

Syllabus for ECE 1010: Robots in Business and Society

Semester: Online, Summer 2017
Credits: 3 (3) (STS Gen. Ed. Req.)
Location and Time: Online

Prerequisites

None:

Instructor Information

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Course Overview

Robotics and automation play an increasing role in our lives, from manufacturing to robotic surgery. What social and ethical questions do robots raise? The course will guide the student through the technologies that are used to build robots and the capabilities of robots in current applications. We will answer questions such as “How does the Roomba robot clean the floor in a house?” We will explore the economics of robots and the implications of their use as a tool to boost productivity. The future of robots as either an adversary to or equal partner with humanity has been portrayed in movies and books; we will analyze emerging trends to develop our own predictions for the future.

Critical Thinking

In their future careers as business leaders, educators, physicians, etc., students will make important decisions about robotics; the course will enhance critical thinking tools they need to make good decisions. This class is part of Clemson Thinks² Quality Enhancement Plan (<http://www.clemson.edu/assessment/thinks2/>), an ambitious experiment in critical thinking that aspires to transform student learning and faculty teaching across the curriculum and in the disciplines. This class is structured to require and improve elements of critical thinking. Students will be expected throughout the class not only to analyze and make decisions about technology, but also to question and reason about their related assumptions and conclusions. The research project will function as an artifact representative of critical thinking.

We will use the California Critical Thinking Skills Test (CCST) to evaluate and monitor student growth in critical thinking. The test will be administered twice: at the beginning and toward the end of the class. The results of these exams do not count toward course grades or degree progress at Clemson and only aggregate results will be used to evaluate the teaching strategies of this course versus other courses.

General Education:

This course meets the STS general education requirement:

Science and Technology in Society:

Demonstrate an understanding of issues created by the complex interactions among science, technology, and society.

Your research project is your STS artifact. While students are no longer required to upload artifacts to an ePortfolio, the university will be collecting artifacts from general education courses to evaluate general education.

Class Procedures and Expectations

This is an internet-only course and has no regular class meetings but students are expected to do daily work. You have flexibility to do the work over a period of half a week, but you cannot skip a week and then catch up. You must take the tests on the assigned day (unless you contact the professor, in advance if possible, about very special circumstances). In this online course, you are required to interact with the content, instructor and classmates several times every week through course assignments and asynchronous discussions, as indicated in this syllabus. In class discussions, exams, and projects, students will be expected not only to present and discuss their opinions and conclusions, but also reflect on how and why they have arrived at them: what other choices were possible, what the rationale for the choices made was, etc..

Late Work: Late work will not be accepted for surveys, quizzes, and discussion boards. All other assignments may be submitted late, but the penalty will be a 10 point per day deduction.

You must:

- read a web source in preparation for each unit.
- watch one or more robot lecture videos and a conversation video (featuring the instructors discussing issues related to the module topic).
- participate in an online discussion/writing component for each unit: write at least two posts on each discussion board on Canvas (the first post must be at least 300 words long, all the posts together for each assignment must add up to at least 500 words).
- watch one of three full length movies: Ex Machina, Her, or 2001: a Space Odyssey in preparation for discussion board 4.
- write a midterm exam and a final exam that must be submitted in Canvas in Microsoft Word or RichText format.
- write a research project on a particular robot that is 6-8 pages long, covers multiple aspects of the Technology Assessment Methodology, and makes a proposal about the development and/or regulation of that robot to be submitted in Canvas in Microsoft Word or RichText format.

Topical Outline

45 Hours with the following topics:

1. **Introduction.** History of robots. How have robots have been developed previously, and to what extent has the public been involved/informed in their use?
2. **Background.** How do today's robots work? What technologies do they use? Introduction to ethics and critical thinking.
3. **Robots and Business.** Why do we have ATMs but not robots taking our money in McDonalds? When is it a good business decision to replace humans with machines? What lessons have been learned from using robots on automobile assembly lines? What effect has perception of job losses had on the evolution of robotics? If robots eventually become so effective that jobs are not replaced with other jobs, how will society react? Robots on the assembly line as a retrospective technology assessment model for what their papers should do.
4. **Artificial Intelligence.**
5. **Robots and Transportation.** Driverless cars are becoming a reality. How should they be regulated and insured? Will/should we put ourselves in robot cars which might decide to crash and kill us to avoid running into and killing a larger number of other people? Will we want to own our own cars or just summon a car to come to us when we need one?
6. **Robots and Security.** Robots are being used today for covert surveillance. How might they be used by governments to monitor and control their populations? What are the limits of the technological fix (the

hope that technology will give us easy answers to hard social problems)? Consider the vulnerability of current systems, such as the power grid, water systems etc. How does this project forward to robotics when they are much more prevalent in our lives? As robots play an increasing role in our lives might they be used against us.

7. **Robots in the Home.** With robots like the Roomba vacuum cleaner and “smart homes”, we are beginning to live with and within robots. How much could/should our surrounding physical environments become “robots for living in”?
8. **Healthcare Robots.** Many people envision future robots as caregivers for the elderly. What are the advantages and disadvantages of robots as caregivers? What choices do we have in who/what cares for us? Why might different countries make different choices?
9. **Military Applications of Robots.** Drones are being used as a key element in today’s U.S. military strategy. What public consultation process, if any, has been adopted prior to deployment of this technology? Should military robots that make their own decisions rather than being remotely controlled by a human be allowed to carry weapons? What are the ethical considerations involved in arming robots?
10. **Space Robots.** Would it be better to send robots into space instead of people? To what extent are scientific spacecraft already robots? What can we learn from the space program about the potential of robots that partly make their own decisions and partly are remotely guided by humans?
11. **Our Future with Robots.** What could future human/robot worlds look like - should they come to pass? At what point should robots have rights? Will we become robots? How many robot parts can a human being have and still be human? Could/should our consciousness be "uploaded" into robots to extend our lives indefinitely? What would this mean for humanity? How accurate have fiction and futurists proved in predicting the future of robots so far? Is the direction in which technology develops inevitable, or do we have choices?

Student Learning Outcomes

The successful student will demonstrate the ability to:

SLO1: Analyze complex problems to identify and evaluate robotic solutions to them

SLO2: Separate relevant from irrelevant technologies for realization of proposed robot solutions to problems

SLO3: Assess alternative solutions for robot designs on both technical and social grounds

SLO4: Communicate complex ideas effectively

The relationships of the above outcomes to Clemson's CT2 Program outcomes, together with the specific aspects of the ECE 1010 class projects they are related to, are illustrated in the following table.

Student Learning Outcome	Associated Class Project Activity	Clemson CT2 Program Outcome
SLO1: Analyze complex problems to identify and evaluate robotic solutions to them and whether technical solutions are appropriate at all	Identify features in the world that need to be known and modified to address a given real world problem with robots. Identify and evaluate potential ethical issues arising from robot solutions to given real world problem.	Explore Complex Challenges
SLO2: Separate relevant from irrelevant technologies for realization of proposed robot solutions to problems	Identify feasible combinations of actuation and sensing for proposed robot solutions to real world problems.	Analyze Multi-dimensional Problems
SLO3: Assess alternative solutions for robot designs	Propose and critique alternative designs.	Synthesize Alternative Solutions to Multi-Dimensional Challenges
SLO4: Communicate effectively complex ideas	Create a clear and concise project report, complete with analysis and recommendations.	Communicate effectively complex ideas

Your ability to develop and demonstrate the skills needed to achieve these outcomes will be an important part of the criteria used to establish your grade for the course projects (see below).

Assessment

Standard grading scale applies; $\geq 90 = A$, $90-80 = B$, $80 - 70 = C$, $70 - 60 = D$, $< 60 = F$

10% Surveys

20% Participation

15% Quizzes

20% Research project (initial discussion 5%, research paper 15%)

15% Midterm exam

20% Final exam

Criteria for grading: correctness and relevance of submitted material on *quizzes* and *exams* (problems will examine knowledge of types, operation, and applications of robots as covered in class lectures); success in meeting Student Learning Outcomes on *discussions* and *research project*. The use of critical thinking in meeting the Student Learning Objectives in working on and discussing the projects is necessary, and will be stimulated during class discussions and project proposals via questions such as:

What is the central issue/problem? (For example in meeting SLO1)

How did you reason out this issue? Why do you think that was the best solution? (For example in meeting SLO2)

What is/are the evidence/arguments pro and con? How did you come to that interpretation? (In meeting SLO3)

What are you claiming/concluding? Why did you make this claim/come to this conclusion? (In meeting SLO4)

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."

The catalog states: "When, in the opinion of a course instructor, there is evidence that a student has committed an act of academic dishonesty, that person must make a formal written charge of academic dishonesty, including a description of the misconduct, to the Associate Dean of Undergraduate Studies. The reporting person may, at his/her discretion, inform each involved student privately of the nature of the alleged charge. In cases of plagiarism instructors may use, as an option, the Plagiarism Resolution Form available from the Office of Undergraduate Studies."

Academic dishonesty includes representing someone else's work as your own or handing in the same paper to two different courses without permission of the instructors. Be careful to avoid plagiarism--text you take from a web site, from a book, or from any class notes the professors share must be either quoted with the source given or restated in your own words, with the source given. Note that the catalog defines as one form of academic dishonesty: "Plagiarism, which includes the intentional or unintentional copying of language, structure, or ideas of another and attributing the work to one's own efforts." Note the word unintentional--if you forget to put quote marks or a reference you can be found guilty of academic dishonesty even if it was not your intention to cheat.

It is cheating to cut and paste or otherwise copy portions of a paper, exam, or discussion board posting from a book, web site, or from the online class notes, even if you change a few words, unless you quote **and** give the source. It is poor writing for more than about 20% of your paper to consist of quotes. In most cases when you use specific material from any source you should paraphrase: cite the source and put the ideas into your own words (generally no more than 5 consecutive words should match the source but if the words are mostly the same it could still be plagiarism even if there aren't 5 consecutive words).

The exams for this course are open book. You may consult your book, your notes, or web pages. You may study with other students before the exam is posted, but once the exam is posted your work must be entirely your own--you may not discuss the exam questions with any person except the professors and the teaching assistant in any format (voice, chat, IM, etc.). You are on your honor on this part; please do not abuse it or we will have to institute timed tests.

This syllabus is a contract between the professor and the students. The professor reserves the right to make changes in special circumstances, but will discuss any changes with the students.

Disability Access Statement from the Office of Student Disability Services

"It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. Students are encouraged to contact Student Disability Services to discuss their individual needs for accommodation."

Calendar of Assignments:

	Topic	Preparation	Class_Material	Assignment
1	Introduction	Critical thinking pre-test VOSTS pre-test	01-1-Intro1010.mp4	Discussion board 1
2	Background	View: “Incredible Robots: The Rise of Machines” https://www.youtube.com/watch?v=8VvYu1fWyxA	02-1-Robot Technology.mp4 02-2-Ethics.mp4 02-3-Critical Thinking.mp4	http://www.philosophyexperiments.com/fatman/ Discussion board 2
3	Business and jobs	View: https://www.youtube.com/watch?v=h0VS-a-3bos Read: https://www.technologyreview.com/s/515926/how-technology-is-destroying-jobs/	03-1-business.mp4 03-2-retrospective.mp4 03-3-Business Discussion.mp4	Discussion board 3
4	Artificial Intelligence	View: The Terminator and the Washing Machine https://www.youtube.com/watch?v=npo0_uaSBM	04-1-Artificial Intelligence.mp4 04-2-AI Discussion.mp4	Discussion board 4— movie assignment
5	Transportation	View: “How Driverless Cars See the Road” http://www.ted.com/talks/chris_urman_how_a_driverless_car_sees_the_road Read: “How should the Law Think about Robots” (click through to full text) http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2263363	05-1-Transportation.mp4 05-2-Transportation Discussion.mp4	Discussion board 5 Midterm exam
6	Security and Privacy	View: 60 Minutes report on Stuxnet https://youtu.be/6WmaZYJwJng	06-1-Security and Privacy.mp4 06-2-Robots and Security Discussion.mp4	Discussion board 6 Project proposal due
7	Homes	Read: <i>Thousand Dreams of Stellavista</i> , Short Story by J.G. Ballard (1963). Available as pdf on Canvas	07-1-home.mp4 07-2-Robots in the Home Discussion.mp4	Discussion board 7
8	Healthcare	Read: http://link.springer.com/article/10.1007%2Fs10676-010-9234-6#/page-1 Granny and the Robots	08-1-health.mp4 08-2-Robots in Healthcare Discussion.mp4	Discussion board 8
9	Military	View: https://www.youtube.com/watch?v=zrD62oXUZkQ Ronald Arkin or http://www.brookings.edu/research/opinions/2012/12/11-robotics-military-singer	09-1-military.mp4 09-2-Robots and Military Discussion	Discussion board 9
10	Space	Read: http://www.ucf.edu/pegasus/opinion/	10-1-space.mp4 10-2-Robots and Space Discussion.mp4	Discussion board 10 Project due
11	Our Future	Critical Thinking post test VOSTS post test	11-1-future.mp4 11-2-Possible Futures Discussion.mp4	Takehome final due