used to satisfy the University Multicultural Requirement (recommended for timely progress toward degree completion.) All Breadth Requirement coursework must be passed with a minimum grade of C-.	
Core Courses for the Major		Core Courses for the Major	
ENGL 410 Technical Writing	3 ^{2F}	ENGL 410 Technical Writing	3 ^{2F}
MATH 241 Analytic Geometry and Calculus A	4 ^{1F}	MATH 241 Analytic Geometry and Calculus A	4 ^{1F}
MATH 242 Analytic Geometry and Calculus B	4 ^{1S}	MATH 242 Analytic Geometry and Calculus B	4 ^{1S}
MATH 243 Analytic Geometry and Calculus C	4 ^{2F}	MATH 243 Analytic Geometry and Calculus C	4 ^{2F}
MATH 351 Engineering Math I	3 ^{2S}	MATH 351 Engineering Math I	3 ^{2S}
PHYS 207 Fundamentals of Physics	4 ^{1S}	PHYS 207 Fundamentals of Physics	4 ^{1S}
BISC 207 Introductory Biology I	4 ^{2S}	BISC 207 Introductory Biology I	4 ^{2S}
CISC 106 General Computer Science for Engineers	3 ^{1F}	CISC 106 General Computer Science for Engineers	3 ^{1F}
CHEG 231 Chemical Engineering Thermodynamics	3 ^{3F}	CHEG 231 Chemical Engineering Thermodynamics	3 ^{3F}
Computer Elective (one of the following two courses must be taken)		EGGG 101 Introduction to Engineering	2 ^{1F}
BREG 209 Technical and Computer Aided Drafting	3 ^{2S}	CIEG 211 Statics	3 ^{2F}
FREC 480 Geographic Info Systems in Natural Resource Mgmt	4 ^{2S}	CIEG 233 Environmental Engineering Processes	3 ^{2F}
EGGG 101 Introduction to Engineering	2 ^{1F}	CIEG 305 Fluid Mechanics	3 ^{3F}
CIEG 211 Statics	3 ^{2F}	CIEG 306 Fluid Mechanics Laboratory	1 ^{3S}
CIEG 233 Environmental Engineering Processes	3 ^{2F}	CIEG 315 Probability and Statistics for Engineers	3 ^{3S}

CIEG 305 Fluid Mechanics	3 ^{3F}		CIEG 337 Environmental Engineering Laboratory	3 ^{3S}
CIEG 306 Fluid Mechanics Laboratory	1 ^{3S}		CIEG 434 Air Pollution Control	3 ^{4S}
CIEG 315 Probability and Statistics for Engineers	3 ^{3S}		CIEG 437 Water & Wastewater Quality	3 ^{4S}
CIEG 337 Environmental Engineering Laboratory	3 ^{3S}		CIEG 438 Water and Wastewater Engineering	3 ^{3F}
CIEG 434 Air Pollution Control	3 ^{4S}		CIEG 440 Water Resources Engineering	3 ^{3F}
CIEG 436 Processing, Recycling, Management of Solid Waste	3 ^{4F}		CIEG 461 Senior Design Project	4 ^{4F,S}
CIEG 437 Water & Wastewater Quality	3 ^{4S}			
CIEG 438 Water and Wastewater Engineering	3 ^{3F}			
CIEG 440 Water Resources Engineering	3 ^{3F}			
CIEG 461 Senior Design Project	4 ^{4F,S}			
Beyond these core courses, one of the four concentrations listed below must also be chosen (see curricula at bottom of page):			Beyond these core courses, one of the three concentrations listed below must also be chosen (see curricula at bottom of page):	
Contaminant Transport and Control Processes			Environmental Biological and Chemical Processes	
Environmental Facilities Design and Construction			Environmental Facilities Design and Construction	
Environmental Biotechnology			Water Resources and Water Quality	
Water Resources and Water Quality				
The concentration determines which chemistry sequence is needed and which technical electives should be taken as a core group. For the freshman chemistry courses, if a student's chemistry background is sufficiently strong, they are advised to take CHEM 111 / CHEM 112 but CHEM 103 / CHEM 104 is acceptable for most concentrations.			For the introductory chemistry courses, CHEM 103/104 is the standard sequence. However, if a student's chemistry background is sufficiently strong, they are advised to take CHEM 111/112/220/221 .	
Each concentration also requires additional technical elective courses to provide the desired focus at the intermediate and advanced levels. Beyond the set of specific core technical electives for the concentration, the remaining technical electives can then be chosen to further pursue this direction of study, or to provide a more diversified environmentla engineering education. All technical electives must be upper level courses in engineering, the sciences, computer science, or mathematics.			Each concentration also requires additional technical elective courses to provide the desired focus at the intermediate and advanced levels. Beyond the set of specific core technical electives for the concentration, the remaining technical electives can then be chosen to further pursue this direction of study, or to provide a more diversified environmentla engineering education. All technical electives must be upper level courses in engineering, the sciences, computer science, or mathematics.	
The chemistry courses and the core technical electives are listed below for each concentration.			The chemistry courses and the core technical electives are listed below for each concentration.	
CREDITS TO TOTAL A MINIMUM OF	125		CREDITS TO TOTAL A MINIMUM OF	125
BACHELOR OF ENVIRONMENTAL ENGINEERING - ENVIRONMENTAL ENGINEERING (CONTAMINANT TRANSPORT AND CONTROL PROCESSES)			BACHELOR OF ENVIRONMENTAL ENGINEERING - ENVIRONMENTAL ENGINEERING (ENVIRONMENTAL BIOLOGICAL AND CHEMICAL PROCESSES)	
BACHELOR OF ENVIRONMENTAL ENGINEERING - ENVIRONMENTAL ENGINEERING (ENVIRONMENTAL FACILITIES DESIGN AND CONSTRUCTION)			BACHELOR OF ENVIRONMENTAL ENGINEERING - ENVIRONMENTAL ENGINEERING (ENVIRONMENTAL FACILITIES DESIGN AND CONSTRUCTION)	

BACHELOR OF ENVIRONMENTAL ENGINEERING - ENVIRONMENTAL ENGINEERING (ENVIRONMENTAL BIOTECHNOLOGY)			BACHELOR OF ENVIRONMENTAL ENGINEERING - ENVIRONMENTAL ENGINEERING (WATER RESOURCES AND WATER QUALITY)	
BACHELOR OF ENVIRONMENTAL ENGINEERING - ENVIRONMENTAL ENGINEERING (WATER RESOURCES AND WATER QUALITY)				
DEGREE:BACHELOR OF ENVIRONMENTAL ENGINEERING			DEGREE:BACHELOR OF ENVIRONMENTAL ENGINEERING	
MAJOR: ENVIRONMENTAL ENGINEERING CONCENTRATION: CONTAMINANT TRANSPORT AND CONTROL PROCESSES			MAJOR: ENVIRONMENTAL ENGINEERING CONCENTRATION: ENVIRONMENTAL BIOLOGICAL AND CHEMICAL PROCESSES	
Physical and chemical processes for pollutant transport and remediation.			Chemical, biological and microbial aspects of contaminant behavior in natural and engineered systems.	
CURRICULUM	CREDITS		CURRICULUM	CREDITS
See University and College requirements.			See University and College requirements.	
CHEM 111 General Chemistry*	3		CHEM 103** General Chemistry	4
CHEM 112 General Chemistry*	3		CHEM 104** General Chemistry	4
CHEM 220 Quantitative Analysis	3		CHEM 321** Organic Chemistry	4
CHEM 221 Quantitative Analysis Laboratory I	1		BISC 300 Introduction to Microbiology	4
CHEG 325 Chemical Engineering Thermodynamics	3		CHEG 443 Physical Chemistry I	3
CHEG 332 Chemical Engineering Kinetics	3		CHEM 527 Introduction to Biochemistry	3
CHEG 342 Heat and Mass Transfer	3		CHEG 325 Chemical Engineering Thermodynamics	3
CHEG 443 Physical Chemistry I	3		CHEG 332 Chemical Engineering Kinetics	3
Additional technical electives, including 3 cr. of Earth Science**	10		Additional technical electives, including 3 cr. of engineering topics and 3 cr. of earth science*	10
*The alternative coursework CHEM 103 / CHEM 104 is also acceptable.			*Advisor should be consulted to ensure that the engineering topic and earth science requirement is met through appropriate technical electives.	
**Advisor should be consulted to ensure that the Earth Science requirement is met through an appropriate elective.			**Students with sufficient Chemistry background should replace these courses with CHEM 111/112/220/221/331/333.	
DEGREE:BACHELOR OF ENVIRONMENTAL ENGINEERING			DEGREE:BACHELOR OF ENVIRONMENTAL ENGINEERING	
MAJOR: ENVIRONMENTAL ENGINEERING CONCENTRATION: ENVIRONMENTAL FACILITIES DESIGN AND CONSTRUCTION			MAJOR: ENVIRONMENTAL ENGINEERING CONCENTRATION: ENVIRONMENTAL FACILITIES DESIGN AND CONSTRUCTION	
Engineering and constructing the systems for air, water, and wastewater purification.			Engineering and constructing the systems for air, water, and wastewater purification.	

CURRICULUM	CREDITS	CURRICULUM	
			CREDITS
See University and College requirements		See University and College requirements	
CHEM 103 General Chemistry	4	CHEM 103 General Chemistry	4
CHEM 104 General Chemistry	4	CHEM 104 General Chemistry	4
CIEG 212 Solid Mechanics	3	CIEG 212 Solid Mechanics	3
CIEG 213 Civil Engineering Materials Lab	1	CIEG 213 Civil Engineering Materials Lab	1
CIEG 301 Structural Analysis	4	CIEG 301 Structural Analysis	4
CIEG 302 Structural Design	4	CIEG 302 Structural Design	4
CIEG 320 Soil mechanics	3	CIEG 320 Soil mechanics	3
CIEG 323 Soil Mechanics Laboratory	1	CIEG 323 Soil Mechanics Laboratory	1
Additional technical electives, including 3 cr. of Earth Science*	8	CIEG 436 Processing, Recycling, Management of Solid Waste	3
		<i>Comptuer Elective. (one of the following two courses must be taken)</i>	
*Advisor should be consulted to ensure that the Earth Science requirement is met through an appropriate technical elective.		BREG 209 Technical and Computer Aided Drafting	3
		FREC 480 Geographic Info Systems in Natural Resource Mgmt	4
		Additional technical electives, including 3 cr. of Earth Science*	8
		*Advisor should be consulted to ensure that the Earth Science requirement is met through an appropriate technical elective.	
DEGREE:BACHELOR OF ENVIRONMENTAL ENGINEERING			
MAJOR: ENVIRONMENTAL ENGINEERING			
CONCENTRATION: ENVIRONMENTAL BIOTECHNOLOGY			
Biological and microbial aspects of contaminant behavior in natural and engineered systems.			
CURRICULUM			
CREDITS			
See University and College requirements.			
CHEM 103 General Chemistry	4		
CHEM 104 General Chemistry	4		
CHEM 331 Organic Chemistry	3		
CHEM 333 Organic Chemistry Lab	1		
PLSC 319 Environmentla Soil Microbiology	4		
BISC 300 Introduction to Microbiology	4		
CHEM 342 Introduction to Biochemistry	3		
Additional technical electives, including 3 cr. of Engineering topics*	9		
*Advisor should be consulted to ensure that the Engineering Topic requirement is met through appropriate technical electives.			

DEGREE:BACHELOR OF ENVIRONMENTAL ENGINEERING			DEGREE:BACHELOR OF ENVIRONMENTAL ENGINEERING	
MAJOR: ENVIRONMENTAL ENGINEERING			MAJOR: ENVIRONMENTAL ENGINEERING	
CONCENTRATION: WATER RESOURCES AND WATER QUALITY			CONCENTRATION: WATER RESOURCES AND WATER QUALITY	
Technical issues associated with providing, maintaining, and improving the supply and quality of surface and groundsaters.			Technical issues associated with providing, maintaining, and improving the supply and quality of surface and groundsaters.	
CURRICULUM	CREDITS		CURRICULUM	CREDITS
See University and College requirements.			See University and College requirements.	
CHEM 103 General Chemistry	4		CHEM 103 General Chemistry	4
CHEM 104 General Chemistry	4		CHEM 104 General Chemistry	4
EGTE 321 Storm Water Management	4		EGTE 321 Storm Water Management	4
CIEG 468 Principles of Water Quality Criteria	3		CIEG 436 Processing, Recycling, Management of Solid Waste	3
CIEG 498 Groundwater Flow and Contaminant Transport	3		CIEG 468 Principles of Water Quality Criteria	3
CIEG 430 Water Quality Modeling	3		CIEG 498 Groundwater Flow and Contaminant Transport	3
Additional technical electives	11		CIEG 430 Water Quality Modeling	3
			Comptuer Elective. (one of the following two courses must be taken)	
			BREG 209 Technical and Computer Aided Drafting	3
			FREC 480 Geographic Info Systems in Natural Resource Mgmt	4
			Additional technical electives	11

Email From Associate Chair of Department of Chemistry and Biochemistry Allowing Students into CHEM 527 and CHEM 321

Paul:

Ten additional students per year in these courses will not cause us any insurmountable problems.

CHEM-527 is taught in both the fall and spring terms; CHEM-321 is taught year 'round: fall, winter, spring, summer.

Best wishes, JB

On 4/1/2011 2:06 PM, Imhoff, Paul T. wrote:

Hello John,

I am the faculty coordinator for the environmental engineering program at UD. You participated in a November College of Engineering Educational Activities Committee (EAC) Meeting and in follow-up discussions with Dan Cha about Biochemistry and Organic Chemistry courses our students take. Based on your input, we revised our proposed curriculum changes to include the following changes in Chemistry courses:

CHEM 527 Introduction to Biochemistry replaces CHEM 342 Introduction to Biochemistry.

CHEM 321 Organic Chemistry replaces CHEM 331/333 Organic Chemistry and Organic Chemistry Majors Laboratory I.

Because our students typically come in with CHEM 103/104, you recommended these course changes.

We anticipate at most 10 students per year taking CHEM 527 and CHEM 321, since this course sequence is required for only one of our three concentrations.

I need an email from a representative of your Department that states that you will be able to handle the number of students in these courses from our program, and that these courses will be taught every year. Can you provide such an email or obtain one from the Department Chair, if this is more appropriate?

Thanks in advance for your help.

Sincerely,

Paul

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Paul T. Imhoff, Ph.D., P.E.
Associate Professor

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