Foundations of Science Syllabus
Summer 2024

Course Number and Title: BIOL 1436 (all online lecture sections): ***Foundations of Science*** (4 credits)

Instructor Name: Dr. S. Koether **Office Number**: 936-294-4242

Office Hours: Bi-eekly via Zoom (*schedule to be determined*) **Email**: Koether@SHSU.edu

Instruction Plans

Online Course: This section is intended for students who registered for a fully online course (BIOL 1436.01 & .02/.03). Please be aware, the course involves online group-work.

Lecture Component:
Lecture comprises **75% of your overall grade**. Lectures will be offered *semi-synchronously*. This means we will have a schedule by which I expect you to watch lectures and do assignments throughout the semester. Chunks of material will open as we progress through the semester.

The lectures will be in the form of pre-recorded video lectures posted in BlackBoard (BB). They will be accessible to you a few weeks in advance, until the end of the semester. (*Note: The lectures will not be made available all at once at the beginning of the semester. The reason for this approach is that it is important that the lectures, labs, and activities that are related to one another are done "together". This will enable you to better see and remember the connections among facts and ideas that are necessary to understand the information*.)

We will have **bi-weekly Q&A sessions.** We recommend attending most of these bi-weekly sessions, but you are only mandated to attend 3 sessions throughout the semester. I can also schedule and meet with students one-on-one as well. There will be an alternate assignment, should students not be able to attend the Q&A sessions.

The purpose of the Q&A sessions is to provide an opportunity for you to ask questions, go over the schedule and assignments, and provide reminders. It also creates a sense of being part of a class and enables you to see your fellow classmates.

Lab Component

Lab assignments comprise 25% of your overall grade. Please see your lab syllabus for information pertaining to lab.

Course Information

Course Catalog Description: The course focuses on the *nature of science as a reliable method of acquiring knowledge about the natural world*. Students will learn how to apply key scientific facts, concepts, laws, and theories to distinguish science from non-science, bad science, and psedudoscience by analyzing a variety of claims and case studies. By employing an innovative, interdisciplinary approach to science education, this course is designed to increase science literacy and critical thinking skills for introductory-level students who are not science majors. Students MUST enroll concurrently in the corresponding lab for this course because the lecture and lab constitute a single course. Credit: 4

Course Description/Rationale: The rationale for this course is to enhance your scientific literacy by making science both interesting and relevant. This will be accomplished by helping you understand how science works and how you can apply science in your daily life, especially when evaluating extraordinary/unusual claims in which almost everyone is interested – including UFOs, ESP, and mysterious creatures like Big Foot.

Accordingly, the overarching objectives of this course are to enhance your scientific literacy and critical thinking skills using an integrated, multidisciplinary approach that draws upon key concepts from the natural sciences, psychology, and critical thinking. The three broad **goals** of this integrated course are:

1) to enhance your understanding and appreciation of science as a proven and reliable method of comprehending the natural world, and to help you distinguish scientific from non-scientific and pseudoscientific ways of thinking about the world;

2) to provide you with a more well-rounded understanding of science by teaching you the basic principles, facts, laws, and theories from the natural sciences and, when relevant, from psychology;

3) to teach you specific rules of critical thinking so that you can use them, and your knowledge of science and the scientific method, to make more informed decisions. All three goals are inseparable and are interwoven throughout the course.

These three goals will be accomplished by using information from the natural sciences, the scientific method, and rules of critical thinking to examine a range of claims that are common in our society. These claims include, but are not limited to, extraordinary claims and pseudoscientific claims such as those pertaining to astrology, UFOs, legendary creatures, the lost continent of Atlantis, alternative medicines, paranormal phenomena, and others. Through an examination of these and other topics, as well as the evidence for key scientific theories, you will learn more about the nature of science and the scientific method, how to more reliably evaluate the veracity of claims, and how to avoid common errors in reasoning that lead to erroneous conclusions. This knowledge will help protect you from fraudulent and misleading claims and will enable you to make more informed decisions regarding issues of significance to our society. Finally, it is my hope that you will gain a greater appreciation of the beauty and wonder of the natural world as revealed by science.

Upon successful completion of the course, you will be able to:

1. Understand and apply scientific terminology pertaining to the nature and conduct of science, such as hypothesis, law, theory, control group, placebo group, confirmation bias, and double-blind study;
2. Apply methods of reasoning used by scientists: i.e., the scientific method based on the requirements of falsifiability/testability, logical consistency, comprehensiveness of evidence, intellectual honesty (objectivity), replication of results, and sufficiency of evidence;
3. Analyze and evaluate common logical fallacies and perceptual biases that interfere with the ability to draw reasonable and/or correct conclusions, as well as the difference between facts, informed opinions, and uninformed opinions;
4. Learn key concepts and theories from a variety of scientific disciplines, especially astronomy, physics, biology, and geology;
5. Demonstrate how to distinguish science from pseudoscience by scientifically evaluating a wide variety of extraordinary claims that are common in our culture today.

Just as importantly, upon completion of this course, we hope that you will have a greater appreciation of the role of science in all of our lives and the need for scientific literacy and critical thinking to help make informed decisions about issues currently facing our society.

Methods of Instruction: This course is based on a combination of traditional lecture format, coupled with the use of "**case studies**" which involve classroom-based group work, class discussions, homework assignments, and readings. The use of **case studies (which are stories with an educational purpose)** has been shown to: significantly increase student interest, enjoyment, and involvement with a course; improve grades; and enhance students' critical thinking ability.

Course Materials:

1. **Computer/Camera (w Audio/Visual capabilities) –** The device you use will need to be compatible with Zoom, Blackboard, and Respondus Monitor test proctoring software. If you need to check your devices capabilities, please contact SHSU Online (936-294-2780).
2. ***Conceptual Integrated Science, 3rd Ed.*** by Hewitt, Lyons, Suchocki, and Yeh (2019), Pearson, San Francisco. ISBN 978-0-1352-1566-1**.** Students may opt into using a ***trial version of a free resource*** some of my colleagues have put together. It may not be perfect just yet, but it will be free.
3. ***How to Think About Weird Things: Critical Thinking for a New Age* – 8th edition, 2019**, by Theodore Schick and Lewis Vaughn, McGraw-Hill. ISBN 978-1-2641-4384-9 (paperback) Please note that you can probably find much cheaper options for 6th and 7th editions online. These older versions, back to the 6th edition, work for this course - though not any older than the 6th edition. The price of this text can range from about $5 to $90; so, shop wisely).
4. ***Foundations of Science Lab Manual,*** Hayden-McNeil, Fall 2022 ISBN: 978-1-5339-4865-6
5. ***Science for Citizens,*** *InSpark Science Courseware - Access Card.* ISBN: 978-0-9968-1960-2

Supplementary Readings: If used, these will be distributed either in class or placed on BlackBoard.

Grade Determination

Your grade is based on the percentage of points earned relative to the maximum number possible for the course - which is 4,000 points. The percentage of the total possible points determined by *individual effort* is 75% (3000 out of 4000 possible), and that determined by *group effort* is 25% (1000 out of 4000 possible).

All of the tests and assignments for the course, including lab assignments, are listed in the **Score Sheet found in BlackBoard. To keep track of your grades, you need to record each and every grade you receive on this sheet as soon as you know the grade**. The Score Sheet will automatically calculate your grade based on the completed assignments and the maximum number of points the assignments are worth. If, for example, the maximum possible points for the assignments were 1000 points at that point in the course, and you had earned 900 points based on the completed assignments, your grade would be 900/1000 = 90%. Again, when you enter the grade, the Score Sheet does the calculation for you. All you have to do is look in the BB Gradebook, find your grade for an assignment or test, and then enter that grade into the Score Sheet.

(***Please note that Black Board will not calculate your grade***; ***it is simply a place to store the grades for assignments and tests. Only the Score Sheet will calculate your grade.***)

Point range for final course grade

A = 3580-4000
B = 3180-3579.9
C = 2780-3179.9
D = 2380-2779.9
F = less than 2380

Assignments and Tests: Grading will be based on 3 lecture exams, 9 reading quizzes and a syllabus quiz, 9 Smart Sparrow activities, case study activities, pre (ILQ) and post (GLQ) lab quizzes, attendance, and peer evaluations for the group assignments made by your fellow group members in both lecture and lab (see details below).

Please note that the number of assignments may be changed slightly (e.g., add or drop a homework assignment) if circumstances warrant such a change. If this happens, it will have a slight effect on the percentage points associated with each aspect of the course.

As regards the percentage of the course grade that each component constitutes, the following is the breakdown and a description of the assignments and tests**:**

- Lecture Tests constitute 40% of the course grade;

- Other Lecture assignments constitute 35% of the course grade, and

- Lab assignments constitute 25%. Because the lab grade is part of the course grade, students must remain enrolled in both the lecture and lab for the entire semester.

Below is a more detailed description of the grading system:

Tests:

There are 3 major exams and each will consist of multiple-choice, true/false, and matching-type questions. The first test is worth 400 points, and tests 2 and 3 are each worth 600 points. There is no "final" in this course, only a third test. We will use finals scheduling/week to proctor the third test.

The tests will be taken on the course BB site using the *Respondus Monitor* testing system. This system requires that you have a computer with a camera and audio for test security purposes. Because these are tests, you are *not* allowed to use any sources of information (e.g., lectures, textbooks, internet, friends, or family) while taking the test.

Time per test: The tests are timed. Approved accommodations will be adhered to.

Test Schedule: I will make the tests available for a 3 or 4-day period to allow you flexibility to take it based on your schedule.

Syllabus Quiz:
This quiz covers key information in the syllabus to ensure that everyone is familiar with class policies and procedures.

InSpark/Argos Assignments:

These assignments, of which there are 8, are also accessed through BB and are intended to reinforce certain key ideas in the class. Your "tutor" for the assignments is a quasi-animated image of Nikola Tesla, the inventive genius who lived in the late 1800s and 1900s. The assignments consist of "interactive screens" which present information and contain questions – some of which are opinions. They often focus more on reflection than on specific/concrete answers.

Understand that each question requires an answer or action of some sort in order to move forward to the next question and complete the assignment. *If the question does have a right or wrong response, you'll have to get it right before you can progress*. *Some slides contain short, embedded animations and videos which you will need to watch to answer the questions that follow*. These assignments can take between 30-75 minutes to complete – depending upon how well you answer each question. More wrong responses (on those that have right/wrong answers) can send you into a remediation loop.

Reading Quizzes: (RQs, These are part of your test grades!!!)

There are **9 Reading Quizzes (RQs)** based on weekly assigned readings. Each quiz consists of a set of questions that are randomly selected from a pool of about 60-90 questions. Because the computer randomly selects questions from the question pool when it generates a quiz, **each version of the quiz will be different** and may consist of some questions that are repeated, *as well as new questions*. *Once available,* **the quizzes**

can be retaken as many times as you want before the due date and it is **only the highest score that is counted**. Because each version of a given quiz is different, and only the highest score counts, it is to your advantage to take it several times so that you will see more questions over the topic.

Perhaps most importantly, these quizzes **constitute part of your test grades** – which is a good thing because you can use your notes when completing the quizzes and, as just stated, you can take them many times!

If you experience computer problems while taking a quiz or test, or any other assignment, please contact the SHSU online helpdesk (936-294-2780) before the assignment is due.

As regards the reading assignments, you'll want to thoroughly read the material – not just skim it. Skimming the text will not adequately prepare you for the test because, as emphasized throughout the course, facts presented in isolation from one another or randomly, *don't make sense and are hard to remember*. *You have to see the connections* among the facts in order to make sense of them – and to remember them! That requires reading all of the material – in order.

Once a reading quiz has been submitted, the answers will be shown. In many cases, explanations are provided for the answers as well. Please remember that this course is primarily about ***understanding and reasoning – not mere memorization***. So, you should always look over the completion reports to ensure that you understand the concepts!

Extra Credit: (only up to 50pts will be offered)

Your instructor may or may not assign extra-credit. Due to an agreement with the other instructors, any extra credit offered cannot total more than 50 pts.

Case Studies in Lecture: Case Studies will be completed in groups. Many assignments will include both an individual (preparatory) portion AND a group portion. Assignments involving group work will be peer evaluated, based on group member effort. Further instructions on the peer evaluation process can be found below.

Note about Grade Corrections: Please check BlackBoard as soon as the grades are posted. **Students have a maximum of two weeks to contest a grade**. For example, if the grade is incorrect, you need to notify me within two weeks of my posting of the grade in BB. After two weeks, if no errors have been reported to me, the grade stands as is.

Attendance/Participation (200 points):

This course abides by University Policy and Regulations concerning attendance (See the Undergraduate Catalog). Accordingly, "regular and punctual attendance" is expected of each student at Sam Houston State University:

In this course *attendance /participation is required for at least 3 (three) Q&A bi-weekly sessions*. You have the opportunity to earn up to 200 points by attending and participating during these sessions.

Additional Information Regarding Attendance, Missed Work, and Missed Exams, etc.

1. **Missed work/Late work:** Late work is normally not accepted unless there are extenuating circumstances.

2**. Missed Work Due to Special/Extenuating Circumstances**: If unusual circumstances arise during the semester, such as a medical problem, death in the family, etc., which adversely affects your attendance and ability to complete work, **PLEASE discuss this with me immediately and provide documentation**. **Don't wait until the end of the semester to discuss the problem with me. If you keep me informed, I will gladly do my best to accommodate your situation**. However, please understand that, because of the nature of the course, there are limits as to how much can be excused and so, at some point, it may be necessary for you to drop the course.

Also, if you wait until after-the-fact, at the end of the semester, to let me know that you were experiencing these adverse circumstances, there is nothing I can do about it at that time. I cannot retroactively make accommodations and I do not give individual extra credit assignments to make up for grade deficiencies.

The Peer Evaluation Process

In this class, students will be divided into groups in order to improve learning. To encourage participation of all members of the group, you will evaluate each of your group members, including yourself, on a 10-point scale, ranging from 0 = no work, to 10 = full participation) after every group assignment.

These scores should be entered immediately after the assignment is due.

For the peer process to work, it is essential that you be fair in your assessments. This means that if someone in your group contributed appropriately, then fairness requires that he or she receives full credit. However, if someone did not contribute adequately, fairness also requires that you give them fewer points. **If a member of the group was not present during activities, or did not contribute to an assignment, they should receive zero points.**

It is also critically important that you do not 'agree' to give each other good scores.

An agreement to give good grades is guaranteed to undermine the integrity of the process and will inevitably result in bad feelings if members of the group don't do their fair share of the work because they think they're going to get a good score no matter what they do. Also, failure to do the peer evaluation correctly, or not to do it, or not to do it on time, results in the loss of 40 points from the overall set of course points.

At the end of the semester, your peer evaluation score is based on the average of the peer evaluation score you received from the members of your group - converted to a percent. Accordingly, an average of 10 equals 100%; an average of 9 equals 90%, and so on. This score is then used to determine the number of *group* points that you will receive at the end of the semester. So, if you receive an average of 10, you will receive 100% of the points earned by your group on the group assignments. If you receive an average of 9.2, then you will receive 92% of the group points, and so on.

Anyone receiving an average of less than 7.0 on his or her peer overall evaluation at the end of the semester will automatically lose all of his or her group-based points.

So the point is,

"Do your best to contribute to the group ☺!"

How to Earn a Good Peer Evaluation Score

2) Come to the case study meetings prepared to contribute by reading the assigned material. The same applies when the group meets to do the group homework assignments. In the case of the homework assignments, this means that you should attempt to answer the questions on the assignments BEFORE you meet with the group.

2) Be positive and friendly and treat the other members of the group the way you want to be treated. In other words, be courteous and respectful of others' comments and ideas - even if you don't agree with them. Be willing to accept that your initial thoughts might be incorrect – but don't be afraid to *courteously* express your views even if they are different from those of others in the group.

3) Contribute significantly to the group homework assignments.

*You should keep a copy of what you have written in case there is a dispute regarding your contribution.

4) Participate in all group meetings and, **if you absolutely cannot be at a meeting or group chat because of work or other legitimate schedule conflicts, make sure you keep in touch** with the group via e-mail, Zoom, Facebook, or phone and let them know ***ahead of time*** that you can't come.

General Class Policies

Academic Honesty: All students are expected to engage in all academic pursuits in a manner that is above reproach. Students are expected to maintain complete honesty and integrity in academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action that is consistent with university policies. Please read the following:

Students are encouraged to study in groups to prepare for tests. However, "group effort" (or using outside sources of information) is definitely not permitted when taking exams! The Respondus system can detect this and it will result in an automatic zero on a test. Two such occurrences will result in an F in the course.

Proper Course Behavior: All of these rules are standard and are based on common courtesy, respect, and honesty – all of which are necessary to ensure a positive learning environment. Students will refrain from negative/disruptive behavior during class and groupwork that intentionally or unintentionally disrupts the learning process and, thus, impedes the mission of the university.

Americans with Disabilities Act: It is the policy of Sam Houston State University that individuals otherwise qualified shall not be excluded, solely by reason of their disability, from participation in any academic program of the university. Further, they shall not be denied the benefits of these programs nor shall they be

subjected to discrimination. Students with disabilities that might affect their academic performance should register with the **Office of Services for Students with Disabilities located in the Lee Drain Annex** (telephone 936-294-3512, TDD 936-294-3786, and e-mail disability@shsu.edu). They should then make arrangements with their individual instructors so that appropriate strategies can be considered and helpful procedures can be developed to ensure that participation and achievement opportunities are not impaired.

SHSU adheres to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations for students with disabilities. If you have a disability that may affect adversely your work in this class, then I encourage you to register with the SHSU Services for Students with Disabilities and to talk with me about how I can best help you. All disclosures of disabilities will be kept strictly confidential. **NOTE: No accommodation can be made until you register with the Services for Students with Disabilities**. For a complete listing of the university policy, see:
http://www.shsu.edu/dept/academic-affairs/documents/aps/students/811006.pdf

Religious Holy Days: If a student desires to be excused from class, an assignment, or a test on a religious holy day, then the student must notify the instructor of each scheduled class that he/she will be absent for religious reasons. In such cases, the student will be required to take the test or submit the assignment early—unless there are good reasons for not being able to do so and the instructor has agreed to those reasons.