MEMORANDUM

TO: Dr. Doug Kalika, Chair
    Graduate Council

FROM: Bruce Walcott, Associate Dean

Enclosed are items for consideration of the Graduate Council:

<table>
<thead>
<tr>
<th>Course</th>
<th>Type</th>
<th>Effective Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE 555 - Microbial Aspects of Environmental Engineering</td>
<td>New</td>
<td>Fall 2001</td>
</tr>
<tr>
<td>CE 585 - Civil Engineering Failures</td>
<td>New</td>
<td>Fall 2002</td>
</tr>
<tr>
<td>CE 655 - Water Sanitation &amp; Health</td>
<td>New</td>
<td>Spring 2002</td>
</tr>
<tr>
<td>CS 611 - Research in Computer Science</td>
<td>New</td>
<td>Fall 2003</td>
</tr>
<tr>
<td>EE 663 - Optoelectronic Devices</td>
<td>New</td>
<td>Fall 2003</td>
</tr>
<tr>
<td>MSE 581 - Quality Control</td>
<td>Drop</td>
<td>Spring 2003</td>
</tr>
</tbody>
</table>
1. Submitted by College of Engineering | Date 09-01-01
Department/Division offering course Civil Engineering |

2. Proposed designation and Bulletin description of this course
   a. Prefix and Number CE555 | b. Title* Microbial Aspects of Environmental Engineering
      *NOTE: If the title is longer than 24 characters (including spaces), write
      A sensible title (not exceeding 24 characters) for use on transcripts

   c. Lecture/Discussion hours per week 3 | d. Laboratory hours per week
   e. Studio hours per week
   f. Credits
   g. Course description
      Environmental microbiology for engineering students with emphasis on microbially
      mediated chemical cycles, microbial ecology, and industrial microbiology.
   h. Prerequisites (if any)
      CHE105 and CHE107, engineering standing or consent of instructor |
   i. May be repeated to a maximum of ____________________________ (if applicable)

4. To be cross-listed as
   ________________ ________________
   Prefix and Number Signature, Chairman, cross-listing department

5. Effective Date Fall 01 | (semester and year)

6. Course to be offered ☑ Fall ☐ Spring ☐ Summer

7. Will the course be offered each year? (Explain if not annually) ☑ Yes ☐ No

8. Why is this course needed?
   Environmental engineering requires a fundamental understanding of prokaryotic microbes
   abilities and growth requirements for design of treatment processes.

9. a. By whom will the course be taught? Dr. Gail Montgomery Brion |
    b. Are facilities for teaching the course now available? ☑ Yes ☐ No
       If not, what plans have been made for providing them?

ORIGINAL

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10. What enrollment may be reasonably anticipated? 30 students

11. Will this course serve students in the Department primarily?  
   Will it be of service to a significant number of students outside the Department?  
   If so, explain.

   Useful to graduate students in geology, agricultural and chemical engineering, etc.

   who utilize microbes but lack undergraduate training in microbiology.

12. Check the category most applicable to this course

   ✔ traditional; offered in corresponding departments elsewhere;
   □ relatively new, now being widely established
   □ not yet to be found in many (or any) other universities

13. Is this course part of a proposed new program:
   If yes, which?

14. Will adding this course change the degree requirements in one or more programs?*
   If yes, explain the change(s) below

15. Attach a list of the major teaching objectives of the proposed course and outline and/or reference list to be used.

16. If the course is a 100-200 level course, please submit evidence (e.g., correspondence) that the Community College System has been consulted.

17. Within the Department, who should be contacted for further information about the proposed course?
   Name Gail Brion  Phone Extension 257-4467

*NOTE: Approval of this course will constitute approval of the program change unless other program modifications are proposed.
APPLICATION FOR NEW COURSE

Signatures of Approval:

[Signature]
Department Chair

[Signature]
Dean of the College

10/8/01
Date

10/22/07
Date

10/29/02
Date of Notice to the Faculty

*Undergraduate Council

*University Studies

*Graduate Council

*Academic Council for the Medical Center

*Senate Council (Chair)

*If applicable, as provided by the Rules of the University Senate

Date of Notice to University Senate

ACTION OTHER THAN APPROVAL
CE 599 (to be 555) Microbial Aspects of Environmental Engineering

COURSE INFORMATION

Offered every Fall semester, Thursday evening 5:00 to 7:45 pm.

Instructor: Dr. Gail Brion, Assoc. Professor, Dept. Civil Engineering
Office: Raymond Bldg C367
Phone: 257-4467
Fax: 257-4404
email: gbrion@engr.uky.edu

Office Hours: T-Th 3-4 PM, W 10-11 AM, or by appointment

Text: Brock Biology of Microorganisms 9th edition

Objectives: To understand the principal unit of life, the cell, and how it functions and is used in industrial and environmental treatment processes. Emphasis will be on the prokaryotic cell structure, function, growth, metabolism, and adaptive traits. Microbially mediated bio-geo-chemical cycles will be understood as well as the metabolic growth requisites of each.

Learning Outcomes: At the conclusion of the semester, the student will have learned:

- The basic organic macromolecules and cellular structures formed from them.
- The function of cellular structures.
- Cellular metabolism with its component parts; oxidation/reduction of key enzymes, glycolysis, the citric acid cycle, oxidative phosphorylation, and photosynthesis.
- The process of growth in batch and continuous systems with respects to modeling exponential growth and calculations on populations distributed as Poisson.
- The diverse ways cells make energy utilizing different electron donors, terminal electron acceptors, different sources of carbon.
- The ways which cellular metabolism drives the geochemical cycles on earth: Carbon cycle, nitrogen cycle, sulfur cycle, and iron cycle.
- The ways engineers harness cellular metabolism for environmental treatment or industrial processes such as bio-mining of copper or in-situ bioremediation of petrochemicals.

Homework: Homework questions will not be collected or graded. Students are responsible for knowing the definition of the glossary terms for each chapter, the key points referred to by the concept checks, the answers to the review questions and the application questions. Students are responsible for reading the assigned lecture material in advance of class.

Attendance: I am under no obligation to instruct students that do not attend class. You are missing class if you are not present and seated before I start lecture. If you miss class for reasons other than those specified below, you would not be entitled to any special treatment or make-up sessions. The following are acceptable reasons for excused absences: 1) serious illness; 2) illness or death of family member; 3) University-related trips; 4) major religious holidays; 5) other circumstances I find to be "reasonable cause for nonattendance." Reasonable cause for me generally involves "acts of God" like epidemics, floods, or fires; not missing your alarm or breaking up with your significant other. When there is an excused absence, you will be given the opportunity to make up missed work and/or exams. It is your responsibility to inform me of the absence preferably in advance, but no later than one week afterwards. The burden of proof is on you to provide sufficient documentation regarding the nature of
the absence. If you were seen at the University Health Service, you may contact Glenda Foster, R.N. at 323-INFO; she can help you determine the "excusability" of an absence. You can also directly contact a your physician and ask that they email me or call me directly.

**Quizzes:** There will be 6 scheduled quizzes evenly distributed over the course of the semester. Each quiz will be closed book and students will be informed at least one week in advance of the date. All quizzes in this class are a mixture of multiple choice "concept" questions, true/false, calculation, and short answer/essay. Quizzes will be discussed and reviewed in class. I reserve the right to assign a 5-10 point pop-quiz question in class (usually done to spur students to read material in advance of the lecture). These pop-quiz scores will be included in the following quiz score. For instance, if I gave a pop quiz question worth 10 points, the next scheduled quiz would only be worth 90 points. The final quiz grade would be the total of points earned out of 100 from the pop-quiz and scheduled quiz scores combined. It is my policy that pop-quiz points will never be more than 50% of a total quiz grade. Quizzes will be kept on file in my office and may be viewed during office hours. The last quiz will be held during the final exam period.

**Grades:** The entire grade will be determined as follows:

<table>
<thead>
<tr>
<th>GRADUATE STUDENTS</th>
<th>UNDERGRADUATE STUDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>Quiz Average</td>
</tr>
<tr>
<td>20%</td>
<td>100%</td>
</tr>
<tr>
<td>Quiz Average</td>
<td>80%</td>
</tr>
</tbody>
</table>

I will tell you statistics (mean, standard deviation, range) for class grades on each quiz and assignment, but will not assign letter grades until the end of the semester. Grades shall be assigned according to a modified curve system. Levels are set for the bottom of the range for whole letter grades, A, B, C, and D, and the top range of E ( > 90 = A; > 80 = B; > 70 = C; > 60 = D; < 59 = E). Overall, there is nothing to prevent everyone in the class from getting an A. Before the midterm withdrawal date all students will be informed of their current grade and advised for withdrawal.

**Paper:** FOR GRAD STUDENTS ONLY. You will be turning in a literature review of a current microbiologically related topic in Environmental Engineering. An example topic would be “The ties between coal-fired energy and microorganisms: impacts of acid mine drainage”, or “Coal slurry and microorganisms: impacts on mercury levels in Hazard County fish”, or “Why microbes confused predictions of the impact of bourbon spills on receiving streams” or “Microbes and distribution system water quality”, or “Sludge bulking: causes and cures”, or “Production of bio-pharmaceuticals”. A good place to start the selection of the paper topic is Chapter 16, but you are really only limited by your imagination. At minimum, 10 references will be required from current periodicals and journals on the topic you select. Topics will be submitted for approval the week before Thanksgiving from an initial outline and review of your collected literature. Papers are to be 10 pages of double spaced, 1 inch margins, 12 point Arial of similar sans serif font and printed on a letter quality printer. Standard formats for headings, footnotes, references and bibliography must be used. Figures, Tables, Photos, and reference articles must be appended to the end of the paper and do not count towards the page limit. These papers will be turned in dead week and available for retrieval at the final examination period. Attached to this syllabus is an example outline and a grading criteria sheet.

**Cheating and Plagiarism:** Do not try to cheat in this class since very unpleasant things will invariably result. At a minimum you will be assigned an “E” for the course. You are encouraged to visit me during office hours to discuss any problems that you are having with the class. Plagiarism will not be tolerated. It is difficult for many students to understand when paraphrasing results in plagiarism. Excessive use of paraphrasing often results in what is known as “accidental plagiarism”. Please look at the following website for examples and clarification http://dephome.brooklyn.cuny.edu/career/acadintg.htm as I follow these guidelines.
Course Outline: a brief and select list of topics to be covered. Emphasis on select topics may be shifted to meet class needs.

Microorganisms and Microbiology: Chapter 1
- The history of life
- Evolutionary relationships among organisms
- Populations, communities, and ecosystems
- Culture of microbes
- Impact of microbes on human affairs
- Roots of microbiology

Macromolecules: Chapter 2
- Strong and weak bonds
- Universal solvent
- Polysaccharides
- Lipids
- Nucleic Acids
- Proteins
  - Peptide bonds
  - Structure
  - Denaturation

Cell Biology: Chapter 3
- Microscopy:
  - Light
  - Fluorescent
  - Electron
- Mathematical significance of smallness
- Cytoplasmic Membrane
  - Structure
  - Function
  - Transport Mechanisms
- Cell Wall
  - Structure
  - Function
  - Differences among prokaryotes
  - Synthesis
- Outer membrane of gram negatives
- DNA
- Flagella and motility
  - Chemotaxis
- Cell inclusions
- Vesicles
- Endosporae
- Comparison of Eukaryotic to Prokaryotic cell structures

Nutrition and Metabolism: Chapter 4
- Energetics
- Catalysis and Enzymes
- Oxidation-Reduction
- Electron carriers
- High Energy compounds
- Fermentation
- Respiration and electron transport
- Citric acid cycle
- Alternative modes of energy production
- Biosynthesis of monomers

Microbial growth: Chapter 5
- Cell growth
- Population growth and models
- Continuous culture
- Environmental effects on growth
- Temperature effects
- Growth at high and low temperatures
- Growth at high and low pH
- Growth under anoxic conditions
- Osmotic effects on growth

Prokaryotic diversity: Chapter 13
- Purple phototrophic bacteria
- Nitrifying bacteria
- Sulfur and Iron oxidizing bacteria
- Hydrogen oxidizing bacteria
- Methano and Methylo trophs
- Pseudomonads: the biofilm architects
- Acetic acid bacteria
- Aerobic nitrogen fixing bacteria
- Neisseria, Chromobacterium and relatives
- Enteric bacteria
- Vibrio, spirilla, and rickettsias
- Sulfate and Sulfur reducing bacteria

Metabolic diversity: Chapter 15
- Carbon metabolism and conservation
- Anoxygenc and oxygenic photosynthesis
- Autotrophic carbon dioxide fixation
  - Calvin cycle
  - Reverse Citric acid cycle
- Chemolithography
- Hydrogen oxidation
- Oxidation of reduced sulfur compounds
- Iron oxidation
- Nitrification
- Methanotrophy and Methylotrophy
- Anaerobic respiration
- Nitrate reduction and denitrification
- Sulfate reduction
- Acetogenesis
- Electron Acceptors (Fe, Mn, chlorate, organics)
- Redox and energetic considerations of fermentation
- Fermentative diversity
- Syntrophy
- Hexose, pentose, and polysaccharide utilization
- Organic acid metabolism
- Lipids as nutrient
- Hydrocarbon Transformations
- Nitrogen fixation

**Microbial Ecology: Chapter 16**
- Populations, guilds, and communities
- Microbes in nature
- Microbial methods
- Enrichment and isolation techniques
- Quantification and variability
- Genetic stains
- Activity measurements
  - Stable isotopes
  - Radio-isotopes
  - Microelectrodes
- Terrestrial Environments
- Aquatic environs
- Deep sea microbiology
- Hydrothermal vents
- Carbon cycle
- Ecology of syntropy and methanogenesis
- Nitrogen cycle
- Sulfur cycle
- Iron cycle
- Microbial leaching of ores
- Mercury and heavy metal transformations
- Petroleum biodegradation
- Xenobiotic biodegradation

**Industrial Microbiology: Chapter 11**
- Microbes and their products
- Large-scale fermentation
- Antibiotics
- Vitamins and amino acids
- Bioconversion
- Enzymes
- Vinegar
- Yeasts and their products
- Fungi
- Sewage and wastewater microbiology