MICROBIAL ECOLOGY (BIOL 5417/MARB 6590)
Department of Life Sciences / Marine Biology
Fall 2016

A. COURSE INFORMATION

Course number/section:  BIOL 5417.001 (lecture); BIOL 5417.101 (lab)
                        MARB 6590.010 (lecture); MARB 6590.110 (lab)
Lecture meeting time:  TTh 03:30-04:45PM
Lecture location:      CI-127
Lab meeting time:      W  02:00-04:50 PM
Lab location:          CS-235
Course Website:        https://bb9.tamucc.edu/ (Blackboard Sign In page)

B. INSTRUCTOR INFORMATION

Instructor:            Dr. Brandi Kiel Reese
Office location:       105 Science Lab 1
Office hours:          M, T, W 8:00-10:00 AM and by appointment
Telephone:             361-825-3022
Email:                 brandi.reese@tamucc.edu
Appointments:          Made at least 24 hrs in advance by phone or e-mail

C. COURSE DESCRIPTION

Catalog Course Description
4 sem. hrs. (3:3)
Relationships between microorganisms and their biotic and abiotic environments. Role of microorganisms in biogeochemical cycling. Methodology in microbial ecology. Biotechnological aspects. Corequisite: Safety training given in SMTE 0092 - Biomedical Laboratory Safety Seminar is required for continued participation in this course. Offered fall semester every year.

Extended Course Description
Microbial roles in freshwater, marine, terrestrial, and urban ecosystems will be studied. Emphasis is placed on the metabolic diversity of specialized microbial communities found in natural habitats. Microbial function in natural and constructed degradation or remediation processes will be examined from an ecological perspective. Microbial ecology encompasses aspects of microbiology relating to environmental research. Applied environmental microbiology is a discipline being sought in fields relating to water quality, water treatment, bioremediation technology, and bioengineering. This course will provide an excellent foundation for specific research in the area of environmental microbiology. An advancement of knowledge in this area will also complement other disciplines in ecology or environmental engineering.

D. PREREQUISITES AND COREQUISITES
Prerequisites
None

Corequisites
SMTE 0091 – Biological Laboratory Safety Seminar

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Required Textbook

Optional Textbook(s) or Other References
3. Scientific journal publications as assigned

Supplies
Should possess lab coat and protective eye-wear for working with chemicals.

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course, students should be able to:

1. Demonstrate through examinations and discussion groups an advanced understanding of microbial structure in ecosystems such as terrestrial, freshwater, marine, urban, and human, and animal.
2. Differentiate the primary nutrient cycles (e.g., O, N, Fe/Mn, S, and C), and indicate the functional genes and microbial groups associated with the transformations
3. Predict how the microbial community would change as a result of perturbations
4. Define the methods used in environmental microbial studies. Describe, using examples, how advances in the field of microbial ecology are tied to technological advances.
5. Discuss the theories for, and evidence in support of, the evolution of diversity among Bacteria and Archaea, and describe how new, uncultivable microbes are identified and taxonomically categorized.
6. Lead discussion groups and participate in the critical analysis of primary scientific publications.
7. Describe the adaptations associated with growth in extreme environments and how extremozymes may be characterized and synthesized.

G. INSTRUCTIONAL METHODS AND ACTIVITIES

The course will be taught through traditional lectures with laboratory exercises that review and emphasize the lecture material. In addition, there will be a class project that will run in conjunction with the weekly Lab exercises in which all students will participate in the collection, processing, and analysis of environmental samples culminating in a scientific paper. This project will allow students to learn first-hand how to design and implement a project to better understand the microbial ecology of a natural system.

H. MAJOR COURSE REQUIREMENTS AND GRADING

The learning outcomes stated earlier will be assessed through a variety of methods as noted in the following table.

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams (2)</td>
<td>40</td>
</tr>
<tr>
<td>Journal-style Manuscript</td>
<td>20</td>
</tr>
<tr>
<td>Presentation</td>
<td>10</td>
</tr>
<tr>
<td>Homework</td>
<td>10</td>
</tr>
<tr>
<td>Final Exam*</td>
<td>20</td>
</tr>
</tbody>
</table>

*Entry to the classroom will be closed on the day of final exam soon as the first student to complete an exam has left the room. Students absent or arriving after room closure will receive a zero for the exam.

Grading: There will be a total of three (3) written exams. Exams may be composed of any, or all, of the following: multiple choice, matching, fill in the blank, problem solving and essay. The final exam is a comprehensive exam. All exams count toward your class grade. No exam grade will be dropped. No make-up exams will be given. If an exam is missed with proper prior notification, the test may be taken as soon as possible after the exam date, but no later than the following class day. If the exam is not taken a grade of zero (0) will be entered. No extra credit assignments will be given.

There will be a class project that occurs outside of the normal classroom meeting time, which will be graded through participation and a writing assignment based on the semester-long lab project due at the end of the semester (style will be discussed in class). Class attendance and participation will be assessed through in-class quizzes and paper discussions, which will also be factored into your final grade.

The grading scale is: A=90-100%, B=80-89%, C=70-79%, D=60-69%, and F=0-59%. All
grades will be rounded to the nearest whole number, therefore, a grade of 89.50% would be rounded to 90% (A) and a grade of 89.49% would be an 89% (B). **Last day to withdraw from class with a "W" is Friday, November 11, and must be done by the student.**

I. **COURSE CONTENT/SCHEDULE**

<table>
<thead>
<tr>
<th>Week #</th>
<th>Week of</th>
<th>Topic</th>
<th>Readings/Assign.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22-Aug</td>
<td>Introduction</td>
<td>Ch. 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Microbiology Review</td>
<td>Ch. 2 - 3</td>
</tr>
<tr>
<td>2</td>
<td>29-Aug</td>
<td>Microbial Growth and Metabolism</td>
<td>Ch. 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Microbial Evolution/Systematics</td>
<td>Ch. 12</td>
</tr>
<tr>
<td>3</td>
<td>5-Sep</td>
<td>Metabolic Diversity</td>
<td>Ch. 13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Functional Diversity</td>
<td>Ch. 14</td>
</tr>
<tr>
<td>4</td>
<td>12-Sep</td>
<td>Bacteria/Archaea Diversity</td>
<td>Ch. 15-16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Microbial Ecosystems overview</td>
<td>Ch. 19</td>
</tr>
<tr>
<td>5</td>
<td>19-Sep</td>
<td>Biomass/Biogeography (In-class Discussion 1)</td>
<td>Whitman, 1998; Kallmeyer et al., 2013</td>
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<td></td>
<td></td>
<td>Exam 1 (Thursday, September 22)</td>
<td></td>
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<table>
<thead>
<tr>
<th>Week #</th>
<th>Week of</th>
<th>Topic</th>
<th>Readings/Assign.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>26-Sep</td>
<td>Microscopy</td>
<td>Chap 18, Sect 1 and 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Culture Dependent</td>
<td>Chap 18, Sect 1 and 2</td>
</tr>
<tr>
<td>7</td>
<td>3-Oct</td>
<td>Culture Independent: Rise of the 'omics</td>
<td>Chap 18, Sect 3 and 4</td>
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<tr>
<td></td>
<td></td>
<td>Measuring Activity</td>
<td>Ch. 5 Sect 3</td>
</tr>
<tr>
<td>8</td>
<td>10-Oct</td>
<td>Experimental Design (In-class Discussion 2)</td>
<td>Prosser, 2010; Lennon, 2011</td>
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<tr>
<td></td>
<td></td>
<td>Calculating Diversity Estimates</td>
<td>TBD</td>
</tr>
</tbody>
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**Biogeochemical Cycles**

<table>
<thead>
<tr>
<th>Week #</th>
<th>Week of</th>
<th>Topic</th>
<th>Readings/Assign.</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>17-Oct</td>
<td>Autotrophy / Heterotrophy</td>
<td>Ch. 20 and 14 + supplemental</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N Cycle</td>
<td>Ch. 20 and 14 + supplemental</td>
</tr>
<tr>
<td>10</td>
<td>24-Oct</td>
<td>S Cycle and Metals</td>
<td>Ch. 20 and 14 + supplemental</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C Cycle</td>
<td>Ch. 20 and 14 + supplemental</td>
</tr>
<tr>
<td>11</td>
<td>31-Oct</td>
<td>Fermentation and Other metabolisms</td>
<td>Supplemental</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mixotrophy (In-Class Discussion 3)</td>
<td>Falkowski, 2008; TBD</td>
</tr>
<tr>
<td>12</td>
<td>7-Nov</td>
<td>Exam 2 (Tuesday, November 8)</td>
<td></td>
</tr>
<tr>
<td>Week #</td>
<td>Week of</td>
<td>Topic</td>
<td>Readings/Assign.</td>
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</tr>
<tr>
<td>12</td>
<td>14-Nov</td>
<td>Microbial Symbioses</td>
<td>Ch. 22 (Paper Draft Due: Thurs, Nov. 10)</td>
</tr>
<tr>
<td>13</td>
<td>21-Nov</td>
<td>Microbial Food Webs</td>
<td>TBD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extremophiles (In-class Discussion 4)</td>
<td>Pikuta et al., 2007; Reese et al., 2014</td>
</tr>
<tr>
<td>14</td>
<td>28-Nov</td>
<td>Built Environment</td>
<td>Ch. 21</td>
</tr>
<tr>
<td>15</td>
<td>5-Dec</td>
<td>Human Microbiome</td>
<td>Ch. 23</td>
</tr>
<tr>
<td>16</td>
<td>12-Dec</td>
<td>Grad Student Presentations (10 min talk + 5 min. questions)</td>
<td>Reviews Due Tues. Dec 6 @ 6:00 pm</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>Reading Days (12/7-12/8)</td>
<td>Final Exam (Monday, December 12, 1:45-4:15 pm)</td>
</tr>
</tbody>
</table>

Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

Laboratory Topics
- Lab Safety, Pipetting, and Dilutions review
- Field Sampling (optional, but strongly encouraged)
- Culturing, Plate counts
- Microscopy and Cell counting
- DNA Extraction
- NanoDrop / Fragment Analyzer / Gel Quantification
- PCR Amplification
- Cloning/RFLP
- Gel Electrophoresis / DGGE
- Sequencing
- Bioinformatics

J. COURSE POLICIES

Attendance/Tardiness
Each student’s individual career experiences provide valuable perspective to their peers. Therefore, it is critical that you attend class regularly to be a partner in this enhanced learning environment. At each class meeting, attendance will be noted. It is each student’s responsibility to contact the instructor directly (phone or e-mail), in advance, if
class will be missed. The instructor will not accept late work without valid reasons. Students with a university approved scheduled absence (athletics, military duty, etc.) must contact the instructor well in advance (>72 hrs) of a scheduled absence. Exams may be taken early in those specific cases. Students who do not arrange to take exams ahead of time will not be eligible for this special consideration. A written excuse from the university department involved is required.

Students are encouraged to contact the instructor any time they are not achieving their intended level of success, prior to taking any other action. Students who need to withdraw must complete an official form and submit it consistent with college policy no later than the official published date. “Incomplete” grades are awarded only when an emergency prevents a student from completing a minor portion of the course assignments. Active participation is a part of your grade. It includes (1) asking questions; (2) answering questions with supportive evidence; (3) responding to other student’s comments, etc. Students are expected to be on time for class, to address others with respect, and to project an attentive and concerned demeanor.

Late Work and Make-up Exams
All exams count toward your class grade. No exam grade will be dropped. No make-up exams will be given. If an exam is missed with proper prior notification, the test may be taken as soon as possible after the exam date, but no later than the following class day. If the exam is not taken, a grade of zero (0) will be entered.

Extra Credit
No extra credit assignments will be given.

Cell Phone Use
The use of cell phones and other personal electronic devices (PEDs) are a distraction and prohibited during class. All cell phones must be turned off during the class period, unless an exception is warranted. Voice recording of lectures is allowed, but no video or photography is allowed during class.

Laptop Use
Laptop computers and tablets may not be used in the classroom. Studies have shown that they are a nuisance to other students and are distracting to the user.

Food in Class
There is NO eating or drinking in the classroom.

Missed Exam
If an exam is missed with proper prior notification, the test may be taken as soon as possible after the exam date, but no later than the following class day. If the exam is not taken a grade of zero (0) will be entered.

Participation
Four or more absences, with the exception of death in the immediate family, sick
child/spouse, military service, or personal sickness may result in a failing grade. Please contact the instructor by phone message or e-mail before class to let the instructor know of your absence.

Other
Cheating is defined as:
- Copying to any extent the work of another student
- Intentionally assisting another student during an examination
- Having access to material related to an examination during an examination
- Possessing or having access to unauthorized copies of an examination
- Departing from any stated examination conditions
*Cheating or other academic dishonesty for exams and assignments will not be tolerated and will result in a Failing (F) grade for the class and suspension.

Plagiarism: The Merriam-Webster Dictionary defines plagiarism as "To pass off as one’s own words or ideas of another.”
Plagiarism involves:
- Submitting another person's work as one's own
- Submitting work from any source that is not properly acknowledged by footnote, bibliography, or reference within a paper
- Submitting work pieced together from phrases and/or sentences from various sources without acknowledgement
- Submitting work with another person's phrase(s) rearranged without acknowledgement
- Submitting work that uses any phrase, sentence, or stylistic mannerism without acknowledgement
- Omitting quotation marks from any directly quoted material
- Failure to use three dots (...) to indicate omission of one or more words
- Any other actions deemed to be plagiarism by the faculty

K. COLLEGE AND UNIVERSITY POLICIES

- **Academic Integrity (University)**
  It is expected that university students will demonstrate a high level of maturity, self-direction, and ability to manage their own affairs. Students are viewed as individuals who possess the qualities of worth, dignity, and the capacity for self-direction in personal behavior. See Full University Policy at [http://catalog.tamucc.edu/content.php?catoid=10&navoid=313#Academic_Integrity](http://catalog.tamucc.edu/content.php?catoid=10&navoid=313#Academic_Integrity)

- **Classroom/Professional Behavior**
  A professional courteous behavior must be exhibited while in class. Students are in the class to learn and distracting behavior will not be tolerated. There is NO eating or drinking in the classroom.

- **Deadline for Dropping a Course with a Grade of W (University)**
  The grade of W will be assigned to any student officially dropping a course by
Friday, November 11, 2016. No student is eligible to receive a W without completing the official drop process by this deadline. Visit the Office of the University Registrar for the Course Drop Form that must be submitted. After Friday, November 11, a student will not be allowed to drop a course.

- **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at http://www.tamucc.edu/provost/university_rules/index.html, and the College of Science and Engineering Grade Appeals webpage at http://sci.tamucc.edu/students/GradeAppeal.html. For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

- **Disability Services**
  The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

  If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

  http://disabilityservices.tamucc.edu/

L. **OTHER INFORMATION**

- **Academic Advising**
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an
appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

Methods of Achieving Success: Achieving success in this course will require a time commitment outside of class that averages three to six hours per week for reading and studying. Students will benefit from actively participating in the lab throughout the semester, classroom discussion, and activities.

GENERAL DISCLAIMER
I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.