COSC 4590 Special Topics: AI Robotics  
Department of Computing Sciences  
Spring 2017

A. COURSE INFORMATION

Course number/section: COSC4590.002  
Class meeting time: MWF 3-3:50  
Class location: CI-127  
Course Website: blackboard

B. INSTRUCTOR INFORMATION

Instructor: Scott A. King  
Office location: CI 341  
Office hours: M 4-5PM, T 8-10AM, W 10AM-noon  
Telephone: 361 825-5877  
e-mail: Scott.King@TAMUCC.edu  
Appointments: Send me an email with possible times.

C. COURSE DESCRIPTION

Catalog Course Description  
Variable content. May be repeated for credit depending on topic. Offered on sufficient demand.

Extended Course Description  
This course is an introduction and survey of artificial intelligence methods for mobile robots (ground, aerial, or marine) for graduate students or highly advanced undergraduates in science and engineering. It covers both the theory and the practice of unmanned systems, relying on biological and cognitive principles that are often quite different from control theory formulations. The course emphasizes software organization and provides a survey of the broad range of algorithms for each component in an intelligent system.

The course has two novel pedagogical aspects:

1. It is a “flipped course” where lectures and reading material are provided online and the classroom time is spent in discussion, examination of working code, and working with robots. The online materials will be provided and students will have to read pre-prints of the new textbook (good news is that you don’t have to buy the book and you will be named in the acknowledgments!)

2. It will use case studies of actual robots plus stories from science fiction in order understand design constraints and the role of autonomy in unmanned systems. The inclusion of science fiction stories stems from the instructor’s High Impact Learning Fellowship.

The class periods will generally, but not always, follow a pattern of: Tuesday- review any questions about the material; Thursday- class exercises, discussions, or project work.
D. **PREREQUISITES AND COREQUISITES**

**Prerequisites**
COSC 3346 Operating Systems and Permission of Instructor

E. **REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES**

**Required Textbook(s)**

Pre-prints of Introduction to AI Robotics, 2nd edition (on-line, free)
Pre-prints of Robotics Through Science Fiction (on-line, free)

**Optional Textbook(s) or Other References**

Previously recorded lectures can be found at: [https://www.udemy.com/artificial-intelligence-for-robotics/](https://www.udemy.com/artificial-intelligence-for-robotics/), but it is more important to read the pre-prints which contain more information than in the lecture.

We will use piazza as the website and repository for the course, please go enroll at piazza.com/tamu/spring2016/csce635/home

F. **STUDENT LEARNING OUTCOMES AND ASSESSMENT**

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of the semester, the student should have a firm foundation in the organization and practical implementation of software for intelligent robots.

As the result, the student should have the knowledge and comprehension, as measured by written assessment of the book chapters and tests, to be able to answer:

1. **What is autonomy?**
   - describe the different aspects of teleoperation, automation, and autonomy
   - describe the 4 primitives of AI robotics (sense, act, plan, learn) and how those are represented within a hybrid deliberative/reactive architecture

2. **How is it programmed?**
   - express and program the major ways of organizing and combining behaviors in behavior-based systems
   - list the most common sensors, their strengths and weakness and state of the art
o discuss the differences and apply the major path planning and simultaneous localization and mapping (SLAM) algorithms
o describe the dimensions and facets of coordination of teams of robots
o discuss and apply appropriate learning algorithms for a specific problem

3. What are the societal and ethical considerations in robotics?
o describe the merits of affective computing and apply the principles of human-robot interaction
o describe the types of ethics and the responsibility of designers

G. INSTRUCTIONAL METHODS AND ACTIVITIES

This class is in transition from the first edition of *Introduction to AI Robotics* (in print) to a second edition (in prep). Much of material on paradigms and software organization has been condensed, while about 50% new material has been added. You will get the new material as handouts to download. The online lectures may not reflect the details in the handouts, so listening to the lecture may not be sufficient. Be aware that material may not be covered in the online lecture.

This class requires class discussion and analysis as it is a design class. It also requires individual programming and group work. This is NOT a standard “read the book, go to a lab and follow the exercise, take the test” class.

H. MAJOR COURSE REQUIREMENTS AND GRADING

There will be no incompletes or make-up sessions for labs or the project.

- 34% There are 5 tests, they are not equally weighted: (T1, 5%), (T2, 10%), (T3, 10%), (T4, 5%), (T5, 4%)
- 36% Chapter readings from textbook. Students will fill in a form showing that they have read and comprehended the chapter. There are 19 chapters, the lowest score will be dropped.
- 10% Case studies. At least 7 case studies, 6 of which will be from science fiction.
- 20% Group project. Students will work in teams of 2-3 on projects related to the deployment of unmanned marine vehicles and unmanned aerial vehicles for rescuing drowning victims; the projects will be based on lessons learned from the instructor’s deployment to Greece to assist with rescuing refugees. Students can choose their own team and pick their project from a list given by the instructor. The group project will have 5 graded phases, the phases are not equally weighted. The final deliverable will be a conference quality report suitable for the AAAI or IEEE ICRA conference.

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<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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<tr>
<td>Exams</td>
<td>34% (5%, 10%, 10%, 5%, 4%)</td>
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<td>Chapter readings</td>
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## I. COURSE CONTENT/SCHEDULE

<table>
<thead>
<tr>
<th>DATE (BY DAY OR WEEK)</th>
<th>TOPIC</th>
<th>CHAPTER(S)</th>
<th>ASSIGNMENTS</th>
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<tr>
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<td>Autonomy</td>
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<td>Teleportation</td>
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<td>Test 1</td>
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<td>Behaviors</td>
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<td>Locomotion</td>
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<td>Exam 2</td>
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<td>Deliberation</td>
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<td>Project 1: presentations</td>
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<td>Spring Break</td>
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<td>Navigation and Motion</td>
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<td>Planning</td>
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<td>Project: design review</td>
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<td>Mapping</td>
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<td>Project 2: test plan review</td>
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<td>Project 3: Intermediate Project Report</td>
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<td>Multi-agents</td>
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<td>Exam 4</td>
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<td>Design, Ethics</td>
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<td>Project 4: Prototype</td>
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<td>Exam 5</td>
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<td>Final-Project 5: final presentation and report</td>
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Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. COURSE POLICIES

Attendance/Tardiness
You are expected to be to all class periods.

Late Work and Make-up Exams
Work will be marked off at 10%/day for 3 days. Make-up exams only in the case of missing class for an appropriate reason, and only if arrangements made in advance.

Extra Credit
None

Cell Phone Use
Cell phones need to be turned off or on vibrate.

Laptop Use
Laptops may be used and necessary for working on your assignments. They should only be used for course work.

Food in Class
No food or drink is allowed in the lab.

Missed Exam
You must make arrangements before missing an exam.

Participation
You are expected to do you reading and cover course materials before class and be prepared to discuss the current topic. You are also expected to be active in the discussion.

Others
All writing is to be your own work. Proper citations are required. Failure to cite will be considered plagiarism.

K. COLLEGE AND UNIVERSITY POLICIES

- Academic Integrity (University)
  University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic
misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- **Classroom/Professional Behavior**
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Statement of Civility**
  Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

- **Deadline for Dropping a Course with a Grade of W (University)**
  The grade of W will be assigned to any student officially dropping a course. Please consult with the instructor before you decide to drop to be sure it is the best thing to do. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Should dropping the course be the best course of action, visit the Office of the University Registrar for the Course Drop Form that must be submitted. No student is eligible to receive a W without completing the official drop process by this deadline. Please consult the Academic Calendar (http://www.tamucc.edu/academics/calendar/) for the last day to drop a course.

- **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at http://www.tamucc.edu/provost/university_rules/index.html, and the College of Science
and Engineering Grade Appeals webpage at http://sci.tamucc.edu/students/GradeAppeal.html. For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

- **Disability Services**
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 believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

http://disabilityservices.tamucc.edu/

- **Statement of Academic Continuity**
In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. **OTHER INFORMATION**

- **Academic Advising**
The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

**GENERAL DISCLAIMER**
I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely
manner during regularly scheduled lecture periods.