

## ME3120: Manufacturing Processes and Their Application 3 (3,0)

Fall 2018, T-Th 11-12:15 PM  
Kinard 201



**Instructor:** Rodrigo Martinez-Duarte, Ph.D.

**Office:** 204 Fluor Daniel EIB

**E-mail:** [rodrigm@clermson.edu](mailto:rodrigm@clermson.edu) (I will try my best to answer promptly but it may take me up to 48 hours, plan accordingly!)

**Office Hours:** By appointment only to accommodate your various schedules

**Course Description:** Fundamental principles associated with production processes and their application to the manufacture of products from metals, polymers, ceramics, and composites. Emphasizes the physical and quantitative aspects of processing, the selection of processes to create products, and the identification of processes used to manufacture existing products.

**Corequisites:**

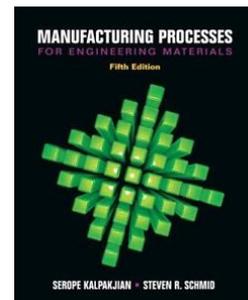
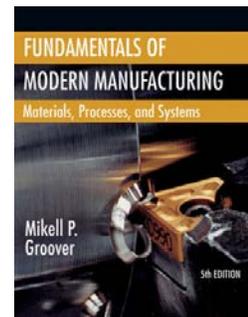
(ME 304) Heat Transfer.

(ME 306) Fundamentals of Machine Design.

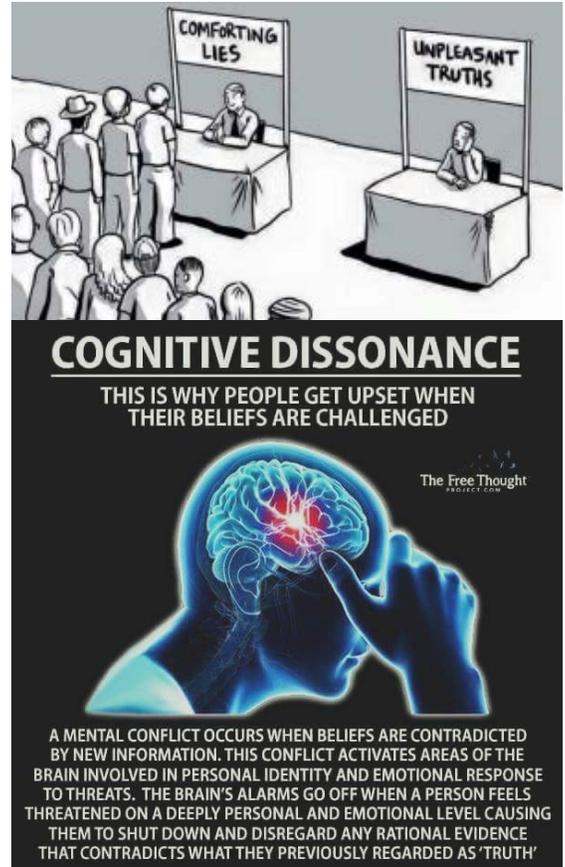
(ME 333) Mechanical Engineering Laboratory II.

**RECOMMENDED References, there is no required textbook (These references are not required but strongly recommended if you are the type of student that benefits from reading the material to fully comprehend it). Make an appointment for office hours if you want to examine these books in my office before buying them.**

- Groover, Mikell P.; 2013, *Fundamentals of Modern Manufacturing: Materials, Processes and Systems*, 5<sup>th</sup> edition, Wiley (ISBN #9781118231463). General introduction to manufacturing. Easy read and good structuring.
- Kalpakjian, S., and Schmid, S., 2007, *Manufacturing Processes for Engineering Materials, 5th Edition*, Prentice Hall (ISBN # 9780132272711). More in depth knowledge. Not as user friendly as Groover.
- Lefteri, Chris; 2013, *Making It*, 2<sup>nd</sup> edition, Laurence King Publishing (978-1-85669-749-1). Good general introduction to different manufacturing techniques. Snippets about each technology. Great overview but not in depth at all.



**Clemson Thinks2:** This is a CT2 course to nurture your skill to think critically. Many definitions for Critical Thinking exist, one of my favorite brief ones is that from Robert Ennis: “*Critical thinking is reasonable, reflective thinking that is focused on deciding what to believe or do*”. To this end, this course will feature activities focusing on metacognition, or thinking/reflecting about your thinking. Society expects you to be a mature thinker who is able to think in the abstract and consider a number of solutions to a problem. We were all immature thinkers at some point of our lives but then a fantastic journey started into increasing the quality of our thoughts. This will be an ongoing process for the rest of your life. Metacognition will help you increase the pace at which you develop your thought. Although simple in nature, it takes practice. You must develop the habit of asking yourself why you believe what you do, why do you act the way you do, and other interesting questions that are most likely to lead to unpleasant truths (see *cognitive dissonance*) but will help you identify the problem and become a better you. A better you can lead to better opportunities, and ultimately a better society. The purpose of making this a CT2 course is to help you strengthen your metacognition skill. Hence, you will be constantly required to think about your thinking through reflections, either individually or as a group.



**Learning Environment:** Research on critical thinking indicate that three activities are particularly effective to nurture critical thinking: discussion, real-world problems and mentoring. This class will feature extensive discussion and you must be prepared to partake in this discussion. You must do two things BEFORE coming to class: 1) study the material assigned for that day (check Canvas); and 2) reflect on it. Plan accordingly to allow for enough time for these activities.

Class time will be partitioned in three major parts: 1) discussion to clarify your confusions on the content you studied before class, 2) a quiz for you to test this knowledge, and 3) activities to deepen your learning about the topic at hand. These in-class activities will include analysis of manufacturing methods, evaluation of choices to manufacture a product, and/or creation of new manufacturing processes.

My role in this course is that of a facilitator and mentor in your learning process. Ultimately, you are responsible for your own learning and you are in control of your own grade. My job is to give you the tools to make the best out of this course and mentor your thinking. Your job is to use them and stay engaged. Prepare before class so you can have a productive experience in class.

### Student Learning Outcomes:

Following successful completion of the course, you should be able to:

- Predict the influence a manufacturing process has on the material properties of a finished product. (Apply level in Bloom's taxonomy below)
- Compare economic costs and environmental impacts between manufacturing processes. (Analyze)
- Classify fundamental manufacturing processes and identify the key parameters for each process. (Evaluate)
- Evaluate the manufacturing process(es) used to produce a finished part. (Evaluate)
- Critique your metacognition skill, i.e. Is my thinking deep enough? (Evaluate)
- Create a manufacturing process for making a product that fulfills a need. (Create)

These objectives were set following the well accepted Bloom's Taxonomy to develop expertise shown in Fig. 1. This taxonomy postulates that the development of skills and abilities depend on a knowledge base. In this class, you will achieve the Remembering and most of the Understanding stages before class by studying class materials and solutions to representative problem sets. Class time will be dedicated to clear confusions that are hindering your understanding and strengthen the stages on top of the pyramid in different degrees. The CT2 activities in this course will help you strengthen your skills of analyzing, evaluating and creating by examining the details of your thought process and efforts towards becoming an expert in a topic, not only manufacturing.

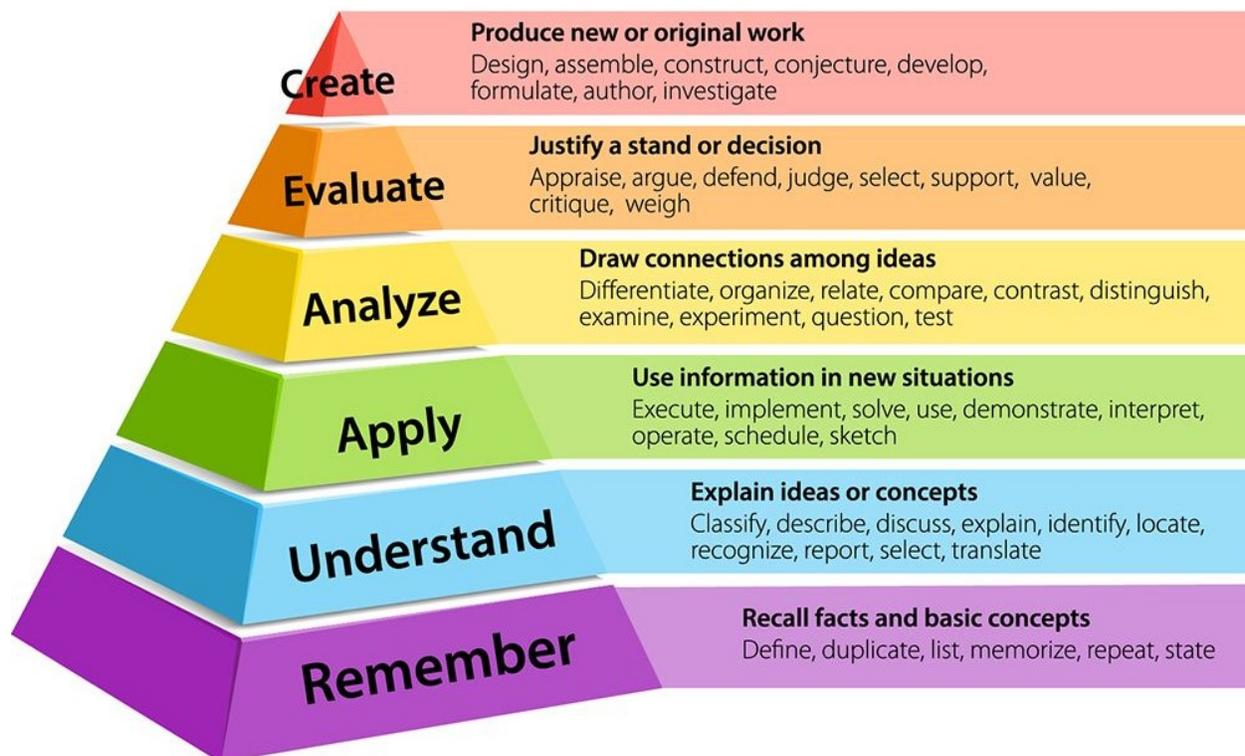


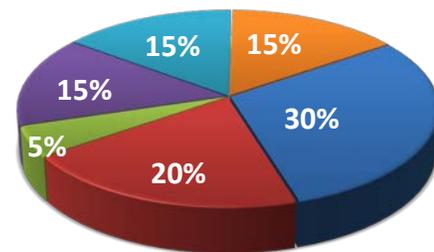
Figure 1. Bloom's Taxonomy as revised in 2001. From <https://www.pinterest.co.uk/pin/551128073140341612/>

**Tentative Course Outline:**

Week	Subject
1	Course Introduction
2	Casting Fundamentals
3	Taxonomy of Casting
4	Principles of Shaping by Deformation Forging
5	Rolling <i>Career Fair is Tuesday September 18-Wednesday 19, Plan Ahead</i>
6	<b>EXAM 1</b> September 25 Team Activity
7	Invited Speaker, Discussion
8	Shearing, Bending
9	Drawing, Machining
10	Team Activities
11	<b>EXAM 2</b> October 30 Team Activity
12	<i>FALL BREAK, NO CLASS 11/6</i> Additive Manufacturing
13	Additive Manufacturing
14	<i>THANKSGIVING, NO CLASS 11/22</i>
15	Integrative Activities
16	Integrative Activities. Final Evaluations

**Grading Breakdown:**

90.0-100%	A	<b>Excellent.</b> Indicates work of a very high character, outstanding quality
80.0-89.99%	B	<b>Good.</b> Indicates work that is definitely above average, though not of the highest quality
70.0-79.99%	C	<b>Fair.</b> Indicates work of average or medium character
60.0-69.99	D	<b>Pass.</b> Indicates work below average and unsatisfactory.
<59.99	F	<b>Fail.</b> Indicates that the student knows so little of the subject that it must be repeated in order that credit can be received.



- Individual Quizzes 30%
- Individual Tests 20%
- Individual Reflection Essays 5%
- Team Analysis Challenges 15%
- Team Manufacturing Problems 15%
- Team Manufacturing Challenge 15%

**INDIVIDUAL QUIZZES (16):** Check the schedule for quizzes in Canvas. You must study the slides pertinent to that class BEFORE class (available in Canvas). Any doubts or concerns from the material you studied before class must be resolved in class and before the quiz. Quizzes will be given in class after addressing any questions you have. If no one raises a question I will assume everything was clear and will proceed to administer the quiz. Quizzes will be in Canvas and feature a multiple-choice format. Where appropriate a question will have one correct answer for full credit, one answer for half-credit, one answer for quarter credit and two wrong answers for no credit. You are required to bring a laptop or phone on quiz days to access the quizzes online. Quizzes will be administered in class and no make-up quizzes will be provided. The two lowest quiz grades will be dropped at the end of the semester.

***You will be required to take The California Critical Thinking Test twice.*** You will take these tests **online at home before** the second and the last day of class. This test will assess your strengths in areas of critical thinking. You will receive full quiz credit for those tests if you complete them in an appropriate time. Completing these tests typically take 50 minutes, and do not involve any studying, preparing, or outside work. Your test scores will have no impact on your grade, your standing at Clemson, or anything else. The California CT Test is a widely accepted mechanism to assess CT skills in academia and industry. Take advantage that is offered to you for free so you can learn more about yourself. Keep it honest, don't fool yourself. Clemson University and myself will use your scores in these tests to improve the quality of your learning experience and that of those coming after you. No credit will be given if you spend less than 20 minutes doing the California CT test.

**INDIVIDUAL TESTS (2):** Two Exams during the semester will test your ability to apply the material covered in class; and may be designed such that you do not finish it during the time allowed. Exams may not replicate practice problem sets or problems tackled in class. Exams will be paper-based and feature multiple-choice format. Where appropriate a question will have one correct answer for full credit, one answer for half-credit, one answer for quarter credit and two wrong answers for no credit. Any instance of cheating on a test will result in failure of the test and a formal charge of academic dishonor. It may take up to two weeks for you to get your graded exam back. Abstain from constantly inquiring about it in class.

Requests to re-evaluate test performance will be accepted during the 3 days following the in-class revision of the exam. Requests must be submitted by email and must provide a detailed justification for re-evaluation. The test is subject to a complete re-evaluation of the grade.

Missed exams will be scored as a zero unless the instructor has given prior consent (at least 48 hours before scheduled exam time) or proof of an exceptional event (family emergency, accident) is shown. If the absence is justified, only one midterm test may be missed. In such case, the grade assigned to the midterm test will be the average between the other test and the average grade of all the quizzes at the end of the semester.

**THERE WILL BE NO FINAL EXAM IN THIS COURSE**

**IMPORTANT:** significant amount of points will be taken for omitting the unit of measurement in your results, *i.e.* kg, m, in, etc., or providing the wrong units. You are responsible for knowing conversion values between metric and English units such as meters to inches, kilograms to pounds, liters to ounces, etc.

**INDIVIDUAL REFLECTIVE ESSAYS (4):** These will be a series of reflection exercises through the semester. These reflections will be identified as Critical Thinking artifacts. The general format of these reflections will be for you to analyze your perceptions and thoughts about different topics in manufacturing. These reflections will be graded on the depth and clarity of your thought, not on whether is right or wrong. Spend the time to complete these reflections: time to think long and hard about the questions *and* time to write a well-edited response. Do not assume these are easy 5 points towards your grade and do not underestimate the effort required to hand-in an acceptable reflection. Instructions and details are posted in Canvas.

Before the truth  
can set you free  
you need to  
recognize which  
**false belief**  
is holding  
you hostage.

-anonymous

WomenWorking.com

**INDIVIDUAL E-LEARNING MODULES (7):** 7 e-learning modules will be available to you during the semester to complement the in-class learning materials. You can earn an additional 5% (0.71% per module) to your final grade if you pass the given module with an 80% or better in the assessment test at the end of the module (the final exam at the end of each module, NOT the practice quizzes throughout the module). See supporting syllabus in Canvas. Contact [support@educateworkforce.com](mailto:support@educateworkforce.com) DIRECTLY in case of any trouble with the e-learning platform and copy me in your email.

**TEAM ACTIVITIES: 2 Analysis challenges, 2 Manufacturing Problems and 1 Manufacturing Challenge.** Your team will be required to hand in a report for each of these activities. Instructions and details will be posted in Canvas. We will start these activities in class but most of them will require you to finish them outside class. Your report will be due on the dates detailed in Canvas. You are responsible to coordinate with your team in case you did not come to class. Credit for an activity will only be given to those names written in the submitted report.



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Your performance will be evaluated by your team in each team activity. You may not receive full credit for the activity if your team considers your performance was not at par with the rest. The following table details the guidelines for evaluating the work by each team member.

Grade	Rationale
0-3	NOT ACCEPTABLE: Did not show up to meetings/activities. Did not contribute to the deliverable at all.
4-6	UNFAIR: Marginal and sporadic contributions of varying quality, e.g. came to one meeting, wrote one poor-quality paragraph, made 1 poor quality figure here and there...
7-9	POOR: Assisted to ALL meetings/activities and remain engaged but his/her contributions were of poor quality, i.e. poor drawings, unclear text, hand written equations, hand drawings
10	EXPECTED: Assisted to ALL meetings/activities and significantly contributed to the deliverable.

The grades given to you by your teammates will be averaged. This average will be a multiplier to the grade your team gets for the project, i.e. you got a 0.65 average and your project got a 85 grade... you get 55.25. Any disputes will be solved with all team members in my office. Team members must provide evidence to support their arguments.

## Course and University Policies

**EXPECTED IN-CLASS BEHAVIOR:** You are encouraged to discuss manufacturing during in-class work times, but you are expected to pay quiet attention when your instructor is speaking. No phones, laptops are permitted unless they are needed for class activities. Tobacco products of any kind are not acceptable for use in the class room.

- Any behavior, such as verbal abuse, threats and disruptive behavior, that compromises the learning environment will be reported to campus police immediately.

**TECHNOLOGY USAGE:** Canvas, Adobe Spark, CAD, word processing, presentation slides, possibly video production using Adobe Premiere. Students are responsible for bringing the appropriate instructional technology to each class.

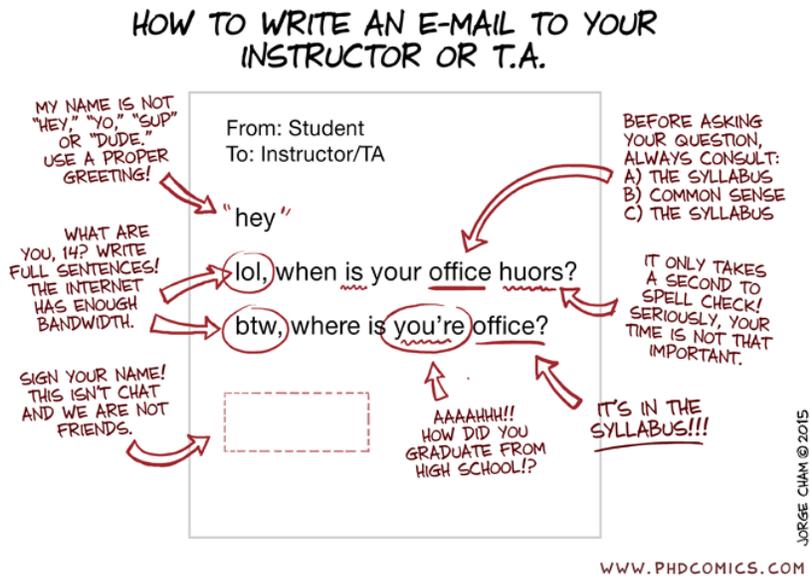
**The use of Laptop, phone will be restricted to taking notes and to instructor-led activities.** [Research shows \(links to external site\)](#) that those who multitask on a laptop/phone (checking content unrelated to class) during class scored lower on assessment compared to those who did not multitasked. Furthermore, those who were in direct view of the multitasking person also scored lower on assessment. Any student is on his/her own right to ask the person multitasking to stop. The multitasking person must comply at once. If you want to disrupt your own learning that is your personal choice; but harming the learning of those around you is wrong and disrespectful.

**CANVAS:** Your Canvas web page will be used to post your schedule with all assignments and other useful documents. You are responsible for the continuous monitoring of your Canvas page for such information. Canvas will also be the way your instructor will keep you informed about your progress in the course.

**E-mail:** E-mail will be used to deliver important and/or urgent information throughout the semester. You are responsible for checking your e-mail for such information and keeping your e-mail address in Canvas accurate. Instructor is not responsible if you miss important information because your account is full, not available, etc. or because you don't regularly check the e-mail address listed in Canvas.

Forwarding to external accounts such as Hotmail and Yahoo accounts that get overloaded will cause you to miss important information.

There is a professional etiquette you will follow when sending me an email. You may address me as Dr. Rodrigo, Prof. Rodrigo, Dr. Martinez-Duarte or Prof. Martinez-Duarte. See figure for common mistakes when sending an email. The use of [Hey as greeting is particularly discouraged in a professional setting \(links to external site\)](#)



**ACADEMIC INTEGRITY:** As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.

"When, in the opinion of a faculty member, there is evidence that a student has committed an act of academic dishonesty, the faculty member shall make a formal written charge of academic dishonesty, including a description of the misconduct, to the Associate Dean for Curriculum in the Office of Undergraduate Studies. At the same time, the faculty member may, but is not required to, inform each involved student privately of the nature of the alleged charge."

- Cheating on any class activity, including exams, quizzes and project, will not be tolerated in any form. A grade of 0 will be given for that activity and formal charges of academic dishonesty will be pursued.
- Outstanding submissions of any class activity may be used as instructional aids in future offerings of this course, so all project submissions must be free of copyrighted work.

**PLAGIARISM.** A simple definition of plagiarism is when someone presents another person's words, visuals, or ideas as his or her own. All students, faculty and administrators at Clemson University are expected to abide by ethical standards of conduct. Accordingly, students are prohibited from copying or submitting any work done by others for personal credit. The instructor will deal with plagiarism on a case-by-case basis. I will use, at my discretion, the Plagiarism Resolution Form. All infractions of academic dishonesty will be reported to Undergraduate Studies for resolution through that office. See the [Undergraduate Academic Integrity Policy \(Links to an external site.\)](#) website for additional information about academic integrity at Clemson. Examples of plagiarism include copying any portion of

an assignment (including any solution manuals), quiz, or test and submitting it as your original work. If in any doubt, consult pages about Do's and Don't's about plagiarism, ask your instructor, ask a librarian. Some examples of websites:

<http://online.sfsu.edu/rone/StudentHelp/Plagiarism.html#examples>

<https://www.indiana.edu/~istd/examples.html>

<http://www.deltastate.edu/academics/libraries/library-guides/roberts-laforge-guides/plagiarism-prevention-a-guide-for-students/>

<http://www.aresearchguide.com/6plagiar.html>

**COPYRIGHT.** All materials found in this course, including exams, quizzes and other forms of assessment, are strictly for the use of students currently enrolled in this course and for purposes associated with this course; they may not be retained or further disseminated. Clemson students, faculty, and staff are expected to comply fully with institutional copyright policy as well as all other copyright laws.

**ACADEMIC GRIEVANCES.** Students are advised to visit the [Ombuds' Office \(Links to an external site.\)](#)Links to an external site. prior to filing a grievance. After discussion with the undergraduate academic ombudsman, students should contact Undergraduate Studies (656-3022) for assistance filing official paperwork.

Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. Any form of abuse, including verbal, will not be tolerated. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This policy is located at <http://www.clemson.edu/campus-life/campus-services/access/title-ix/>. The Office of Access and Equity is in 110 Holtzendorff Hall. It can also be reached by phone 864 656 3181 or by email [cuae@clemson.edu](mailto:cuae@clemson.edu). You may report an incident following this link <https://www.clemson.edu/campus-life/campus-services/access/title-ix/students/reporting.html>



**STUDENT ACCESIBILITY SERVICES.** Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a

barrier to full access to this class should let the professor know, and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848, by emailing [studentaccess@lists.clemson.edu](mailto:studentaccess@lists.clemson.edu), or by visiting Suite 239 in the Academic Success Center building. Appointments are strongly encouraged – drop-ins will be seen if at all possible, but there could be a significant wait due to scheduled appointments. Students who receive Academic Access Letters are strongly encouraged to request, obtain and present these to their professors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information at the [Student Accessibility Services Website \(Links to an external site.\)](#) and the [Office of Access and Equity Website \(Links to an external site.\)](#).

**INCLEMENT WEATHER:** In case of class cancellation mandated by the university due to inclement weather, I will communicate with the class via Canvas to announce any changes in tests, quizzes, or other assessment.

**Additional Course Policies:**

- Students may leave the classroom if instructor is more than 15 minutes late, and he has not notified the class of a delay.
- Requests to re-evaluate performance are accepted for 3 days following distribution of graded work. Requests can be submitted by email and must provide a detailed justification to re-evaluation. The assignment/assessment is subject to a complete re-evaluation of grade.
- Students that perform below expectations (D or less) during the semester should expect to be contacted by the instructor.
- Attendance will not be taken. However, keep in mind that there are no make-up quizzes or in-class activities.
- If student is late for class, she/he may enter the classroom as long as it is done in a quiet manner and without disrupting the class.
- Student will be asked to leave the room if he/she is disturbing the instructor or the class in any way. Student must leave the classroom quietly. In these cases, student is responsible to find out about materials covered in class and any assigned work, i.e., homework, team work.

The schedule, policies, procedures, and assignments in this course are subject to change to improve learning outcomes.

## Student Support Services

### Academic Success Center

The Academic Success Center provides free services, including tutoring, academic coaching, and academic skills workshops, for all Clemson students. Visit the [Academic Success Center website \(Links to an external site.\)](#) for more information on their services and workshops.

### Writing Center

Clemson University's Writing Center offers free one-on-one tutoring for all Clemson students. Visit the [Writing Center's website \(Links to an external site.\)](#) for more information about their services or to make an appointment.

### **Cooper Library**

Reference librarians are available in person and via text, phone, email, and chat to answer your research questions. Visit [Ask a Librarian \(Links to an external site.\)](#) for more information or to get in touch with a librarian.

### **Technical Support**

If you are having hardware or software problems, CCIT's Service Desk may be able to help you. Contact them at [ITHELP@clemsun.edu](mailto:ITHELP@clemsun.edu) with a detailed description of your problem.

### **Academic Advising**

[Academic advising \(Links to an external site.\)](#) is an ongoing educational process that connects the student to the University. Academic advising supports the University's mission of preparing the student for learning beyond the confines of the academy. Academic advisors represent and interpret University policies and procedures to the student and help the student navigate the academic and organizational paths of the institution.

### **Registrar**

The [Registrar's office \(Links to an external site.\)](#) provides information about important deadlines, degree and program requirements, and other key information, including use of iROAR to add, drop, or withdraw from courses.