Online Foundations of Science
Spring Semester 2018

Course Number: BIOL 1436.30,.31

Office Number: LDB 308

Class Time: Online

Physical Office Hours: Tues 9:30-11am, Wed 8:30-11:00

Class Meeting Room: Online

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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**. 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 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 journals and the use of "**case studies**" which involve classroom-based group work, homework assignments, and readings. The use of case studies (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: There are two textbooks for the course and a lab manual. You are also required to have an audio/video recording device (camera w/ microphone).

1) **How to Think About Weird Things: Critical Thinking for a New Age** – 7e, 2013, by Theodore Schick and Lewis Vaughn, McGraw-Hill. ISBN 9780078038365 (paperback). *Required -You may use the 6th edition if you can find it cheaper, we do have a few for short-term check-out at the library*

2) **Foundations of Science - Custom** (This is a custom edition of Conceptual Integrated Science, by Hewitt, Lyons, Suchocki, and Yeh, 2012), Pearson/Addison-Wesley, San Francisco. ISBN 9781269685535 *Required - we do have a few for short-term check-out at the library*

3) **Lab manual: Foundations of Science Lab Manual** ISBN 9780738091907 *Required - Get this as quickly as possible*

4) **Camera (audio/visual recording device on computer)**

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

Grading Criteria

Because the lecture and lab portions of the course are considered to be part of the *same* course, the final course grade is based on a combination of lecture (75%) *and* lab (25%). In other words, there is no separate lab grade. Because of this, students must remain enrolled in both the lecture and lab for the entire semester; they cannot drop either the lecture or the lab and receive a grade for the course. The 4 in the 1436 designation for the course indicates that this is a 4-credit course that has a lab component.

Grading will be based on three (3) lecture tests, a ProctorFree practice test, a syllabus quiz, nine (9) reading quizzes, four (4) group case studies, eight (8) individual and eight (8) group lab quiz grades, peer evaluations by your fellow group members in both lecture and lab (see details below), and 10 journals (3 per unit/ 1 final reflection).

Please note that the number of assignments may be changed slightly (e.g., 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.

In an integrated course such as this, each topic serves as the foundation for subsequent material; consequently, **students should remember and understand all of the basic principles covered previously in the course** in order to apply them in the case studies and labs, and to do well on exams.

Tests: There are 3 major exams and each will consist of multiple-choice, matching, essay, and short answer-type questions. These will all be administered/recorded through **ProctorFree**.

ProctorFree Practice Test: This is a simple way to earn points, but is crucial to your success in the class. Tests will be administered using ProctorFree. We will conduct a practice test early in the semester, to ensure your computer is compatible with the software or find a suitable computer before our first test. Please call the SHSU help-desk should you need assistance with ProctorFree (936-294-2780). I strongly recommend using an up-to-date version of **Google Chrome**, **uploading the most recent version of Java** onto your computer, having a **strong/secure internet connection** (not a coffee shop connection), and **shutting down background programs and windows before taking a test in ProctorFree**.

Syllabus Quiz: The syllabus quiz provides you with an easy way to earn points and familiarize yourself with the course.

Reading Quizzes: Each week, you will be assigned readings from the books listed above and, in some cases, from PowerPoint lectures that are posted on BlackBoard but which are not discussed in class. To ensure that students read these assignments, **a set of reading questions will normally be given every one to two weeks over the reading material**. These assignments will be ***completed* online, in BlackBoard.** You are asked to *use both your books and notes* to complete the assignments. Once available, you may re-take the reading quiz assignment as many times as you wish before the due date for the reading assignment. If you experience computer problems, please contact the online helpdesk (936-294-2780) before the assignment is due. The reading quizzes will be available for a week, or more, before they are due. **They can be re-taken as many times as you want before the due date and it is the highest score that is accepted**. The quizzes are randomly created from a pool of questions. The pool typically consists of 60 to 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. The more times you take it, the more questions you will see before the test. We suggest you complete the reading quizzes early, should you have questions or computer problems. Because

the reading quizzes are available for an extended period of time and can be re-taken before the due date, ***late reading quizzes will not be accepted***. We do not recommend waiting to the last available day to complete the reading quizzes, as you may experience computer and/or technical issues. By attempting the quizzes earlier in the week, you will ensure you earn a higher grade and submit the assignment on time.

As regards the reading assignments, **I strongly recommend that you thoroughly read the material – don't just skim it**. If you try to avoid actually reading the material and, instead, merely skim the chapter until you find something that 'looks right,' you will *not* learn the material. This technique really doesn't work because, as emphasized throughout the course, facts presented in isolation from one another don't make sense. You have to see the connections among the facts in order to make sense of them – and to remember them! This is why reading *all* of the material for comprehension does work!

Once the quizzes have been submitted, a screen will show you which questions you earned credit on and which you missed. In many cases, explanations are provided for the answers as well. Many students print off their completion reports for study guides. Please remember that this course is about *understanding and reasoning – not memorization*. So, you should always look over the completion reports to ensure that you understand the concepts. In other words, the quizzes and completion reports serve as a study guide for the readings.

Journals: Students will conduct 3 journal entries per unit and 1 culminating reflection. My face-to-face classes get 200 points for attendance. They do this by showing up, interacting in group activities, and turning in reflection pieces. Because this is an online course, I wanted to give you the opportunity to earn the same. This will account for 200 points of your grade (or 5% of your overall grade).

Case Studies: You will critically analyze case studies with your group, using the skills and knowledge garnered in this class. Each case study will be conducted and finalized within your group's wiki page. Each group member will have their own member letter and highlighting color. Assignments will have obligatory due dates (for individual work) and final/hard due dates (for group consensus). Further instructions will be relayed within the course. We begin with an easier case study, to give students and groups a chance to learn procedures.

Lab – Case Studies: The lab grade will consist of both individual scores and group-derived scores. Most of the labs will be based on case studies that will involve instructor-led discussions in which members of groups work together to develop responses, propose hypotheses and experimental designs, or offer explanations for what has been reported or observed. In short, labs involve a lot of discussion – both within each group and among groups. The lab instructor will facilitate these discussions. The discussions make the labs fun and interesting because they are not based simply on rote memorization and fill-in-the-blank activities; rather, they involve group discussion and exploration of topics.

At the beginning of the lab, each student will be given a short, Individual Lab Quiz (ILQ) over the information provided in the lab readings and relevant readings assigned in lecture. This is intended to ensure that everyone reads the ***lab exercise and textbook background readings*** (listed on the lecture syllabus) ***before coming to class so*** they will be prepared for the lab discussion. The quiz will include some vocabulary terms listed at the end of the lab exercise and related lecture notes and readings. Questions will be multiple-choice and/or short answer essay.

At the end of the lab, each group will be given a Group Lab Quiz (GLQ) regarding the information covered in lab. The group will work together as a team to complete it. Groups will be created by the lab instructor at the beginning of the year. The purpose for the group work is to enhance understanding of the material by having group members help teach each other the material and reinforce the key concepts covered in the lab. The group scores obtained over the semester will be adjusted by the peer evaluation score the student receives from his/her peers using the procedures outlined on the peer evaluation form.

Peer Evaluations: You will evaluate each of your group members, including yourself, on a 10 point scale. (0=no work, 10=full participation) Please note that 10 is the maximum number of points that may be awarded.

You must be fair in your assessments, but if someone in your group did not contribute adequately, then you should give them fewer points. **If they were not present or did not contribute to an assignment, they should receive zero points.**

It is imperative that you assign these scores **PRIVATELY** (NOT in front of your team members) AND that you do this on the day the case study was conducted or turned in! **It is also critically important that you do not 'agree' to give each other good scores.** This is guaranteed to undermine the integrity of the process and will inevitably result in bad feelings if someone in the group doesn't do his or her fair share of the work because he or she thinks they're going to get a good score no matter what they do.

At the end of the semester, your peer evaluation score is equal to the average of the amount of peer evaluation points you received from the members of your group - converted to a percent. Accordingly, an average of 10 points equals 100%; an average of 90 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. 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.

If you have an average of less than 7, you will not receive ANY of the group points.

Use the following additional criteria when assigning points:

1) Be fair! If a person made a genuine effort to contribute, then award 10. ***Do not give points to a student for an assignment if that student was absent or did not participate*** *the day/week a group assignment was completed. And, do not give any points on a group homework assignment if the person did not contribute.*

2) You cannot give anyone in your group more than 10 points. (This prevents people from giving their friends an unfairly large amount of points, which would necessarily hurt other members of the group because there would be less points to distribute to other group members).

3) **You do not have to distribute all of the points**. If someone does not contribute appropriately, then give him or her less than 10 points. And, as stated previously, if someone is absent in your group on the day of the assignment, then give him/her no points; i.e., a zero.

4) **Anyone receiving an average of less than 7.0 on his or her peer evaluation at the end of the semester will automatically lose his or her group-based points.** So, for example, if a student receives an average of less than 7.0 in lecture, the student will lose all of the group-based points earned by the group in lecture.

It is the last rule that normally ensures everyone will contribute to the group's efforts! Also, the fact that the score is an average prevents anyone who might be unfair in the awarding of points from single-handedly undermining the final grade of a group member. And, if one student gives a score that is much less than those of other students (which implies that it is unfair), ***I have the option of ignoring that score***. In fact, I can override a low average score if there is evidence that the grade was unfairly assigned by the group. ***This serves as a safety net for each student***.

This type of peer-evaluation method has been used in many universities and works very well. Students like it because it encourages everyone to pull their own weight and contribute to the group.

How to Earn a Good Peer Evaluation Score

1) Join your group discussions and get to know your group members.

2) Come prepared to contribute to the case studies and quizzes by attending group discussions (so you know what's going on), and reading the assigned material. In other words, make sure you can and do contribute constructively to the discussions.

3) 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 also don't be afraid to courteously express your views even if they are different from those of others in the group.

4) Contribute significantly to the group homework assignments. Do your part and do it on time – not at the last minute. *I might suggest keeping a copy of group communications in case there is a dispute. Remember, I can override the group's evaluation in the unlikely event that it was unfair. ***However, this normally requires that you be able to document what you contributed so that I can base my decision on evidence rather than hearsay***.

I will average your peer evaluations halfway through the semester and post them in Blackboard. This evaluation will serve only to give each person feedback from the members of his or her group so that he or she can correct any problems that might exist. Only your final average peer evaluation will be used in calculating your final groups points.

Very important note: Although points are not given for completing peer evaluations, **points will be deducted if the rules are not followed** and/or if you do not submit a peer evaluation for your group members. Specifically, 25 points will be deducted for each of the following:
* not submitting a weekly peer evaluation, if present
* submitting duplicate peer evaluations
* awarding points to absent group members
* evaluating your group on a day you were absent

* an inconsistent evaluation (i.e. awarding a member 4 points, but remarking that they "fully participated")
* openly bartering/asking for better/worse peer evaluation points
* evaluating an incorrect section, group, or listing one's self using an incorrect member designation
* other such actions that undermine the peer evaluation process at the instructor's/coordinator's discretion

Case Study Schedule for Spring 2018:

Individual Work Due ***Feedback***	**Group Final Agreement Due**	**BB Wiki #**	**Topic**
1/24 *1/26*	1/31	CS 01	Group Norms
1/31 *2/02*	2/07	CS 02	Lab 01. The Checks Lab (p. 1)
2/07 *2/09*	2/14	CS 03	Xango Lecture Case Study (p. 73)
2/14 *2/16*	2/21	CS 04	Lab 02. Salem's Secrets (p. 7)
2/21 *2/22*	2/28	CS 05	Argument Lecture Case Study
2/28 *3/02*	3/07	CS 06	Lab 03. The Fast & the Forgetful: Limits to Percp & Memory (p. 13)
3/07 *3/09*	3/14	CS 07	Lab 04. I'm a Libra. Astronomy meets Astrology. (p. 21)
3/21 *3/23*	3/28	CS 08	Lab 05. *Star Trek* and the Laws of Nature (p. 27)
3/28 *3/30*	4/04	CS 09	Lab 06. The Haunting: Laws of Nature (p.35)
4/04 *4/06*	4/11	CS 10	Tragic Choices Lecture Case Study (p. 77)
4/11 *4/13*	4/18	CS 11	Anti-oxidant Alkaline Water Lecture Case Study
4/18 *4/20*	4/25	CS 12	Lab 08. The Present Is the Key to the Past (p. 47)
4/25 *4/27*	5/02	CS 13	Lab 09. Natural Selection (p. 59)

Late Work Policy

Late work will not be accepted.

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, or if it was not posted correctly, you need to notify me within two weeks of my posting of the grade. After two weeks, if no errors have been reported to me, the grade stands as is.

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:

1) Students are asked to take the tests without textbooks, searching the internet (googling), using their notes, etc. Students are expected to take the tests on their own. We will use ProctorFree to monitor the tests. If a violation is observed, it will result in an automatic zero on a test. Two such occurrences will result in an F in the course.

Proper Course Behavior: Students will refrain from behavior/language in the online classroom that intentionally or unintentionally disrupt the learning process and, thus, impedes the mission of the university. Inappropriate language or behavior in the online classroom may result in a student being reported to the Dean of Students for disciplinary action in accordance with university policy.

Study Tips: Please read and follow these tips to enhance your grade in the course. I want you to do well!

1. **This course deals with arguments and evidence for or against certain claims. So, in order to study, you should imagine that you have been asked to write an essay in which you must present evidence and arguments to either support or refute a claim. This helps you learn and retain the material – and it makes the learning process more fun and interesting. This approach amounts to pretending that you are teaching the material to someone else.** You cannot simply memorize your notes and definitions and expect to do well on the tests. You must truly understand the material in order to obtain a good grade.

2. **Take notes.** You will almost certainly need to take notes in order to recall, integrate, and understand the information. In addition, note taking requires active listening; i.e., a conscious attempt to determine what is important and to look for connections between ideas. Lectures aren't simply a bunch of facts and definitions thrown together. **In the class, the lectures are arguments either for or against certain claims and you'll need to understand the arguments**.

3. **Review your notes before the next class.** Constant reviewing will help you learn the material in smaller 'bites' of information – which makes it much easier to learn. Just as importantly, reviewing your notes before the next lecture will help you see how the previous material connects with the material to be covered in the upcoming class.

4. This course requires that students learn a significant amount of material on their own, independent from the lecture material. Furthermore, the reading quizzes are based on the reading material! **So, reading the textbooks and reader for this course really, truly is a necessity. *The ability to learn on your***

own is one of the most important skills you will learn in college, and it is one of the most important skills that employers look for in job candidates.

5. When it comes time to **review for an exam**, first read the highlighted portions of the text, then concentrate on your notes. You might also want to follow the procedures below:

   a. As you review your notes, first concentrate on absorbing the key ideas and understanding the organization of the material - why certain ideas followed others in the class and how they are related.

   b. Once this is done, begin to focus on the details - the "whys." As stated above, **tests in this course are absolutely not based on the mere memorization of definitions, or on the recognition of verbatim statements from lecture**; rather, the test questions assume you already know the definitions and that you understand the concepts discussed in lecture. **So, you will not be asked definitions; rather you will be asked to apply facts and principles, i.e., to think with the information you have learned**. Of course, you have to know the definitions to begin the process of answering questions; so, by all means, learn the definitions as the first step in learning the material☺

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

Special Circumstances: If unusual circumstances arise during the semester, such as a medical problem, death in the family, etc., which adversely affects your participation **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 extra credit assignments to make up for grade deficiencies.