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Course Description (quoted from Search-A-Bull)

An introduction to municipal water supply and waste water treatment. Topics include water requirements and waste volumes, water quality, physical and chemical treatment processes, and advanced wastewater treatment processes.

Course Description (quoted from OASIS)

An introduction to municipal water supply and waste water treatment. Principles of environmental process engineering, reactor design, and kinetics. Interpretation of water quality information for water and wastewater applications. Design concepts for physical and chemical treatment units used in the production of drinking water and in wastewater treatment. Theory and design of biological wastewater treatment systems for municipal, industrial, and hazardous wastes. Management of process residuals.

So what will we really cover this semester?

The descriptions above are pretty good, but also pretty broad – there are a lot of "physical and chemical treatment units" and "biological wastewater treatment systems" out there. So how do we decide which ones to cover in ENV 4417? We will use treatment plants in the Tampa Bay area as "case studies". For example, the cities of Temple Terrace, Tampa, and Dunedin all have very different treatment trains for their drinking water. Why? What is it about the water source and quality in these three cities that would lead them to employ such different treatment processes? What are the unique processes employed by each of these cities? How do those treatment processes work and enable the cities to meet their water quality goals? (We won't necessarily study these three cities in particular...that is just an example.)

Course Objectives

During this semester, students should learn:

- common ways of describing and quantifying water quality;
- what treatment processes are commonly used for centralized treatment of drinking water and municipal wastewater;
- the principles behind how those common treatment processes work;
- how to quantitatively analyze and (preliminarily) design those treatment processes; and
- Why different treatment processes are selected depending on the quality of the water source and/or the requirements of the final product water.

Learning Outcomes (ABET "a through k" outcomes)

The work completed by students in this course will help those students to attain:

- (a) an ability to apply knowledge of mathematics, science, and engineering;
- (d) an ability to function on multi-disciplinary teams;
- (e) an ability to identify, formulate, and solve engineering problems;
- (g) an ability to communicate effectively; and
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

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Lectures: Tuesdays and Thursdays, 12:30–1:45, room CIS 1016

Fridays, 12:10-2:00, room ENG 004

Credit: 3 units, letter grade

Instructor: Professor J A Cunningham

E-mail: cunning@usf.edu Phone: (813) 974-9540

Office: ENC (Engineering III) 3215

Office Hours: Fridays, 12:10–2:00, ENG 004

We will also schedule some field trips for this time block on Fridays, so some weeks I might not be available for ENV 4417 office hours, but I think you will have

sufficient access to me to get your questions answered.

Text Book: Water Supply & Pollution Control, 8th edition

Viessman W Jr., Hammer MJ, Perez EM, Chadik PA

Pearson / Prentice Hall, ISBN 0-13-233717-7

Canvas: Course documents – including homework assignments – will be posted on Canvas. I

will also attempt to maintain a course web site linked to my home page, but no

promises on that front.

Prerequisite: EGN 3353, Fluid Mechanics (grade C– or better)

ENV 4001, Environmental Systems Engineering (may be taken concurrently)

CWR 4540, Water Resources Engineering (may be taken concurrently)

E-Mail: Outside of class, I will use e-mail to disseminate information. This will be done

through the Canvas program so I can reach all students at once. If you use more than one e-mail address, make sure Canvas forwards to your primary e-mail address.

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Other Text Books that Might Be Helpful

The required text book for this class will be the **8**th **edition** of *Water Supply & Pollution Control*, by Viessman et al., published by Pearson / Prentice Hall. This is a classic text book (which is why it has survived to its 8th edition), for a long time known as "Viessman and Hammer", until the addition of the new co-authors with the 8th edition. However, students may wish to make use of other text books that are focused on water supply, water quality, water treatment, and/or wastewater treatment. Of the many such books available, a few of the best known ones are the following. (I will try to put some or all of these on course reserve in the library.)

Water Quality: Characteristics, Modeling, Modification, 1985. Tchobanoglous G and Schroeder E. Prentice Hall.

[This book was pretty well known and popular but they never made a second edition, and the first edition is difficult to find now. I don't think they still print new copies. So if you find one somewhere, count yourself lucky!]

Wastewater Engineering: Treatment and Resource Recovery, 5th Edition, 2013. Metcalf & Eddy / AeCOM; McGraw-Hill.

[This is the book for wastewater engineering. In the industry it is commonly known as "the bible". You will also hear people refer to it simply as "Metcalf & Eddy". Metcalf & Eddy was a consulting firm that was sold to AeCOM back around the year 2000, but the text book is so well-known as "Metcalf & Eddy" that they still put that name prominently on the cover, even though Metcalf & Eddy doesn't really exist any more. The actual authors of the book are George Tchobanoglous, H David Stensel, Ryujiro Tsuchihashi, and Franklin Burton, so you could theoretically see this book referred to as "Tchobanoglous et al.", but almost always it is still known as "Metcalf & Eddy".]

Water and Wastewater Engineering: Design, Principles, and Practice, 2011. Davis ML; McGraw-Hill.

[I like this book a lot and almost adopted it as our primary text book for this semester. It covers both water treatment and wastewater treatment in one book, unlike the others on this list, which are either water treatment or wastewater treatment, but not both.]

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Other Text Books that Might Be Helpful, continued

Water Treatment: Principles and Design, 3rd Edition, 2012. Crittenden JC, Trussell RR, Hand DW, Howe KJ, Tchobanoglous G. John Wiley & Sons, Inc. / MWH.

[This is a great book, but it is quite large to carry around in your backpack. The first edition of this book was "authored" by Montgomery-Watson, another engineering consulting firm, kind of the way that the wastewater book is "authored" by Metcalf & Eddy. But unlike the wastewater book, the later editions of this book have credited the actual authors, rather than still giving the credit to Montgomery-Watson. Montgomery-Watson merged with Harza and became MWH back around 2000, right around the same time that Metcalf & Eddy was being bought by AeCOM. This text book now says "MWH" on the cover, and some people might call this book the "MWH" water treatment book, but that terminology is not universal in the same way as Metcalf & Eddy.]

Principles of Water Treatment, 2012. Howe KJ, Hand DW, Crittenden JC, Trussell RR, Tchobanoglous G. John Wiley & Sons, Inc. / MWH.[This book is a smaller, "distilled" version of the big Water Treatment book described immediately above. It is less comprehensive but a lot easier to carry around with you!]

Water Treatment Plant Design, 5th Edition, 2012. American Water Works Association and American Society of Civil Engineers.

[This is another classic book in the industry. It tends to be pretty practical and not very theoretical, which makes it very useful, but not great as a teaching text for college students.]

Water Engineering: Hydraulics, Distribution and Treatment, 2016. Shammas NK, Wang LK. John Wiley & Sons, Inc.

[This is a new book and I don't know a lot about it yet, but it looks promising, and in particular it looks quite comprehensive for the subjects in the title – hydraulics, distribution, and treatment. Unfortunately it does not have wastewater treatment, only water treatment.]

This list is still not comprehensive, and students may find other books that cover some of the material of this course. There is nothing wrong with exploring other points of view or other ways of understanding and interpreting the material covered in this course.

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Course Schedule

This is my first time teaching this class, so I am not yet sure how the pacing will go. Furthermore, the particular treatment processes we cover will depend on what treatment plants students select to use as case studies. Therefore I have left the "Topics Covered" field in the chart below very vague intentionally. I will fill in details as we proceed and it becomes clear (a) what processes are most relevant for us this semester and (b) how much we can reasonably cover in the time we have.

Week #	Dates	Topics Covered	Reading	Assignment
Week 1	August 25 August 27	Course introduction and overview Water resources, supply, management	Syllabus Chptrs 1, 2, 4	Form groups
Week 2	September 1 September 3	Water quality Water quality	Chapter 8	Select plant
Week 3	September 8 September 10	Introduction to water treatment Water treatment processes – softening	Chapter 9 Chptrs 10, 11	HW 1
Week 4	September 15 September 17	Water treatment processes – softening Water treatment processes – softening		
Week 5	September 22 September 24	Water treatment processes – membranes Water treatment processes – membranes		HW 2
Week 6	September 29 October 1	Water treatment processes – membranes Water treatment processes – disinfection		Plan field trip HW 3
Week 7	October 6 October 8	Water treatment processes – disinfection Water treatment processes – disinfection		Initial site visit
Week 8	October 13 October 15	Water treatment processes Exam #1 – Water Treatment		HW 4 Exam #1
Week 9	October 20 October 22	Introduction to wastewater treatment Wastewater treatment processes	Chapter 9 Chapter 12	Paper outline
Week 10	October 27 October 29	Wastewater treatment processes Wastewater treatment processes		HW 5
Week 11	November 3 November 5	Wastewater treatment processes Wastewater treatment processes		Rough draft
Week 12	November 10 November 12	Wastewater treatment processes Wastewater treatment processes	Chapter 13	HW 6 Peer review
Week 13	November 17 November 19	Wastewater treatment processes Wastewater treatment processes	Chapter 14	HW 7
Week 14	November 24 November 26	Exam #2 – Wastewater Treatment Thanksgiving – no class		Exam #2
Week 15	December 1 December 3	Group presentations Group presentations		Presentations Presentations
Week 16	December 8 December 10	Final paper (group project) due, 4:45 PM Final exam, 10:00–noon		Final paper Exam

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Class Policies: 1, Grading

- Each student in the class will be assigned a letter grade at the end of the semester.
- Assigned grades can potentially range from A+ to F, or FF for academic dishonesty. Students who keep up in class and meet the standards for the class can expect a grade between A and C.
- Plus/minus modifiers will be used as deemed appropriate by the instructor (e.g., A-, B+, etc.).
- Semester grades will be based on the following weighting: Homework assignments 25%, Group Project 25%, In-class exams 25% (two at 12.5% each), Final exam 25%.
- Attendance in class does not factor into your semester grade other than helping you to perform well on assignments and exams (i.e., there are no "class attendance points" awarded).
- Letter grades will <u>not</u> be assigned based on the common system of 90% earns an A, 80% earns a B, etc. Instead, at the end of the semester, after I compute the semester scores for all students in the class (according to the weighting given above), I determine what score merits an A, B, C, etc. This system is chosen because tests and quizzes are designed to produce a wide spread of grades, which is advantageous for both teaching purposes and evaluation purposes.
- Students who are not used to this system of grading sometimes have a little trouble adjusting because they find it difficult to gauge their performance during the semester. I will give you feedback as the semester proceeds so that you can gauge your performance. My current *guess* is that the grade scale will be 85-100% = A, 70-85% = B, 55-70% = C, 40-55% = D.
- Extra credit is available, as described elsewhere in this syllabus. However, students are cautioned not to over-rely on extra credit to save their semester grades. Extra credit only goes so far.

Class Policies: 2, Group Semester Project

- There will be a semester project that counts for 25% of your semester grade.
- The general nature of the semester project will be to learn about one of the treatment plants (water or wastewater) in the Tampa Bay area, to summarize the treatment processes employed by the plant, to explain why the plant employs the particular processes that it does, and to discuss how the treatment processes enable the plant to meet its treatment objective.
- Details about the group semester project will be provided in separate documents throughout the semester.
- Most stages of the semester project will be conducted and submitted by groups. This is for three reasons. First, engineers need to learn how to work in groups, so this is good practice for you. Second, if your group works together well, then each student's workload should be reduced by working in a group. Third, it makes grading more manageable for a class of this size.
- Groups will probably consist of three or four students, but the actual number will be determined when we see how many students are enrolled for the class. I am hoping for about 6 groups.

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Class Policies: 3, Exams

- There will be two written exams during the semester, to be taken in class. Tentative dates of the exams are provided elsewhere in this syllabus. Any changes to these dates will be announced sufficiently ahead of time.
- There will be a written final exam, to be taken at the time designated by the registrar. The assigned time is **Thursday**, **December 10**, from 10:00–noon.
- The format of the examinations (quantitative, qualitative, problem-solving, multiple choice, true/false, essay, etc.) will be left to the discretion of the instructor.
- Examinations will be closed-book. However, students may use *personal note sheets*: one sheet of 8.5-by-11 (or A4) paper for each in-class exam, and two such sheets for the final exam. Students may use both front and back of the sheets, but sheets must be hand-written no scanning, printing, mechanical reproductions, etc. Retrieval of information by other means during the examination will be considered cheating.
- Laptop computers and other electronic devices (other than a standard engineering calculator) *may not* be used during exams. Calculators *may not* be pre-programmed with formulae from the class.
- Students who will not be available for one of the exams should inform the instructor far enough *before* the exam to make alternate arrangements.
- Students who miss an exam unexpectedly (e.g., due to sudden illness, family emergency, or other unforeseen circumstances) must provide documentation or evidence of the reason for missing the exam. It will then be *up to the instructor's discretion* whether a "make-up" exam will be offered. Make-up exams are usually given orally.
- Re-scheduling of the final exam is not possible because the date and time are set by the registrar.
- My intention is to design exam questions such that students who have attended class and have done the homework assignments will be familiar with all the material needed to answer the questions. It will not be my intention to "surprise" you, only to challenge you.
- Generally, exam questions are intended to test the most important concepts of the course. A good exam should require the students to demonstrate their mastery of the material by synthesizing and applying the most important concepts of the course. Exam questions are not likely to test students on their recall of minutiae.

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Class Policies: 4, Homework Assignments

- There will be about 7 homework sets to be performed during the semester.
- Depending on how many students are enrolled in the class, I might require assignments to be completed in groups. All students in the group will receive the same score on the assignment. We will decide about group size during the first week of class, once the enrollment is set.
- Even if assignments are completed by a group, it is recommended that all students work industriously to complete the homework assignments to maximize their mastery of the material covered this semester. If you do a good job on the homework assignments, you are likely to perform well on the exams. If you don't spend the time on the homework, then you are likely to have difficulty on the exams.
- You may not refer to a previous year's solution sets when completing the homework. That constitutes referral to somebody else's work and is therefore considered cheating.
- Assignments will usually be distributed at least one week before the due date.
- Assignments are due in class on their due date unless otherwise noted. Occasionally, assignments
 will be due on a non-class day. In those cases, I will provide instructions on how to submit the
 completed work.
- Homework solutions will be provided to students, usually after the next class following the due date.
- Homework should be neat and legible, on standard 8.5-by-11-inch or A4 paper, stapled.
- Report numerical answers to a reasonable number of significant digits. The point of this is that you should consider the level of uncertainty associated with your reported answer.
- Your homework solutions must include at least enough detail that I can follow your reasoning and calculations. An answer provided without this level of detail will be considered insufficient.
- Helpful hint: when performing calculations, be careful of your units. You will catch about 90% of your mistakes (yes, really) if you take proper care of your units.

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Class Policies: 5, Group Work (applies both to homework and to project)

- Whatever work is submitted by a group should represent work actually completed by that group.
 You must conduct the actual computations and write up your own work without referring to the
 solutions of people outside your group. Copying the work of others (including text, computations,
 figures, tables, sections of computer programs, spreadsheets, or sections of lab reports) will be
 considered cheating.
- Your group may discuss assignments with students in other groups. However, any work that your group submits for a grade should have been completed by your group only. Therefore, an acceptable procedure would be to discuss an assignment with another group, but then to complete the assignment within your own group. An unacceptable procedure would be for students in two (or more) groups to complete an assignment side-by-side and then submit work that is essentially the same. If two groups submit assignments that are similar enough to indicate that the work was not completed by each group individually, then all members of both groups will be penalized.
- At the end of the semester, you will be given the opportunity to evaluate the other members of your group(s) based on the effort they put forth on the group's behalf. I will take these evaluations into account when assigning semester grades. Students who do not contribute fairly to their groups' semester project will be penalized on those areas of the semester grading formula. Students who go "above and beyond the call of duty" on their group's behalf may be given bonus points in the appropriate areas. Penalties and bonuses will be up to the instructor's discretion, but will be based on the evaluations submitted by the group members.
- Assignments are due *at the <u>beginning</u> of class* on their due date unless otherwise noted. I usually give students a few minutes to get their assignments stapled and submitted. A few minutes into the lecture I will issue a "last call." If you do not have your assignment submitted by the time I issue the last call, then *your assignment is late*.
- Each student group is allowed one late submittal during the semester -- no questions asked. Late assignments must be submitted by the beginning of the next class after the original due date. After one late submittal, no late assignments will be accepted from that group regardless of reason or excuse. You get one free late homework assignment <u>or</u> one free late project assignment, not one of each.
- All students in a group are collectively responsible for what is submitted by the group. This means, for instance, that *students are responsible for making sure that their group members do not cheat or conduct plagiarism*. (This has been an issue in ENV 4001.)
- All students in the group will receive the same grade on any group assignment. If the grade is penalized for any reason (plagiarism, late penalty, etc.), then all members of the group will receive the same penalty. There might be one or two parts of the semester project that will be conducted individually, but most will be submitted by the group.

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Class Policies: 6, Field Trips

- As part of the group semester project, students will schedule field trips to treatment plants around the Tampa Bay area.
- Each group will be asked to schedule a field trip to their "case study" treatment plant. Therefore, there will be about 6 field trips throughout the semester.
- We will try to schedule field trips on Fridays to make use of the scheduled block of time. However, this depends somewhat on the cooperation of the plants we are visiting.
- Students are required to attend at least 2 field trips during the semester. Attendance on field trips will factor in to the group project grade.
- If space permits, students can attend more than two field trips. However, no extra credit is offered for attending more than two. It is just for your own education.
- I will try to get us bus transportation for the field trips, but this will depend on whether the College or the Department will pay for the Bull Runner rental. If not, then we will have to use our own private vehicles and carpool to field trip sites.
- Field trips typically take about 3 to 4 hours from the time we depart campus to the time we return.

Class Policies: 7, Extra Credit

- There are two mechanisms by which students can receive extra credit.
- First mechanism: If you find an article or current news item relevant to this class in a newspaper or a weekly periodical (*Time*, *Newsweek*, etc.), submit that item to me along with *complete bibliographic reference information*. (For instance, if you cut an article out of the newspaper, be sure to indicate which paper it is from, what date, what section, and what page number.) If I show your item in class, you will receive 2 points of extra credit on the next exam. The item submitted should be taped neatly to 8.5-by-11 paper. This may require you to trim or splice the item depending on the format in which it was originally printed. Students can submit more than one item throughout the semester, up to a maximum of 10 points. If more than one student submits the same item, and I show that item in class, then each student who submitted it will receive 2 points of credit. It is up to my discretion which submitted items will be shown in class. Be sure to indicate your name somewhere so that I can award you credit for the item(s) you submit.
- Second mechanism: Conduct a simple laboratory experiment in conjunction with your group project. For instance, you could measure the hardness of your plant's source water, then conduct softening in the laboratory and measure the hardness after softening. Or, you could conduct a jar test to determine a recommended dose of coagulant. These are just a couple ideas. If you want to pursue this path for extra credit, discuss with me what you would like to do, and we'll decide how much credit it is worth. I will be pretty generous with extra credit through this mechanism because I think it will really enhance and augment your learning experience.
- No, you can not earn extra credit by going on extra field trips.

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Class Policies: 8, Attendance

- Attendance in class lectures is recommended but not required. It is likely that diligent attendance
 in class lectures will improve your understanding of the course material, and, hence, improve your
 semester grade.
- Attendance in class does not factor into your semester grade other than helping you to perform well on assignments and exams (i.e., there are no "class attendance points" awarded).
- If you miss class, there is no need to inform me or to provide me with documentation for your absence. (I don't take it personally, really.) However, I do recommend that you acquire the lecture notes from a classmate.
- If you choose to attend class, I require that you do not engage in behavior that distracts me or that disrupts the class for others in attendance:
 - Please make sure mobile phones are turned off. NO TEXTING DURING CLASS!
 - Laptop computers should be used only for taking notes, not for e-mail, web browsing, or any other activity that might distract your classmates or your instructor.
 - Please do not chat with your classmates, read the newspaper, work on homework for other courses, or engage in any other behavior that is distracting to your classmates or to your instructor.
 - If you need to do something other than participate in the class lectures, then please do so outside the classroom.
 - Students who are engaged in such activities in class will be asked to leave.

Class Policies: 9, Laptop Computers

- Students may use laptop computers for taking notes in class.
- Laptop computers should be used only for taking notes, not for e-mail, web browsing, or any other activity that might distract your classmates or your instructor. If it becomes apparent that a student is using his/her laptop for any of these activities, that student will be asked not to bring his/her laptop to class in the future.
- Laptop computers *may not* be used during exams.

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Class Policies: 10, Academic Honesty

- Any handouts used in this course are copyrighted. "Handouts" means all materials generated for
 this class, which include, but are not limited to: syllabi, notes, quizzes, exams, in-class materials,
 review sheets, and problem sets. This includes materials that are posted on the web as well as
 materials distributed in class. Because these materials are copyrighted, you do not have the right
 to copy the handouts unless the instructor (or other copyright holder) expressly grants
 permission.
- Students may audio tape lectures for their own private, personal use, or for a classmate who is registered in the class during this semester. Audio tapes may not be sold or distributed to anybody who is not registered in the class this semester.
- No form of scholastic dishonesty (cheating, plagiarism, etc.) will be tolerated. As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you have permission of that person. This includes copying material from books, reports, journals, pamphlets, handouts, other publications, web sites, etc., without giving appropriate credit for those ideas and/or without identifying material as quotations when taken directly from another source.
- Cheating on homework and exams will not be tolerated. Cheating will be dealt with according to university policy.
- You may discuss project assignments with students who are not in your project group. However, when you prepare your assignments, you must do so without referring to the work of students who are not in your group. Copying assignments from a student outside your group is considered plagiarism. See Class Policy #5, above.
- Violation of these rules -- even unintentionally! -- can result in disciplinary action including a
 grade penalty, up to and including an F or FF in the course, suspension, dismissal, and expulsion
 from USF. If you have any questions regarding plagiarism or other forms of scholastic
 dishonesty, please consult the relevant sections of the USF student catalogs, and/or ask the
 instructor.

Class Policies: 11, USF Statement on Emergencies

In the event of an emergency, it may be necessary for USF to suspend normal operations. During this time, USF may opt to continue delivery of instruction through methods that include but are not limited to: Canvas, Elluminate, Skype, e-mail messaging, and/or an alternate schedule. It's the responsibility of the student to monitor the Canvas site for each class for course specific communication, and the main USF, College, and department websites, e-mails, and MoBull messages for important general information. (*Instructor's note*: examples of "emergency" could be a hurricane, outbreak of contagious disease, etc.)

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Class Policies: 12, USF Statement on Academic Accommodations for a Disability

Students in need of academic accommodations for a disability may consult with the Office of Students with Disabilities Services (SDS) to arrange appropriate accommodations. Students are required to give reasonable notice prior to requesting an accommodation.

(*Instructor's note*: The Americans with Disabilities Act 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 believe you have a disability requiring an accommodation, please contact SDS as soon as possible.)

Class Policies: 13, USF Policy on the Observance of Religious Days by Students

Students are expected to attend classes and take examinations as determined by the USF System. No student shall be compelled to attend class or sit for an examination at a day or time prohibited by his or her religious belief. However, students should review the course requirements and meeting days and times to avoid foreseeable conflicts, as excessive absences in a given term may prevent a student from completing the academic requirements of a specific course. Students are expected to notify their instructors at the beginning of each academic term if they intend to be absent for a class or announced examination [emphasis added], in accordance with this policy. Students absent for religious reasons, as noticed to the instructor at the beginning of each academic term, will be given reasonable opportunities to make up any work missed. In the event that a student is absent for religious reasons on a day when the instructor collects work for purposes of grading (homework, pop quiz, etc.), the student shall be given a reasonable opportunity to make up such work or shall not have that work averaged into the student's grade at the discretion of the instructor. Any student who believes that he or she has been treated unfairly with regard to the above may seek review of a complaint through established USF System Academic Grievance Procedures (found in the Graduate and Undergraduate Catalogs) and those provided by the University's Office of Diversity and Equal Opportunity. [http://generalcounsel.usf.edu/policies-and-procedures/pdfs/policy-10-045.pdf, accessed 11 Sept 2014]