CENTRAL TEXAS COLLEGE
ENVR 1401
ENVIRONMENTAL SCIENCE I

Semester Hours Credit: 4

INSTRUCTOR: _____

OFFICE HOURS: **_____**

I. INTRODUCTION

A. "A survey of the forces, including humans, that shape our physical and biologic environment, and how they affect life on Earth. Introduction to the science and policy of global and regional environmental issues, including pollution, climate change, and sustainability of land, water, and energy resources." - Academic Course Guide Manual (ACGM)

B. This course can be used to meet the core requirements for AA/AS degrees and transfers to other Texas public colleges and universities for BA/BS degrees. This course also satisfies the science requirements in most curricula and may serve as preparation for careers in science.

C. In support of the objectives of the Texas core curriculum, the course provides significant exercise of a student's critical thinking skills, communication skills, teamwork, and empirical and quantitative skills. These objectives form a foundation of intellectual and practical skills that are essential for all learning.

* Critical thinking skills include creative thinking; innovation inquiry; analysis, evaluation, and synthesis of information.
* Communication skills include effective development, interpretation, and expression of ideas through written, oral, and visual means.
* Teamwork includes the ability to consider different points of view and to work effectively with others to support a shared purpose or goal.
* Empirical and quantitative skills include the ability to manipulate and analyze numerical data or observable facts to reach informed conclusions.

D. Prerequisite: Appropriate placement score (at least a 350 on the math portion of the TSI) or TSI exemption or completion of the appropriate level of Developmental Studies course (DSMA 0303).

II. LEARNING OUTCOMES

Upon successful completion of this course the student will be able to:

A. Recognize, describe, and quantitatively evaluate earth systems, including the land, water, sea, and atmosphere, and how these function as interconnected ecological systems.
B. Assess environmental challenges facing humans caused by their interaction with the physical and biological environment (e.g., population growth, energy resources, food production, pollution, water and resource use).
C. Acquire a scientific vocabulary and critical thinking skills related to environmental science.
D. Assess the effectiveness and feasibility of environmental policy and its impact.

E. Apply the scientific method to environmental investigation.

F. Measure and observe aspects of the environment (e.g., air, water, soil) through sampling and sample analysis.
G. Develop an assessment plan for an environmental case study.
H. Demonstrate the collection, analysis, and reporting of data.

III. INSTRUCTIONAL MATERIALS

A. Required Textbook:
The instrucional materials identified for this course are viewable through http://www.ctcd.edu/books.

IV. COURSE REQUIREMENTS

A. Synchronous Virtual Instruction:
This is a synchronous virtual course. Online attendance is required during scheduled meeting days/times. You will be sent a link to access the meetings online. Lecture and lab will be hosted by your instructor through a web-based video conferencing tool (Webex, Zoom, etc.) You must have reliable internet connection and a webcam to participate.

B. Class Participation: Students are expected to attend lecture and lab online during their scheduled time. Check your CTC email for links to join the class. Leaving class early or arriving late may be counted as an absence, unless it has been excused.

C. Laboratory Activities: Attendance and active participation in lab online is required. Check your CTC email for links to join the class.

D. Late Work: Late work should be avoided, as it will result in a deduction of points from the score. Late work on Prelecture Homeworks and Labs will be accepted, but with a 10% deduction per day late with a maximum of 50% overall deduction. No excuses will be accepted.

V. COURSE WORK

A. Lecture Exams:
There are 4 lecture exams to be taken during a scheduled class date/time. In order to access the exams, BioSig verification will be required. This should be set up at beginning of semester, so that you will be able to take the test during the limited amount of time. You will have a least a 24 hour window to take each exam. If you cannot avoid missing one – for whatever reason – be sure to take the comprehensive final exam which will replace your zero for that one you missed.

B. Mastering Exercises:
Dynamic study modules and Prelecture Homework assignments will be completed from Pearson's Mastering website (embedded/accessible viaBlackboard). Do not wait to complete these, as multiple ones will all be due on the same day – typically on the day of a lecture exam. See Blackboard for due dates. For most, you should have plenty of time to complete in advance. Late work policy applies to Prelecture Homework assignments. Late work cannot be accepted for the Dynamic study modules.

C. Lab Exercises:

There are 6 lab exercises through SimBio. There are due dates for these labs. In addition, there may be other virtual or demo labs as time permits. You should be able to complete plenty of time in advance. Late work policy applies.

VI. SEMESTER GRADE COMPUTATIONS

Your course grade is based on a total of 1000 points.
A: 900-1,000 B: 800-899 C: 700-799 D: 600-699 F: 000-599

assessment	point value	points earned
lecture exams	340	
labs	300	
dynamic study modules (on Mastering)	150	
Homeworks (on Mastering)	210	

Add all points in each assessment category earned to get total number of points for course. There are no extra credit assignments, but extra points will be awarded for active participation in lecture and lab. Up to 15 points will be awarded depending on level of participation, attendance and civility, as explained below in VII E. There is no point in asking instructor for extra credit at any point during the semester, as it will never be offered to certain students and not others.

VII. NOTES AND ADDITIONAL INSTRUCTIONS FROM THE INSTRUCTOR

A. Course Withdrawal: It is the student's responsibility to officially drop/withdraw from a class if circumstances prevent attendance or if the student decides not to continue with the course and this must be done before the withdrawal date. An instructor cannot initiate a withdrawal based on the student's request. GoArmyEd students should contact their ACES counselor before withdrawing and withdraw through the GoArmyEd portal. All other students who desire to or must officially withdraw from a course on or after the first scheduled class meeting must file an Application for Withdrawal with the local CTC representative by the last date to withdraw. Students enrolled in distance learning courses and who do not have access to a local CTC representative should submit a withdrawal form to EaglesOnCall@ctcd.edu or the CTC Records Office in Killeen, Texas.
*Applications for Withdrawal will be accepted at any time before the completion of the 12th week of classes for 16-week courses, the sixth week of classes for eight-week courses, or the fourth week of classes for six-week courses.
*For non-GoArmyEd active military students, the effective date of withdrawal is the filing date with the Education Center. For all other students, the effective date of withdrawal is the date that the withdrawal application is received by the Central Texas College representative.
*Students who used financial aid, military tuition assistance, VA benefits, or other non-personal funds may be required to repay tuition and fees to the funding agency. For specific repayment requirements, contact the Office of Student Financial Aid or Veterans Services Office before withdrawing. Military tuition assistance students should visit their military Education Center or Navy College Office.
*Students may not withdraw from a class for which the instructor has previously issued a grade of "F." It is the student's responsibility to officially withdraw from a course if circumstances prevent attendance. To do so, complete and sign the Central Texas College Application for Withdrawal (CTC Form 59) any time prior to Friday the 12th week of classes during the 16-week fall and spring semesters. The deadline for withdrawal is published each semester in the Schedule Bulletin (http://www.ctcd.edu/academics/class-schedules/). A student may not withdraw from a class for

which the instructor has previously issued the student a grade of "F" or "FN" for nonattendance.

B. Administrative Withdrawal: A student may be administratively withdrawn by a designated member of the administrative staff of the College under the following conditions:
The student has been placed on Academic Suspension or Disciplinary Suspension;
The student has an outstanding financial obligation owed to the college; or
The student registered for a course without the required prerequisite or departmental permission.
The college is under no obligation to refund tuition and fees, or other costs associated with a student who is administratively withdrawn. It is the student's responsibility to officially drop/withdraw from a class if circumstances prevent attendance or if the student decides not to continue with the course and this must be done before the withdrawal date. An instructor cannot initiate a withdrawal or drop a student based on the student's request. GoArmyEd students should contact their ACES counselor before withdrawing and withdraw through the GoArmyEd portal. All other students who desire to or must officially withdraw from a course on or after the first scheduled class meeting must file an Application for Withdrawal with the local CTC representative by the last date to withdraw.

C. Incomplete Grade: If a student has made satisfactory progress in a course with the exception of a major quiz, final exam, or other project, the instructor may – after reviewing documentation showing the reason for missed work – grant a temporary grade of incomplete, "IP". See current college catalog for more information.

D. American's With Disabilities Act (ADA): Disability Support Services provide services to students who have appropriate documentation of a disability. Students requiring accommodations for class are responsible for contacting the Office of Disability Support Services (DSS) located on the central campus. This service is available to all students, regardless of location. Explore the web site at www.ctcd.edu/disability-support for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.

E. Civility: Individuals are expected to be cognizant of what a constructive educational experience is and be respectful of those participating in a learning environment. Examples of uncivil conduct in class include, but are not limited to: eating, talking, sleeping; use of inappropriate language; tardiness, leaving class early. Cell phones and other electronic media devices must be muted during lecture and lab and cannot be used except for emergencies. Note that all of these activities distract other students and disrupt their learning experience. The offending student may or may not be given a warning before a CTC Counseling and Disciplinary Referral Form is filed and may receive disciplinary action up to and including expulsion. See Student Handbook for more information.

F. Cheating: Students are expected to be familiar with the definitions and consequences of academic misconduct as stated in the Student Handbook; in addition, CTC provides an explanation of scholastic dishonesty in the course website on Blackboard. During a test students cannot leave the room or use unauthorized materials, such as electronic or print media. Doing so will constitute cheating and result in a zero for that test.

G. Instructor Discretion: The instructor reserves the right of final decision in course requirements.

H. Courtesy: Students are expected to discuss any course-related issue or problem with their instructor first. If the problem has not been resolved at that level, students may contact the Head of the Science Department.

VIII. COURSE OUTLINE

A. CHAPTER ONE: SCIENCE AND SUSTAINABILITY

1. Learning Outcomes:
    a) Define environmental science.
    b) Identify natural resources; distinguish among perpetually renewable, potentially renewable and nonrenewable resources.
    c) Discuss how the tragedy of the commons relates to many environmental problems and define sustainability.
    d) Define ecological footprint and explain how and why it differs between developing and developed countries.
    e) Describe the scientific process: the scientific method and peer review.
    f) Distinguish between hypothesis and theory.
2. Learning Assessment: **Exam 1**

B. CHAPTER FIVE: ECONOMICS, POLICY AND SUSTAINABLE DEVELOPMENT

1. Learning Outcomes:
    a) Describe ecosystem services.
    b) Identify root causes of environmental problems.
    c) Explain the role of science in policy-making.
2. Learning Assessment: **Exam 1**

C. CHAPTER TWO: ENVIRONMENTAL SYSTEMS: MATTER, ENERGY AND ECOSYSTEMS

1. Learning Outcomes:
    a) Define matter and describe the hierarchical organization of the natural world.
    b) Distinguish between ions and isotopes.
    c) Be able to use periodic table so: if given atom of some element (e.g.Na), determine number protons or electrons; if given isotope of some element (e.g.U-235), determine number of neutrons; if given ion (e.g. Na +1), determine number of protons or electrons.
    d) Distinguish between acids and bases and describe the pH scale.
    e) Describe the law of conservation of matter.
    f) Define energy and differentiate between kinetic and potential energy.
    g) Describe the first and second laws of thermodynamics.
    h) Describe the feeding relationships between producers, consumers, and decomposers.
    i) Recognize the chemical reactions for cellular respiration and photosynthesis.
    j) Distinguish between gross and net primary productivity; identify factors that affect primary productivity.
    k) Identify terrestrial and aquatic ecosystems with high and low net primary productivity.
    l) Describe the flow of matter and energy through ecosystems.
    m) Summarize the water, carbon, and nitrogen cycles and how human activities affect them.
2. Learning Assessment: **Exam 1**

D. CHAPTER THREE: EVOLUTION, BIODIVERSITY, AND POPULATION ECOLOGY

1. Learning Outcomes:
    a) Define evolution; describe lines of evidence for evolution.
    b) Distinguish between microevolution and macroevolution and give examples of each.
    c) Define adaptation; describe conditions under which natural selection will work.
    d) Distinguish between natural selection and artificial selection.
    e) Discuss speciation, extinction, and adaptive radiation.
    f) Define ecology; identify the levels of hierarchical organization within the realm of ecology.

g) Define ecological niche; distinguish between generalist and specialist species.
h) Identify characteristics of population: size, density, age distribution, and dispersion pattern.
i) Describe how births, deaths, immigration and emigration determine changes in population size.
j) Predict a population's growth rate if given the age distribution of the current population.
k) Compare and contrast exponential and logistic population growth.
l) Define carrying capacity; describe effects of an overshoot or dieback.
m) Distinguish between density-dependent and density-independent control on population growth.
n) List characteristics of r-selected and K-selected species and provide examples of each.

2. Learning Assessment: **Exam 1**

E. CHAPTER FOUR: SPECIES INTERACTIONS AND COMMUNITY ECOLOGY

1. Learning Outcomes:
a) Identify trophic levels in a food chain; describe a food web.
b) Explain why food chains have a limited number of trophic levels.
c) Characterize keystone species.
d) Describe the following interspecific interactions and recognize examples of each: exploitative (competition, predation, parasitism, and herbivory), mutualism, and commensalism.
e) Describe competitive exclusion and resource partitioning.
f) Define coevolution; describe evolutionary arms race.
g) Describe ecological succession; compare and contrast primary and secondary succession.

2. Learning Assessment: **Exam 1**

F. CHAPTER SIX: HUMAN POPULATION

1. Learning Outcomes:
a) Characterize past and present human global population growth.
b) Describe how the agricultural and industrial revolutions affected human population growth and carrying capacity.
c) Explain the IPAT model.
d) Discuss the cultural carrying capacity for the global human population.
e) Distinguish between developed and developing countries in terms of age distribution, total fertility rate, birth rate, death rate, population growth rate and population size.
f) Explain what has contributed to most of the world's population growth during the 20^{th} century.
g) Distinguish between replacement-level and total fertility rate.
h) Describe recent and projected human population trends and describe population momentum.
i) Identify factors that affect fertility rate.
j) Describe the demographic transition model and characterize its four stages.
k) Explain why the "population problem" does not only exist for developing countries.

2. Learning Assessment: **Exam 2**

G. CHAPTER SEVEN: SOIL, AGRICULTURE, AND THE FUTURE OF FOOD

1. Learning Outcomes:
a) Describe the Agricultural Revolution.
b) Distinguish between traditional and industrialized agriculture.

c) Identify the goals, methods and outcomes of the Green Revolution.
d) Describe soil and the different layers found in a profile of mature soil.
e) Discuss the problem of soil degradation, its causes and effects.
f) Define desertification and identify its causes.
g) Compare the efficiencies of converting grain to different types of animal products.
h) Provide advantages and disadvantages of aquaculture.
i) Identify the main cause of hunger and malnutrition.
j) Identify challenges to future food production, and describe sustainable agriculture.
k) Describe methods of soil conservation.
l) Describe integrated pest management.
m) Compare and contrast traditional selective breeding and genetic engineering.

2. Learning Assessment: **Exam 2**

H. CHAPTER EIGHT: BIODIVERSITY AND CONSERVATION BIOLOGY

1. Learning Outcomes:
   a) Recognize the 3 levels at which biodiversity occurs.
   b) Distinguish between extinction and extirpation.
   c) Distinguish between background extinction and mass extinction.
   d) Compare the current extinction rate to the background extinction rate.
   e) Identify and discuss the main threats to species diversity.
   f) Distinguish between intrinsic and instrumental value of biodiversity.
   g) Describe ecotourism and community-based conservation.
   h) List the 2 criteria for the 'hotspot' designation for an area of land.
   i) Identify characteristics that make species prone to extinction.
   j) Distinguish between endangered and threatened species.
   k) Discuss approaches to protect species, e.g. CITES and ESA.
   l) Describe the role of captive breeding in conservation.
2. Learning Assessment: **Exam 2**

I. CHAPTER NINE: FORESTS, FOREST MANAGEMENT AND PROTECTED AREAS

1. Learning Outcomes:
   a) Identify economical and ecological services of forests.
   b) Distinguish among tree farms, primary and secondary forests.
   c) Describe methods of harvesting timber and sustainable forestry.
   d) Identify causes and effects of deforestation.
   e) Distinguish between surface fires and crown fires; describe prescribed burning.
   f) Recognize different types of public land in the US.
   g) Describe the purpose and organization of a biosphere reserve or habitat corridor.
2. Learning Assessment: **Exam 2**

J. CHAPTER TEN: ENVIRONMENTAL HEALTH AND TOXICOLOGY

1. Learning Outcomes:
   a) Explain the goals of environmental health and identify major environmental health hazards.
   b) Describe the types of toxic substances in the environment, the factors that affect their toxicity, and the defenses that organisms have against them.
   c) Explain the movements of toxic substances and how they affect organisms and ecosystems.
   d) Discuss the approaches used to study the effects of toxic chemicals on organisms.
   e) Summarize risk assessment and risk management.
   f) Compare philosophical approaches to risk and how they relate to regulatory policy.
2. Learning Assessment: **Exam 3**

K. CHAPTER TWELVE: FRESHWATER, OCEANS AND COASTS

1. Learning Outcomes:
    g) Describe Earth's water supply: percentage of fresh and salt water, ground and surface liquid water.
    h) Define watershed (drainage basin), water table, and aquifer.
    i) Describe wetlands and the ecological services they provide.
    j) Identify threats to wetlands and define mitigation banking.
    k) Describe ecological restoration and give an example.
    l) Recognize ways we contribute to flooding and ways we can minimize the risks of flooding.
    m) Identify causes of water shortage.
    n) Describe water use; distinguish between consumptive and non-consumptive use of water.
    o) Describe ways to obtain more water and identify advantages, disadvantages of each.
    p) Describe productive marine and coastal ecosystems and discuss human activities that affect them.
    q) Identify the 3 main types of water pollution and provide examples of each.
    r) Summarize the Clean Water Act.
    s) Identify point and nonpoint sources of water pollution.
    t) Describe the process of cultural eutrophication.
    u) Outline the goals and methods of wastewater treatment.
    v) Recognize the extent and signs of overfishing; identify its causes and effects.
    w) Describe ways to manage fisheries: exclusive economic zones, maximum sustainable yield and marine protected areas or reserves.
    x) Identify sources of marine pollution.
2. Learning Assessment: **Exam 3**

L. CHAPTER FIFTEEN: NONRENEWABLE ENERGY SOURCES, THEIR IMPACTS AND ENERGY CONSERVATION

1. Learning Outcomes:
    a) Describe today's sources of commercial energy.
    b) Describe the composition and formation of fossil fuels.
    c) Define reserves and EROI.
    d) Identify main uses of coal, oil, natural gas, nuclear power; describe environmental impacts of each.
    e) Describe what is meant by clean coal technology.
    f) Compare U.S. oil consumption and supply.
    g) Relate peak oil to the energy crisis.
    h) Describe oil shales and oil sands, and describe their environmental impacts.
    i) Provide examples of energy efficiency and energy conservation.
2. Learning Assessment: **Exam 3**

M. CHAPTER SIXTEEN: RENEWABLE ENERGY ALTERNATIVES

1. Learning Outcomes:
    a) Describe main categories of renewable sources of energy: solar, geothermal and hydrogen.
    b) Describe different ways solar energy is used: active, passive, concentrated, and photovoltaics.
    c) Discuss specific forms of renewable energy: their uses, advantages and disadvantages.
2. Learning Assessment: **Exam 4**

N. CHAPTER THIRTEEN: ATMOSPHERIC SCIENCE, AIR QUALITY, AND POLLUTION CONTROL

1. Learning Outcomes:
    a) Explain the importance of the troposphere and stratosphere to life on earth.
    b) Distinguish between natural and anthropogenic sources of air pollution, primary and secondary pollutants, and point and non-point sources.
    c) Distinguish between industrial and photochemical smog.
    d) Describe a temperature inversion and its effect.
    e) Identify the 6 criteria pollutants for which national ambient air quality standards are set by the EPA.
    f) Discuss the purpose and effectiveness of the Clean Air Acts.
    g) Describe ways to reduce air pollution.
    h) Define acid deposition and describe its effects.
    i) Explain why POPs are found in higher concentrations in polar environments.
    j) Describe indoor air pollution and how it differs in developed and developing countries.
    k) Describe the causes and effects of ozone depletion, and identify methods of mitigation and adaptation.
2. Learning Assessment: **Exam 4**

O. CHAPTER FOURTEEN: GLOBAL CLIMATE CHANGE

1. Learning Outcomes:

    a) Explain how the terms global climate change and global warming are different but related.
    b) Describe past and present trends in climate change.
    c) Identify the two basic factors affecting the surface temperature of earth.
    d) Identify the concern over current global warming.
    e) Describe the natural greenhouse effect and the enhanced greenhouse effect.
    f) Identify specific human activities that have contributed to the increase of specific greenhouse gases.
    g) Summarize findings of the Intergovernmental Panel on Climate Change.
    h) Describe how global climate change is affecting natural ecosystems and human societies.
    i) Distinguish between mitigation and adaptation as responses to global climate change and provide examples of each.
2. Learning Assessment: **Exam 4**