**COURSE SYLLABUS**

<table>
<thead>
<tr>
<th>COURSE NUMBER</th>
<th>Course Title</th>
<th>Credits</th>
<th>Clock Hours Per Week: 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB 2033</td>
<td>Ecology</td>
<td>3.0</td>
<td>Lecture 2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Laboratory 2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Demonstration (Yes)</td>
</tr>
</tbody>
</table>

Department: Biology  
Prerequisites: BSC 1010, BSC1011, or Instructor's Consent

College: Arts and Sciences


Faculty Name: Dona Milinkovich  
Term and Year: Fall 2010

Office Location: 201 Jones Hall  
Campus Telephone: 850-561-2744

Office Hours (Others by Appointment)  
Monday 9:30 – 11 a.m.  
Tuesday  
Wednesday 9:30 – 11 a.m.  
Thursday  
Friday  
Saturday

**Course Description:**
As suggested by G. E. Hutchinson, one can think of ecology as the theater within which the evolutionary play takes place. Consequently it is a scientific discipline that unifies all aspects of the biological sciences.

In this course the student will focus on ecology and its principles, such as how to characterize the abundance, distribution, and diversity of organisms. We will do so within the context of evolution as both are essential for a complete understanding of virtually all facets of biology. Additionally, this course will introduce the student to the impacts humans have within the earth’s ecosystem. Ultimately, the goal of this course is to help the student think like an ecologist. The student will gain a combination of the naturalist’s background and expertise in the basic biology of a variety of aquatic, terrestrial, and marine organisms, and the mathematical skills to develop predictive models of their abundance and distribution. At the end of this class the student should be able to appreciate the great diversity of species; factors that influence their presence and abundance, and their interactions and adaptations to the biotic and abiotic environment.

**Laboratory Section:** We meet 2 hours a week to supplement and more thoroughly examine material introduced during the lecture portion of the course. Because this is an introductory course, required of all majors, we are limited in the amount of ‘real’ ecology we can accomplish during this period. Therefore we will also use this laboratory period as a discussion, or ‘recitation’ section to better address questions that arise from the lecture material. Our primary focus however, will be to introduce you to actual methods and models ecologists use to understand the distribution, abundance, and interaction of organisms. We will use a combination of simulated exercises, computer simulations, traditional ‘paper and calculator/computer’ problem sets, field trips, and formal lab write-ups to evaluate your understanding and application of ecological methodologies.

**Overall Goals of the Course**
Emphasis on fundamental concepts of ecology, such as ecosystems, energy, relations, primary and secondary production, nutrient cycling, populations, communities, succession, terrestrial and aquatic ecosystems, and human ecology.

F=Florida Educator Accomplished Practices Standards (FEAPS)  
I=Interstate New Teacher Assessment and Support Consortium Standards (INTASC)  
(K)=Knowledge  
(S)=Skill  
(D)=Disposition

Approved/Revised 10/30/07
Conceptual Framework

The Conceptual Framework in the Professional Education Unit (PEU) at Florida A&M University is an integrated approach to providing educational experiences that result in exemplary professional educators. The Framework is comprised of six themes with the mission of developing high quality classroom teachers, administrators and support personnel. The term “exemplary” refers to the kind of graduates the PEU strives to produce. The figure below provides a diagram of the Exemplary Professional Conceptual Framework:

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**TECHNOLOGY**

- **CF 2**
  
  *Through this focal area, the FAMU professional education candidate will:*

<table>
<thead>
<tr>
<th>CF: 2.1 (S)</th>
<th>Use of available technology and software to support student learning.</th>
<th>F: 4,12</th>
<th>I: 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF: 2.3 (K)</td>
<td>Know fundamental concepts in technology.</td>
<td>F: 12</td>
<td>I: 1.6</td>
</tr>
<tr>
<td>CF: 2.4 (K)</td>
<td>Understand fundamental concepts in technology.</td>
<td>F: 2,12</td>
<td>I: 6</td>
</tr>
<tr>
<td>CF: 2.5 (S)</td>
<td>Use fundamental concepts in technology.</td>
<td>F: 12</td>
<td>I: 6</td>
</tr>
<tr>
<td>CF: 2.6 (S,D)</td>
<td>Facilitate access to technology for students.</td>
<td>F: 12</td>
<td>I: 6</td>
</tr>
<tr>
<td>CF: 2.7 (S)</td>
<td>Facilitate the use of technology by students.</td>
<td>F: 4,12</td>
<td>I: 6</td>
</tr>
</tbody>
</table>

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**CRITICAL THINKING**

- **CF 4**
  
  *Through this focal area, the FAMU professional education candidate will:*

<table>
<thead>
<tr>
<th>CF: 4.1 (K)</th>
<th>Understand a variety of instructional/professional strategies to encourage student development of critical thinking and performance.</th>
<th>F: 4,7</th>
<th>I: 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF: 4.2 (S)</td>
<td>Use a variety of instructional/professional strategies to encourage students' development of critical thinking and performance.</td>
<td>F: 2,7</td>
<td>I: 4</td>
</tr>
<tr>
<td>CF: 4.3 (D)</td>
<td>Value critical thinking and self-directed learning as habits of mind.</td>
<td>F: 4</td>
<td>I: 1.4</td>
</tr>
<tr>
<td>CF: 4.4 (K)</td>
<td>Acquire performance assessment techniques and strategies that measure higher order thinking skills of student.</td>
<td>F: 1,4</td>
<td>I: 1.8</td>
</tr>
<tr>
<td>CF: 4.5 (S)</td>
<td>Demonstrate the use of higher order thinking skills.</td>
<td>F: 8</td>
<td>I: 4</td>
</tr>
</tbody>
</table>

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**F**=Florida Educator Accomplished Practices Standards (FEAPS)

**I**=Interstate New Teacher Assessment and Support Consortium Standards (INTASC)

(K)=Knowledge  (S)=Skill  (D)=Disposition

Approved/Revised 10/30/07
Specific Behavioral Objectives

A student who successfully completes this course will be able to:

- Understand of the major ecological principles and terminology.
  - This outcome will be assessed by examinations in lecture and laboratory.
- Demonstrate oral and written communication skills.
  - This outcome will be assessed by examinations in laboratory, the scientific paper, and one oral presentation.
- Be able to analyze and interpret data, and critically interpret scientific information.
  - This outcome will be assessed by examinations in lecture and laboratory, especially the identification of microbial unknown. Also case studies, epidemiological analysis, and data interpretation will be included on worksheets and lab exercises.
- Demonstrate familiarity with basic scientific methodology and experimental procedures used in ecology.
  This outcome will be assessed by performance in the laboratory and in the field.

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Behavioral objectives</th>
<th>INTASC Standards</th>
<th>FEAPs</th>
<th>FTCE SAE</th>
<th>PEU Conceptual Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demography and Population Lab Exercise</td>
<td>Students should demonstrate a basic understanding of the major ecological methodology and terminology.</td>
<td>I: 1, 4, 6, 8</td>
<td>FEAPs: 4.1:4b, 4c, 4g, 4j, 8.1:8b, 8c, 8f, 12.1:12b, 12c, 12i, 12j, 12k, 12l</td>
<td>FTCE: 1.1.4, 1.6–1.14, 2.1, 2.2, 2.3, 3.13, 4.6, 9.1–9.11, 10.1–10.12</td>
<td>CF: 2.1, 2.3, 2.4, 2.5, 2.6, 2.7, 4.1, 4.2, 4.3, 4.4, 4.5</td>
</tr>
<tr>
<td>Ecological Data Analysis Lab Exercise</td>
<td>Demonstrate familiarity with basic scientific methodology and experimental procedures used in ecology Be able to analyze and interpret data, and critically interpret scientific information. This outcome will be assessed by examinations in lecture and laboratory, especially the identification of microbial unknown.</td>
<td>I: 1, 4, 6, 8</td>
<td>FEAPs: 4.1:4b, 4c, 4g, 4j, 8.1:8b, 8c, 8f, 12.1:12b, 12c, 12i, 12j, 12k, 12l</td>
<td>FTCE: 1.1.4, 1.6–1.14, 2.1, 2.2, 2.3, 3.13, 4.6, 9.1–9.11, 10.1–10.12</td>
<td>CF: 2.1, 2.3, 2.4, 2.5, 2.6, 2.7, 4.1, 4.2, 4.3, 4.4, 4.5</td>
</tr>
<tr>
<td>Final Exam</td>
<td>Demonstrate familiarity with basic scientific methodology and experimental procedures used in ecology. Also case studies, epidemiological analysis, and data interpretation will be included on worksheets and lab exercises</td>
<td>I: 1, 4, 6, 8</td>
<td>FEAPs: 4.1:4b, 4c, 4g, 4j, 8.1:8b, 8c, 8f, 12.1:12b, 12c, 12i, 12j, 12k, 12l</td>
<td>FTCE: 1.1.4, 1.6–1.14, 2.1, 2.2, 2.3, 3.13, 4.6, 9.1–9.11, 10.1–10.12</td>
<td>CF: 2.1, 2.3, 2.4, 2.5, 2.6, 2.7, 4.1, 4.2, 4.3, 4.4, 4.5</td>
</tr>
</tbody>
</table>

**National and State Standards Addressed in the Course**

**Interstate New Teacher Assessment and Support Consortium (INTASC) Standards**

**Standard 1: Subject Matter:**
The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and can create learning experiences that make these aspects of subject matter meaningful for students.

**Standard 4: Instructional Strategies**
The teacher understands and uses a variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills.

**Standard 6: Communication**
The teacher uses knowledge of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom. Standard.

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Standard 8: Assessment
The teacher understands and uses formal and informal assessment strategies to evaluate and ensure the continuous intellectual, social and physical development of the learner.

Florida Educator Accomplished Practices (FEAPs)

1. CRITICAL THINKING

1.1 The preprofessional teacher is acquiring performance assessment techniques and strategies that measure higher order thinking skills in students and is building a repertoire of realistic projects and problem-solving activities designed to assist all students in demonstrating their ability to think creatively.

1.2 Identifies strategies, materials, and technologies that she/he will use to expand students’ thinking abilities.

1.3 Has strategies for utilizing discussions, group interactions, and writing to encourage student problem solving.

1.4 Demonstrates and models the use of higher-order thinking abilities.

1.5 Uses technology and other appropriate tools in the learning environment.

8. KNOWLEDGE OF SUBJECT MATTER

8.1 The preprofessional teacher has a basic understanding of the subject field and is beginning to understand that the subject is linked to other disciplines and can be applied to real-world integrated settings. The teacher’s repertoire of teaching skills includes a variety of means to assist student acquisition of new knowledge and skills using that knowledge.

8.2 Increases subject matter knowledge in order to integrate the learning activities.

8.3 Uses the materials and technologies of the subject field in developing learning activities for students.

8.4 Develops short- and long-term personal and professional goals relating to knowledge of subject matter.

12. TECHNOLOGY

12.1 The preprofessional teacher uses technology as available at the school site and as appropriate to the learner. She/he provides students with opportunities to actively use technology and facilitates access to the use of electronic resources. The teacher also uses technology to manage, evaluate, and improve instruction.

12.2 Uses technology tools on a personal basis.

12.3 Demonstrates awareness of and models acceptable use policies and copyright issues.

12.4 Selects and utilizes educational software tools for instructional purposes based upon reviews and recommendations of other professionals.

12.5 Selects and utilizes educational software tools for instructional purposes based upon reviews and recommendations of other professionals.

12.6 Uses digital information obtained through intranets and/or the Internet (e.g., e-mail and research).

12.7 Uses technology to collaborate with others.

12.8 Develops professional goals relating to technology integration.

Florida Teacher Certification Examination (FTCE) Subject Area Examination (SAE) Competencies and Skills

1 Knowledge of the investigative processes of science

1.1 Identify components, proper use, and care of light microscopes.

1.2 Identify proper techniques for common laboratory procedures (e.g., dissecting; reserving, staining, and mounting microscope specimens; preparing laboratory solutions; using chromatography; performing gel electrophoresis).

1.3 Identify proper techniques for field studies (e.g., site selection, sampling, transects, collecting techniques, environmental measurements).

1.4 Calculate measurements in the appropriate metric units.

1.5 Differentiate between assumptions, inferences, observations, hypotheses, conclusions, theories, and laws.

1.6 Interpret empirical data (e.g., charts, graphs, tables, diagrams).

1.7 Differentiate the characteristics and methodologies of scientific and nonscientific knowledge.

1.8 Identify relationships between the variables and possible outcomes of a specific experiment.

1.9 Relate the validity and reliability of scientific knowledge to reproducibility, statistical significance, technological limitations, bias, and types of error.

1.10 Identify the development of biological theories and knowledge through important historical events, creative endeavors of diverse individuals, and experimental evidence.

1.11 Differentiate between qualitative and quantitative data in experimental, observational, and modeling methods of research.

1.12 Determine the elements of a well-designed and controlled experiment.

1.13 Identify evidence of the dynamic nature of science in the face of new scientific information.

1.14 Identify patterns (e.g., circadian rhythms, migration

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Approved/Revised 10/30/07
2 Knowledge of the interaction of science, technology, and society, including ethical, legal, and social issues
2.1 Analyze the ethical, legal, economic, and social implications of current scientific research and practices (e.g., reproductive and life-sustaining technologies, genetic basis for behavior, population growth and control, government and business influences on biotechnology, cloning, genomics, genetic engineering).
2.2 Analyze environmental challenges (e.g., ozone depletion, pollution, climate change, health effects) that may result from scientific and technological advances.
2.3 Analyze the effects (e.g., multigain resistance, rapid transmission across international boundaries) of globalization on the spread and treatment of pathogens and invasive species.

3 Knowledge of the chemical process of living things
3.13 Identify the effect of environmental factors on the biochemistry of living things (e.g., ultraviolet light effects on melanin and vitamin D production).

4 Knowledge of the interaction of cell structure and function
4.6 Compare characteristics of the major taxa (e.g., domains, kingdoms, phyla), including cellular characteristics.

9 Knowledge of ecological principles and processes
9.1 Distinguish between individuals, populations, communities, ecosystems, biomes, and the biosphere.
9.2 Analyze the relationship between organisms (e.g., producers, consumers, decomposers) and their trophic levels.
9.3 Identify processes, components, and roles of organisms in the hydrologic, carbon, nitrogen, and phosphorous cycles.
9.4 Analyze patterns of energy flow in an ecosystem.
9.5 Evaluate factors that affect population composition, growth, size, and geographic distribution.
9.6 Classify examples of species interactions (e.g., competition, predation, parasitism, mutualism, commensalism).
9.7 Distinguish between primary and secondary succession in biotic communities.
9.8 Analyze the costs and benefits of managing renewable and nonrenewable resources.
9.9 Evaluate the effects of human population size, resource use, and technology on environmental quality.
9.10 Evaluate the consequences of loss of biodiversity.
9.11 Characterize the biotic and abiotic components that define Florida’s ecosystems (e.g., freshwater, marine, estuary, terrestrial).

10 Knowledge of evolutionary mechanisms
10.1 Compare the current theory of evolution by natural selection with previous scientific theories of evolution (e.g., Lamarck, Darwin).
10.2 Analyze exceptions to and limitations of the biological species concept.
10.3 Compare systems of classification (e.g., classical taxonomy, phenetics, cladistics).
10.4 Apply a taxonomic (e.g., dichotomous) key to a set of objects.
10.5 Analyze variation within a species along an environmental cline.
10.6 Identify factors affecting speciation (e.g., mutation, recombination, types of isolation, sexual reproduction and selection, genetic drift, plate tectonics, geographic distribution).
10.7 Evaluate the roles of mutation, recombination, isolation, sexual reproduction and selection, genetic drift, plate tectonics, and geographic distribution in evolution.
10.8 Compare the concepts of punctuated equilibrium and gradualism.
10.9 Interpret examples of evidence for evolutionary theory (e.g., molecular, morphological, embryological, paleontological).
10.10 Analyze aspects of modern scientific theories (e.g., primitive precell, endosymbiotic) on the origin and early evolution of life on Earth.
10.11 Differentiate patterns of evolutionary change (e.g., coevolution, convergent evolution, divergent evolution, parallel evolution) as they relate to major taxa.
10.12 Apply the Hardy-Weinberg equilibrium, using the formula and assumptions, to predict changes in genotypic frequencies in a population.

National Science Teachers Association Standards
C.2.a. Core Competencies. All teachers of biology should be prepared to lead students to understand the unifying concepts required of all teachers of science, and should in addition be prepared to lead students to understand:
1. Life processes in living systems including organization of matter and energy.
5. Ecological systems including the interrelationships and dependencies of organisms with each other and their environments.
6. Population dynamics and the impact of population on its environment.
9. Behavior of organisms and their relationships to social systems.
12. Applications of biology in environmental quality and in personal and community health.

C.2.b. Advanced Competencies. In addition to these core competencies, teachers of biology as a primary field should be prepared to effectively lead students to understand:
14. Biochemical interactions of organisms with their environments
18. Issues related to living systems such as genetic modification, uses of biotechnology, cloning, and pollution from farming.
21. Applications of biology and biotechnology in society, business, industry, and health fields

C.2.c. Supporting Competencies. All teachers of biology should also be prepared to effectively apply concepts from other sciences and mathematics to the teaching of biology including basic concepts of:
24. Earth and space sciences including energy and geochemical cycles, climate, oceans, weather, natural resources, and changes in the Earth.

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Teaching Methods
Lectures, class discussions, brainstorming sessions, problem centered hands on investigations, research and technologies such as internet, CD-ROM, blackboard and computer animations

Topics and Tentative Course Calendar

PCB 2033 – Ecology and Population Biology (Lecture Schedule)

<table>
<thead>
<tr>
<th>Class Dates</th>
<th>Topic</th>
<th>Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 August</td>
<td>Introduction to Ecology</td>
<td>1</td>
</tr>
<tr>
<td>1 September</td>
<td>Physical Environment and Adaptations</td>
<td>2-3</td>
</tr>
<tr>
<td>5 September</td>
<td>Labor Day – No Class Scheduled</td>
<td></td>
</tr>
<tr>
<td>7 September</td>
<td>Physiological Adaptations</td>
<td>3</td>
</tr>
<tr>
<td>12 September</td>
<td>Adaptations to Variable Environments</td>
<td>9</td>
</tr>
<tr>
<td>14 September</td>
<td>Abiotic Variation</td>
<td>4</td>
</tr>
<tr>
<td>19 September</td>
<td>Terrestrial &amp; Aquatic Biomes &amp; Ecosystems</td>
<td>5-6</td>
</tr>
<tr>
<td>21 September</td>
<td>Exam 1</td>
<td></td>
</tr>
<tr>
<td>26 September</td>
<td>Population Structure</td>
<td>13</td>
</tr>
<tr>
<td>28 September</td>
<td>Demography &amp; Life Tables</td>
<td>14</td>
</tr>
<tr>
<td>3 October</td>
<td>Population Growth &amp; Regulation</td>
<td>14</td>
</tr>
<tr>
<td>5 October</td>
<td>Population Dynamics</td>
<td>15</td>
</tr>
<tr>
<td>10 October</td>
<td>Density Dependence/ Density Independence</td>
<td>15</td>
</tr>
<tr>
<td>12 October</td>
<td>Exam 2</td>
<td></td>
</tr>
<tr>
<td>17 October</td>
<td>Population Genetics</td>
<td>16</td>
</tr>
<tr>
<td>19 October</td>
<td>Natural Selection, Adaptation &amp; Evolution</td>
<td>16</td>
</tr>
<tr>
<td>24 October</td>
<td>Life History, Evolution, &amp; Phenotypic Plasticity</td>
<td>10</td>
</tr>
<tr>
<td>26 October</td>
<td>Sociobiology, Individual Interactions</td>
<td>12</td>
</tr>
<tr>
<td>31 October</td>
<td>Species Interactions</td>
<td>17-20</td>
</tr>
<tr>
<td>2 November</td>
<td>Competitive Exclusion Principle</td>
<td>19</td>
</tr>
<tr>
<td>7 November</td>
<td>Lotka Volterra Competition</td>
<td>19</td>
</tr>
<tr>
<td>9 November</td>
<td>Exam 3</td>
<td></td>
</tr>
<tr>
<td>14 November</td>
<td>Predation</td>
<td>17-18</td>
</tr>
<tr>
<td>16 November</td>
<td>Predators &amp; Prey</td>
<td>17-18</td>
</tr>
<tr>
<td>21 November</td>
<td>Community Structure &amp; Stability</td>
<td>21</td>
</tr>
<tr>
<td>23 November</td>
<td>Biodiversity – Diversity Indices</td>
<td>23</td>
</tr>
<tr>
<td>28 November</td>
<td>Succession</td>
<td>22</td>
</tr>
<tr>
<td>30 November</td>
<td>Disturbance Ecology</td>
<td>22</td>
</tr>
<tr>
<td>5 December</td>
<td>Island Biogeography &amp; Extinction</td>
<td>23-24</td>
</tr>
<tr>
<td>7 December</td>
<td>Conservation, Ecological Sustainability &amp; Invasion</td>
<td>25-26</td>
</tr>
<tr>
<td>Week of 12</td>
<td>Exam 4: Final Exam</td>
<td></td>
</tr>
</tbody>
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PCB 2033 – Lab/Discussion Schedule

<table>
<thead>
<tr>
<th>Class Dates</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 August/ 1 September</td>
<td>No Labs Scheduled</td>
</tr>
<tr>
<td>13/15 September</td>
<td>Population Sampling</td>
</tr>
<tr>
<td>20/22 September</td>
<td>Spatial Analysis of Populations</td>
</tr>
<tr>
<td>27/29 September</td>
<td>Demography and Population Dynamics Exercises</td>
</tr>
<tr>
<td>4/6 October</td>
<td>Population Dynamics Simulations</td>
</tr>
<tr>
<td>11/13 October</td>
<td>Campus Ecology Lab</td>
</tr>
<tr>
<td>18/20 October</td>
<td>Population Genetics Exercises, Simulations</td>
</tr>
<tr>
<td>25/27 October</td>
<td>Campus Ecology Lab</td>
</tr>
<tr>
<td>1/3 November</td>
<td>Lotka-Volterra Competition Simulations</td>
</tr>
<tr>
<td>8/10 November</td>
<td>Predation/Foraging Simulations</td>
</tr>
<tr>
<td>15/17 November</td>
<td>Ecological Data Analysis Exercise</td>
</tr>
</tbody>
</table>

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Approved/Revised 10/30/07
Methods of Evaluation/Performance-based Assessment

Three regular examinations are given during the semester, in addition to a comprehensive final examination given during finals week. The final examination is mandatory and will count as one exam. Eighty-five percent (85%) of the final course grade will be determined by the simple average of these four total lecture exams. The remaining 15% contribution will be determined by the laboratory/discussion section and attendance/participation. Unless otherwise indicated, all assignment will be due the week following the section meeting. All section handouts will be available in PDF form in the course folder on the tutorial lab’s computer desktops in 201 Jones. No exam score will be dropped. There are no additional exams, assignments, or extra credit scheduled. Any make-up exam meet published University standards: A=90-100%, B=80-89%, C=70-79%, D=60-69%, F=59%. An Incomplete (I) will only be given to cases meeting university guidelines.

Grading

- 90-100% = A
- 80-89% = B
- 70-79% = C
- 60-69% = D
- > 59% = F

Course Policies

Policy Statement on Non-Discrimination It is the policy of Florida Agricultural and Mechanical University to assure that each member of the University community be permitted to work or attend classes in an environment free from any form of discrimination including race, religion, color, age, disability, sex, marital status, national origin, veteran status and sexual harassment as prohibited by state and federal statutes. This shall include applicants for admission to the University and employment.

Academic Honor Policy The University’s Academic Honor Policy is located in the FANG Student Handbook, under the Student Code of Conduct-Regulation 2.012 section, beginning on page 55-56.

ADA Compliance To comply with the provisions of the Americans with Disabilities Act (ADA), please advise instructor of accommodations required to insure participation in this course. Documentation of disability is required and should be submitted to the Learning Development and Evaluation Center (LDEC). For additional information please contact the LDEC at (850) 599-3180.

References

1. Göran I. Ägren and Ernesto Bosatta. Theoretical Ecosystem Ecology - Understanding Element Cycles. Cambridge Univ. Press,
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