526.01W The Quantum Universe for Educators

ONLINE COURSE SYLLABUS: Fall 2019

INSTRUCTOR INFORMATION

Instructor: **Dr. Bahar Modir**
Office Location: STC 343
Office Hours: TBA
Office Phone: 903-886-5359
University Email Address: bahar.modir@tamuc.edu
Preferred Form of Communication**: Email**
Communication Response Time: Within 24 hours (48 at weekends and holidays).

COURSE INFORMATION

Materials – Textbooks, Readings, Supplementary Readings

The 2 required books can be ordered from online retailers for a total of around $100 or under.

Textbook(s) Required

Orzel, C. (2010), *How to Teach Quantum Physics to Your Dog*, Oneworld Publications, ISBN-10: 1851687793, ISBN-13: 978-1851687794

McIntyre, D. (2012), *Quantum Mechanics: A Paradigms Approach*, Addison-Wesley, ISBN-10: 0321765796, ISBN-13: 978-0321765796

Optional Texts and/or Materials

Baggott, J.M. (2013), *The Quantum Story: A History in 40 Moments*, Oxford University Press, ISBN-10: 0199655979, ISBN-13: 978-0306821448

Course Prerequisites

Math: Students are required to know mathematics through Calculus 3 or equivalent, or have taken or be concurrently taking the Mathematical Methods for Educators Course (PHYS 530). **This course makes extensive use of linear algebra, (especially matrix algebra) and complex numbers**. We will need some differentiation and integration, and the Schrodinger equation, which plays a central role in quantum mechanics, is a second-order differential equation.

Physics: A course in calculus-based physics is required. Some knowledge of basic thermodynamics and statistical mechanics will be an advantage, but I will explain concepts from those subjects when we need to use them.

Course Description

The history of quantum mechanics including the experimental results that required a new theory of the interaction between light and matter at microscopic level. The uncertainty principle, wave-particle duality and wave mechanics. Applications (including simple calculations) to atomic physics, nuclear physics, semiconductors, lasers; how quantum mechanics has shaped the modern world. The impact of quantum mechanics in our culture; 3 its uses and misuses. Prerequisites: University physics and calculus up to partial differential equations (2015 TAMUC Graduate Catalog).

Quantum theories underpin our modern world. Without quantum mechanics, modern electronic devices such as computers, cell phones, most modern medical imaging and technology, most development in materials science, the World Wide Web, and many

other things would not exist. It is the most accurately tested physical theory that exists - giving numerical predictions verified by experiments to more decimal places than our theories of gravity, Newton's laws of motion or our laws of thermodynamics.

Quantum mechanics is also most misunderstood and abused scientific theory. Misunderstanding is not surprising. Quantum mechanics makes claims on the nature of reality at the microscopic level running counter to our everyday experience. Some principles of quantum mechanics have made it into popular culture in a distorted way; for example the, notion reality can be affected by the observer. These vague notions are exploited by those who wish to peddle all manner of pseudoscience. It is therefore very important to understand how to interpret quantum mechanics.

In this class, we will learn about the fascinating history of the development of quantum mechanics, the fundamental principles of the theory and the practical and fundamental physics applications, develop lesson plans introducing the exciting physics of quantum theory to high school students, and explain the ways in which the theory can be misunderstood and misused.

The purpose of this class is three-fold:

1. To give you a working knowledge of the fundamentals of quantum mechanics and its modern applications. To appreciate how it has created the modern world, and that it is the most precisely tested scientific theory.
2. To explore the history and interpretation of quantum theory as an archetype of a scientific revolution, in order understand better how scientific theories develop.
3. To discuss the teaching of these at a high school level, examine common misconceptions, explore the many tools available on the web that aid us, and to share experiences and resources as a community.

Student Learning Outcomes

At the end of the course students will:

1. Demonstrate knowledge of the history of quantum mechanics, and argue why it is an exemplar of a scientific revolution.
2. Explain the principles of quantum mechanics, express them mathematically, and apply them to make quantitative predictions in fundamental and applied physical situations.
3. Detail current and future practical applications of quantum mechanics.
4. Summarize the ongoing discussion on the interpretation of quantum mechanics and critically analyze articles in the popular media relating to quantum theory. Create lesson plans which accurately and engagingly introduce quantum physical principles to high school students.

COURSE REQUIREMENTS

Minimal Technical Skills Needed

Instructional Methods / Activities / Assessments The details of the course structure are given below. Any changes will be communicated via email and announcements on myLeo Online. Your TAMUC email account will be used at all times, and it will be your responsibility to check it regularly (at least once every 24 hours).

The course is organized into five units, each containing 3 weeks (most of which last about a week, but some of which last 2 weeks!).

Introductory tasks

The semester starts at **12.01 a.m. Monday, August 26th**, which is when the introductory material and unit 1 will become available.

Before tackling Unit 1 and the rest of the course, you must complete the following activities which you can find in the introductory module:

(1) **Complete the pre-course assessment**, which will be given again at the end of the course, so we can measure your learning gains on Student Learning Outcomes 1-5. This assessment will not count towards your class grade. It can only be taken once and once you begin the quiz you will have 40 minutes to complete it. The **pre-course assessment** must be completed before you can gain access to the first week of the class.

(2) Read the **syllabus**.

(3) Take the **syllabus quiz** to make sure you understand the mechanics of the course. This can be taken any number of times. The **syllabus quiz** will not be graded, but it must be completed with 100% correct answers before you can gain access to the first week of the class.

(4) **Introduce** yourself to the class on the **"Class Introductions"** discussion thread.

NOTE: You must complete the pre-course assessment to access the rest of the class, and complete the syllabus quiz with 100% correct answers before access the first, and subsequent, units.

Regular week tasks, material and due dates

The course material is organized into 5 units of three weeks each, most of which do indeed last a week, but be aware that some will last 2 weeks! Always check the class schedule at the end of this syllabus.

Each unit covers a major topic in quantum mechanics. Each week you will be required to complete discussion posts and quizzes, and homework will be assigned each week and collected in at the end of each unit.

Unit 1, Weeks 1-3 are available from the first day of the semester, Monday, August 26th. Subsequent units are available on the dates listed at the end of the syllabus. All 3 weeks from each unit become available when the unit opens, and homeworks from all 3 weeks are due at the end of each unit, to allow for some self pacing. ***However, note that discussion posts and quizzes are due weekly, and discussion posts cannot be completed ahead of the particular week they open. This is essential to ensure relatively coordinated discussion between all members of the class.*** You will always be able to access previous week's material, and you can continue posting in their discussion threads, but you won't be able to take the quiz past the due date, and discussion posts after the deadline will not count towards you grade. Other than the homework, all tasks must completed weekly. Make sure you are familiar with the schedules at the back of the syllabus.

During each week, the following tasks will be assigned, to be completed either by the end of the week (in the case of discussions and quizzes) or the unit (note: reading and viewing material are necessary to take part in the discussion and complete the quizzes accurately).

(1) Complete the **reading assignments**. These will come from the course textbook or other articles and material posted on MyLeo Online.

(2) Watch the unit's **1-5 Mini-lectures** which will cover one or two key concepts at a time, to reinforce reading material, or give examples of problem solving.

(3) Complete the **quizzes** designed to assess students' comprehension of the reading assignments, mini-lectures and basic knowledge of key principles. Quizzes must be completed by **11.59 p.m. the Sunday** that concludes the corresponding week.

(4) Participate in the **discussion threads**. Each week you must make at least 3 substantial posts in each of the current week's topics, and 2 responses to posts in the previous week's topics. A week's discussion thread opens at **12.01 a.m. Fridays** and remains open throughout the semester.

(5) Complete the **homework**. All three weeks' homeworks will become available with the unit. Although they are intended to be completed weekly, they are collected it every

three weeks at the end of each unit to allow some amount of self-pacing. However, you should attempt to regularly work through homeworks; attempting to do all of them at the end of the third week will result in medically inadvisable stress and under-par results.

(6) Two **projects** will be assigned at about one third and two thirds of the way semester.

A complete list of due dates for discussion posts, quizzes and homeworks are given on pp. 20-21 of this syllabus.

Learning Activities and Assessments

The following describes the assignments you must complete which will contribute to your progress through the course and to your final grade, together with how they will be assessed.

• **Quizzes** are designed to assess students' comprehension of the reading assignments, mini-lectures and basic knowledge of key principles, often in response to the mini-lectures and reading assignments.

Quizzes are designed to provide you with assessment of your learning. Half of the quiz grade will be awarded just for completing the quiz; the other half will come from your actual quiz score.

You will only be able to take quizzes once. Once you begin taking the quiz, you will have a time limit of one hour to complete it. Once completed, you cannot return to it and revise your answers. You will see your score, however, and what answers you got wrong.

Quizzes address: Learning Outcomes 1-3

• **Ongoing Discussions** will be conducted each week on the concepts introduced in the reading material and lectures. A number of threads will be opened, one per topic. Sometimes I will ask a question or pose a problem to get you started. Certain threads require you to post before you see responses of other students; this will be clearly indicated.

Learning and understanding is significantly enhanced by active engagement in the class through continual discussion of topics. All students are required to participate in the discussions with a number of substantive posts. **Students are required to make 3 substantive posts, in three separate threads, giving your thoughts about the reading or answering the opening questions. In addition, students are required to make two posts in the previous week's threads, replying to posts of other students or of myself. That makes a total of 5 posts per week that will be graded.**

The rubric for grading the online discussions is found on pp.16-17 of the course syllabus.

Of course, continued discussion beyond the minimum posts required is strongly encouraged. I will pitch into the discussion at various times during the week, answering queries and asking new questions to make sure we discuss all the week's material adequately.

When appropriate, at least one thread will be devoted to discussing how one might teach the week's concepts at the undergraduate level, and for the sharing of your own experiences and resources for the benefit of the teaching community.

I hope to make the discussion threads a fun and lively forum throughout the semester!

The discussion threads will be found underneath each week's tab on the left side of the LearningStudio window.

Discussions address: Learning Outcomes 1-4

Weekly homework will be set. Homework activities will fall into 3 categories:

- Quantitative questions from the textbook
- 250 word Reading reflections on the education literature, graded according to the rubric on pages 18-19.
- Tutorial homeworks graded according to the rubric on pages 17-18.

Full instructions will be provided each week, together with the method of assessment, in the weekly content area.

Homework questions will be collected in for grading at 5 different dates during the semester (roughly every 3 weeks). Homework can be delivered to the assignment at any time, up to the due date. Each week's homework questions will have their own DropBox that will be available under each week's assignment sub-module on the left side menu of the course content.

Homework that involves problem solving, pictures, or other material that is difficult to submit as a Word format or similar, may be submitted as hand written work scanned in or photographed. If you use a camera phone to take pictures of your work, a useful app is CamScanner (https://www.camscanner.com), which compiles multiple pictures into one document for ease of uploading. There is a free version that I encourage you to check out. Make sure that your work is legible in scanned form.

Homeworks address: Learning Outcomes 1-4

2 Projects will be assigned throughout the semester, one after roughly 6 weeks, one after about 10 weeks. Each one will be due by the date I set the next one (giving you about 4 weeks for each one.) I will give more details and instructions closer to when they are assigned. For now, I will give you an idea of what each one involves:

Project 1: Develop a complete lesson plan, including exercises and evaluation,

introducing a topic in quantum mechanics to high school students and that is related to a modern application of quantum mechanics.
Addresses: Learning Outcome 4

OR Find and critically analyze an article from the popular media which contains a misuse or misunderstanding (intentional or otherwise) of quantum theory.
Addresses: Learning Outcome 4

Project 2: Outline the ways in which the history of the uncovering of Quantum Theory in the period 1900-1927 encapsulates the way in which science works.
Addresses: Learning Outcome 1

GRADING

Full completion of quizzes - 1% each week	12%
Performance on Quizzes - 1% each week	12%
Discussion – about 2% each week	26%
Homework – 2.5% each week	30%
Project 1	10%
Project 2	10%

Final grades in this course will be based on the following scale:

A = 90%-100%
B = 80%-89.99%
C = 70%-79.99%
D = 60%-69.99%
F = 59.99% or Below

TECHNOLOGY REQUIREMENTS

LMS

All course sections offered by Texas A&M University-Commerce have a corresponding course shell in the myLeo Online Learning Management System (LMS). Below are technical requirements

LMS Requirements:
https://community.brightspace.com/s/article/Brightspace-Platform-Requirements

LMS Browser Support:

https://documentation.brightspace.com/EN/brightspace/requirements/all/browser_support.htm

YouSeeU Virtual Classroom Requirements:
https://support.youseeu.com/hc/en-us/articles/115007031107-Basic-System-Requirements

ACCESS AND NAVIGATION

You will need your campus-wide ID (CWID) and password to log into the course. If you do not know your CWID or have forgotten your password, contact the Center for IT Excellence (CITE) at 903.468.6000 or helpdesk@tamuc.edu**.**

Note: Personal computer and internet connection problems do not excuse the requirement to complete all course work in a timely and satisfactory manner. Each student needs to have a backup method to deal with these inevitable problems. These methods might include the availability of a backup PC at home or work, the temporary use of a computer at a friend's home, the local library, office service companies, Starbucks, a TAMUC campus open computer lab, etc.

COMMUNICATION AND SUPPORT

The following is the list of communication methods used in this class and their purposes. These include student-instructor, instructor-student and student-student communication.

You will be expected to check your university email account and log onto MyLeo Online at least once every 24 hours Monday-Friday in order to keep abreast of the latest class announcements.

- **Email** will be used by me to communicate to the class as a whole general information about upcoming assignments, due dates, and any changes in the schedule or syllabus that might occur.

  I will also email students individually with occasional feedback from assignments and on the class as a whole.

  Students can use email to ask me any questions about (i) course logistics (upcoming assignments, due dates...) (ii) as any questions about the way their specific assignments were graded and feedback they have been given (iii) constructive feedback to me about how the 14 course is going and any problems/concerns with the course structure (and even things that work particularly well!)

In emails, please put “PHYS526 Online” in the subject header. I will reply to emails within 24 hours (48 at weekends and holidays)

I will always send emails to your official University Email address as given through MyLeo. It will be your responsibility to check your university email regularly.

• **Announcements** on MyLeo Online will be used to communicate to the class as a whole general information about upcoming assignments, due dates, and any changes in the schedule or syllabus that might occur. New announcements will appear to you the next time you log in to MyLeo Online.

• **Discussion threads** for each unit should be the main way in which you ask and debate the answer to questions you have about the course material itself. Here you can brainstorm problem solving techniques and analyses of reading material. These questions should be continually addressed by your fellow students, and by myself, although in the spirit of discussion concrete answers will only be given after an honest and sustained attempt to figure out the answers yourselves.

• **We will use Zoom** for the live office hours. It is essentially a more sophisticated version of Skype, and can support conversations between multiple people. It works through a web browser; I will email a link ahead of each office hours.

Technical Support

If you are having technical difficulty with any part of Brightspace, please contact Brightspace Technical Support at 1-877-325-7778. Other support options can be found here:

https://community.brightspace.com/support/s/contactsupport

Interaction with Instructor Statement

The best method to reach the instructor is through email. You can send an email to bahar.modir@tamuc.edu with **PHYS 526 in the subject line**. If you do not receive a response within 48 hours, send a reminder email.

COURSE AND UNIVERSITY PROCEDURES/POLICIES

Course Specific Procedures/Policies

Course Specific Procedures
Academic Honesty

Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including (but not limited to) receiving a failing grade on the assignment, the

possibility of failure in the course and dismissal from the University. Since dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced. In **ALL** instances, incidents of academic dishonesty will be 15 reported to the Department Head. Please be aware academic dishonesty includes (but is not limited to) cheating, plagiarism, and collusion.

Cheating is defined as:

- Copying another's test of assignment.
- Communication with another during an exam or assignment (i.e. written, oral or otherwise).
- Giving or seeking aid from another when not permitted by the instructor.
- Possessing or using unauthorized materials during the test.
- Buying, using, stealing, transporting, or soliciting a test, draft of a test, or answer key.

Plagiarism is defined as:

- Using someone else's work in your assignment without appropriate acknowledgement.
- Making slight variations in the language and then failing to give credit to the source.

Collusion is defined as:

- Collaborating with another, without authorization, when preparing an assignment. If you have any questions regarding academic dishonesty, ask. Otherwise, I will assume that you have full knowledge of the academic dishonesty policy and agree to the conditions as set forth in this syllabus. **Homework and discussion posts will be randomly tested for plagiarism.**

Attendance Policy

In an online class, attendance means active participation; students are expected to spend at least 2 hours/week on the discussion threads and at least 10 hours/week is required to complete all the assignments, including reading. At least five substantive discussion posts are required by each student each unit to gain full points on the discussion part of the grade. If you are unable to log on for an extended period of time (greater than a week) then contact me in advance to discuss how to proceed. We recognize that many of you already have a busy work schedule, and that occasionally you might get behind in a unit. Spending even 15-30 minutes a day on class material and the discussion threads will help greatly, **and if you find yourself struggling at any time, please do not hesitate emailing me; I can be flexible to accommodate your busy schedule.**

Assignment policy

Students will be responsible for knowing when due dates for homeworks, quizzes and projects are by reading the syllabus, looking at the schedules under “Course Home” and

in this syllabus, and reading the relevant sections when posted on myLeo Online. If the schedule changes, you will receive an email and and announcement on myLeo Online about it.

Late work
Late homeworks will be penalized by 10% by each day they are late (i.e. a Homework submitted more than 10 days late gets no credit). Late projects (except the last one, which is due by the last day of classes) will be penalized by 10% by each day they are late. Quizzes and discussion posts will not be accepted past the due date. Netiquette: Communication Courtesy Code Students are expected to follow rules of common courtesy in all email messages, threaded discussions and chats. The same rules apply online as they do in person. Be respectful of other students. Foul discourse will not be tolerated. Please take a moment and read the following links concerning "netiquette".
http://www.albion.com/netiquette/
http://www2.nau.edu/delearn/support/tutorials/discrubrics/netiquette.php

Syllabus Change Policy

The syllabus is a guide. Circumstances and events, such as student progress, may make it necessary for the instructor to modify the syllabus during the semester. Any changes made to the syllabus will be announced in advance.

University Specific Procedures

Student Conduct

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. The Code of Student Conduct is described in detail in the Student Guidebook.
http://www.tamuc.edu/Admissions/oneStopShop/undergraduateAdmissions/studentGuidebook.aspx

Students should also consult the Rules of Netiquette for more information regarding how to interact with students in an online forum:
https://www.britannica.com/topic/netiquette

TAMUC Attendance

For more information about the attendance policy please visit the Attendance webpage and Procedure 13.99.99.R0.01.
http://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/academic/13.99.99.R0.01.pdf

Academic Integrity

Students at Texas A&M University-Commerce are expected to maintain high standards of integrity and honesty in all of their scholastic work. For more details and the definition of academic dishonesty see the following procedures:

Undergraduate Academic Dishonesty 13.99.99.R0.03

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/undergraduates/13.99.99.R0.03UndergraduateAcademicDishonesty.pdf

Graduate Student Academic Dishonesty 13.99.99.R0.10

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/graduate/13.99.99.R0.10GraduateStudentAcademicDishonesty.pdf

Students with Disabilities-- ADA Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

Office of Student Disability Resources and Services
Texas A&M University-Commerce
Gee Library- Room 162
Phone (903) 886-5150 or (903) 886-5835
Fax (903) 468-8148
Email: studentdisabilityservices@tamuc.edu
Website: Office of Student Disability Resources and Services
http://www.tamuc.edu/campusLife/campusServices/studentDisabilityResourcesAndServices/

Nondiscrimination Notice

Texas A&M University-Commerce will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

Campus Concealed Carry Statement

Texas Senate Bill - 11 (Government Code 411.2031, et al.) authorizes the carrying of a concealed handgun in Texas A&M University-Commerce buildings only by persons who have been issued and are in possession of a Texas License to Carry a Handgun.

Qualified law enforcement officers or those who are otherwise authorized to carry a concealed handgun in the State of Texas are also permitted to do so. Pursuant to Penal Code (PC) 46.035 and A&M-Commerce Rule 34.06.02.R1, license holders may not carry a concealed handgun in restricted locations.

For a list of locations, please refer to the Carrying Concealed Handguns On Campus document and/or consult your event organizer.

Web url:
http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/34SafetyOfEmployeesAndStudents/34.06.02.R1.pdf

Pursuant to PC 46.035, the open carrying of handguns is prohibited on all A&M-Commerce campuses. Report violations to the University Police Department at 903-886-5868 or 9-1-1.

Harassment Policy

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources here:

University Title IX Contact: Michele Vieira, 903-886-5025, mailto:TitleIX@tamuc.edu

University resource webpages:
http://www.tamuc.edu/facultyStaffServices/humanResources/title-ix/resources.aspx

http://www.tamuc.edu/campuslife/campusServices/universityPoliceDepartment/crimePrevention/sexualAssault.aspx

University Counseling Center: 903-886-5145,
http://www.tamuc.edu/campusLife/campusServices/counselingCenter/default.aspx

Campus police: mailto:upd@tamuc.edu, call 911 in emergency situations

External resources:

Crisis center of NorthEast Texas: http://www.ccnetx.org
Know your IX: http://knowyourix.org
End rape on campus: http://endrapeoncampus.org
Clery Center for Security on Campus: http://clerycenter.org
Not Alone: https://www.notalone.gov

COURSE OUTLINE / CALENDAR

This schedule is tentative.

The dates given in the first column are what I'm defining to be the begin and end dates of each week, from when the week's material becomes available to when the quiz and discussion posts are due.
During weeks 1-6 we will also practice some necessary background math and introduce Dirac notation. We will mostly be reading journal articles for weeks 1-6, including some primary sources.

Unit	Date week opens	Topic	Chapter/Sections (Teaching Physics to your Dog)	Chapter/Sections (Quantum Mechanics)
1	1: Aug 26	19th C physics, black body radiation/Max Planck/the quantum	Chapter 1:pre-Einstein	Appendix B
1	2:Sep 6	Einstein/Photoelectric effect	Chapter 1:Einstein	Appendix B/C
1	3: Sep 13	The Bohr-Sommerfeld atom		Appendix C
2	4: Sep 20	Heisenberg/Matrix mechanics, uncertainty principle	-	Appendix D
2	5: Sep 27	Schrödinger/Wave mechanics/wavefunctions	-	Appendix D, Chapter 5
2	6:Oct 4	The Copenhagen Interpretation/Intro to quantum states	Chapter 1	Chapter 3
3	7:Oct 18	Quantum States/Stern-Gerlach Experiment I	Chapters 2,3	Chapter 1.1,1.2
3	8:Oct 25	Quantum States/Stern-Gerlach Experiment II/	Chapter 4	Chapter 1.3,1.4
3	9: Nov 1	Operators/Quantum Zeno	Chapter 5	Chapter 2.1-2.3
4	10: Nov 8	Quantum tunneling/commutation	Chapter 6	
4	11: Nov 15	Entanglement, EPR and Bell's Theorem	Chapter 7	Chapter 4
5	12: Nov 22	Feynman diagrams, QFT, the standard model	Chapter 9	-
5	13: Nov 29	Qubits, Doping, Transistors	Chapter 10	Chapter 5, 15.10, 16.2

Online discussion rubric

Each week your discussion posts will be graded using the following rubric. Each week's discussion posts contribute up to 2% to your final grade.

Note: One post counts as 100 words or more on topic. Posts with less words or posts not addressing the week's class topic will not be considered for grading. Of course, the discussion should be allowed to flow naturally, and shorter posts will naturally occur, including one word posts of the type "I agree!" and "Yes!" or "No!". This is fine, and indeed necessary – it is just that the grading will be based upon posts of 100 words or more.

A reminder that netiquette should be observed at all times: please make sure you visit and understand the following resources:
http://www.albion.com/netiquette/
http://www2.nau.edu/d-elearn/support/tutorials/discrubrics/netiquette.php

Criteria	**Unacceptable(0)**	**Poor (1)**	**Good (2)**	**Excellent (3)**
Number of posts	No posts during the week.	1-2 posts during the week.	3-4 posts during the week.	5 or more posts during the week.
Spelling and Grammar	Posts are not in complete sentences, or more than half of the sentences have spelling or grammatical errors.	Between a quarter and half of sentences have spelling or grammatical errors.	Less than a quarter of sentences have spelling or grammatical errors.	No spelling or grammatical errors.
Knowledge	Posts demonstrate no evidence of knowledge of the week's reading.	Posts demonstrate evidence of only a cursory reading of the week's material, and little attempt to critically analyze	Posts demonstrate reasonable knowledge of the week's reading, and an attempt to critically analyze it.	Posts demonstrate evidence of comprehensive knowledge of the week's reading, and significant attempts to

		it.		critically analyze it.
Appropriateness and awareness of other student contri-butions	Posts rude/ disrespectful. No attempt to build upon other students' posts or support other people's arguments.	Minimal acknowledge-ment of other students' posts. Little attempt to build upon arguments.	Reasonable attempts to build upon other students' posts and contribute to their arguments.	Excellent awareness os other students' posts and substantial efforts to contribute to their arguments.
References and support	Arguments are unsupported, come across as unsubstantiated opinion.	Minimal support for students' arguments. Student's thinking unclear, hard to discern how student arrived at their conclusions.	Reasonable attempt to justify arguments made, with some references to the week's reading and external sources where appropriate.	Arguments are fully backed up, with clear explanations of how the student arrived at their conclusions, with full references to the week's reading or to external sources where appropriate.

Credit: The following online rubrics have been used to inform the development of the rubric above:
http://www.udel.edu/janet/MARC2006/rubric.html
http://www2.nau.edu/d-elearn/support/tutorials/discrubrics/discrubric.php
https://topr.online.ucf.edu/images/f/f0/IDL6543_Discussion_Rubric.pdf

Tutorial homework rubric

Each graded item on the tutorial homework is worth 4 points total. The assignment of the 4 points is determined by the following rubric. An item is defined as an individual question/problem, involving a sketch, written explanation, qualitative or quantitative answer.

Points	2	1	0
Quality of written explanation OR sketch	The written explanation shows that the student has put in thought, and the reasoning is logical. OR The sketch shows that the student has put in thought, and the sketch is mostly correct.	The written explanation shows that the student has put in thought, but the reasoning makes little sense. OR The sketch shows that the student has put in thought, but the sketch is mostly incorrect.	Written explanation reflects minimal effort. OR Sketch reflects minimal effort.
Completeness	Response to question is complete. When a written explanation is required, complete sentences are used.	Response to question is incomplete. When a written explanation is required, complete sentences are not used. Much of the writing is unreadable, word choice is inaccurate, and errors severely impede communication.	There is no response.

READING REFLECTION HOMEWORK rubric

Each reading assignment will be accompanied by one or more writing prompts. Students should follow the directions in the prompts. Homework will be graded according to the following rubric. Note that the maximum possible score is 16 points. Scores will be converted to percentages, so that a raw score of 16 is 100%.

Points	4	3	2	1

Clarity of main points	Main points are clear and easy to comprehend.	The main points are mostly clear, but slightly difficult to comprehend.	Main points are difficult to identify, or writing is difficult to comprehend.	Writing is incomprehensible.
Detail	Writing includes many specific details that are related to the main points.	Writing includes some specific details that are related to main points.	Writing includes very few specific details, or there are many details that are unrelated to the main points.	Writing includes no specific details.
Argument	The writer connects their main points with the details they have provided and makes a coherent argument.	The writer connects some of their main points to details provided, but the argument is may not be logically clear.	The writer's arguments or justifications are difficult to follow.	The writer includes no arguments or justifications.
Relevancy	Writing is completely related to the prompt.	Writing is mostly related to the prompt but is occasionally off topic.	Writing is occasionally related to the prompt but is mostly off topic.	Writing is completely unrelated to the prompt.

COURSE DUE DATES: DISCUSSION POSTS

Each week, you must post at least **one** post in each of **three different** discussion threads, giving your initial thoughts on the subject of the thread or any conceptual or mathematical difficulties you are having with the thread subject. You must also post at least **two** follow up posts in your choice of the **previous week's** threads, responding to another person's comments, or one of my comments. That makes a total of **five** posts per week that will be graded, except for the first week.

Discussion threads for a particular week open at **12.01 a.m.** each **Friday** with the rest of the week's material. To receive credit for your posts, they must be made within the time-frame outlined below. The threads remain open until the end of the semester.

WEEK	DISCUSSION THREADS OPEN	3 POSTS IN 3 DIFFERENT THREADS DUE	2 FOLLOW-UP POSTS DUE
1	Aug 26	Sept 8	Sept 15
2	Sep 6	Sept 15	Sept 22
3	Sept 13	Sept 22	Sep 29
4	Sept 20	Sep 29	Oct 6
5	Sept 27	Oct 6	Oct 13
6	Oct 4	Oct 20	Oct 27
7	Oct 18	Oct 27	Nov 3
8	Oct 25	Nov 3	Nov 10
9	Nov 1	Nov 10	Nov 17
10	Nov 8	Nov 17	Nov 24
11	Nov 15	Nov 24	Dec 1
12	Nov 22	Dec 1	Dec 8
13	Nov 29	Dec 8	Dec 15

COURSE DUE DATES: QUIZZES

The introductory week's **pre-course assessment** and **syllabus quiz** becomes available on **Monday Aug 26th** at **12.01 p.m.** *For the syllabus quiz only, you may take the quiz as many times as you like. You will only gain access to the rest of the course once you have made 100% on the syllabus quiz and have completed the pre-course assessment.*

Quizzes on each week's reading material become available at **12.01 a.m.** each **Friday**, with the rest of the week's material, and close at **11.59 p.m. (midnight)** the following **Sunday, 9 days later**.

NOTE: *Apart from the introductory quiz, quizzes can only be attempted once. Once you begin taking the quiz, you will have a time limit of one hour to complete it. Once completed, you cannot return to it and revise your answers.*

WEEK	QUIZ AVAILABLE	QUIZ DUE
1	Aug 26	Sep 8
2	Sep 6	Sep 15

3	Sept 13	Sep 22
4	Sept 20	Sep 29
5	Sept 27	Oct 6
6	Oct 4	Oct 20
7	Oct 18	Oct 27
8	Oct 25	Nov 3
9	Nov 1	Nov 10
10	Nov 8	Nov 17
11	Nov 15	Nov 24
12	Nov 22	Dec 8
13	Nov 29	Dec 15

COURSE DUE DATES: HOMEWORKS

Homework for a given week becomes available with each week, on **Friday** at **12.01 a.m.** They are due at **11:59pm** on the due dates shown in the calendar below.

Unit	HW AVAILABLE	HW DUE
1 (Weeks 1-3)	Aug 26	Sep 22
2 (Weeks 4-6)	Sep 20	Oct 20
3 (Weeks 7-9)	Oct 18	Nov 10
4 (Weeks 10-11)	Nov 8	Nov 24
5 (Weeks 12-13)	Nov 22	Dec 13