

Unmanned Vehicle System Development
Spring 2018

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Section Information:

AE 5379-001 LEC	UNMANNED VEHICLE SYSTEM DEVELOPMENT
MAE 4379-001 LEC	UNMANNED VEHICLE SYSTEM DEVELOPMENT
ME 5379-001 LEC	UNMANNED VEHICLE SYSTEM DEVELOPMENT
EE 4379-001 LEC	UNMANNED VEHICLE SYSTEM DEVELOPMENT
CSE 4379-001 LEC	UNMANNED VEHICLE SYSTEM DEVELOPMENT
CSE 5384-001 LEC	UNMANNED VEHICLE SYSTEM DEVELOPMENT
EE 4379-001 LEC	UNMANNED VEHICLE SYSTEM DEVELOPMENT
EE 6322-001 LEC	UNMANNED VEHICLE SYSTEM DEVELOPMENT
IE 5379-001 LEC	UNMANNED VEHICLE SYSTEM DEVELOPMENT

Time and Place of Class Meetings: NH 105, Monday 3:00 PM to 5:50 PM

Description of Course Content: Introduction to the technologies needed to create an UVS (Unmanned Vehicle System). Integration of these technologies (embodied as a set of sensors, actuators, computing and mobility platform sub-systems) into a functioning UVS through team work. UVS could be designed to compete in a student competition sponsored by various technical organizations or to support a specific mission or function defined by the instructors. Prerequisite: B or better in the *Introduction to Unmanned Vehicle Systems* course and admission to the UVS certificate program.

Student Learning Outcomes: This course is designed to provide students with hands on exposure to the technologies and engineering methods used to develop and deploy Unmanned Vehicle Systems. This course explicitly takes a multi-disciplinary approach to presenting unmanned systems. The class will be team-taught with faculty from the Computer Science, Mechanical, Aerospace, and

Industrial Engineering Departments. This course is designed to present the student with project experiences that would typically fall outside his/her main area of study challenging the student to explore the inherently multi-disciplinary nature of today's complex engineered systems. This course is the second course of a common two course sequence that forms the foundation of an Undergraduate and Graduate UVS Certificate program offered in the Electrical Engineering, Computer Science Engineering, Mechanical and Aerospace Engineering, and Industrial, Manufacturing, and Systems Engineering Departments.

By the end of the course, you will have experience in the following areas:

- Hands-on experience with the integration of an UVS mobile platform.
- Test, trouble shoot, and operate an UVS mobile platform.
- The use of the Matlab/Simulink toolsets to model, simulate and control unmanned systems
- Utilize various types of sensors found within UVS and implement suitable sensor fusion methods
- Implement common methods used by UVS to perform Guidance, Navigation, & Control functions
- The programming of Micro Controllers to drive unmanned mobile platforms
- The use of machine vision systems to support planning and obstacle avoidance

Required Textbooks and Other Course Materials: There is no required Text for this course. Notes and supplemental materials will be provided by the course instructors.

Descriptions of major assignments and examinations: the students in the class will be assigned to multi-disciplinary student teams. Each student will conduct a sequence of four Class Projects during this course. The major assignments for the projects will be Class Project write ups, team presentations, and team capability demonstrations. In addition, each team will submit team evaluations and a final team report.

Attendance: At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance

Attendance of the class is required. All team members are required to be present for Team Demonstration and Presentation Activities. Missing members (that do not have pre-arranged excused absences) and their teams will lose points on their Demonstration & Presentation assessments.

However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Blackboard. This date is reported to the Department of Education for federal financial aid recipients.

Other Requirements: Undergraduate Students must be accepted into the professional program within their home engineering department. Graduate students must be in good academic standing at the time of enrollment for the class. Degreed Undergraduates seeking to obtain a UVS Certificate without pursuing a Masters degree, must be accepted into one of the departmental Graduate UVS Certificate programs.

Grading: The following items will be graded and used to determine the final class grade.

Class Projects: 4 projects,	23% each	- 92% Total
Project Write Ups:	5% each	- 20% Total
Project Presentations:	4% each	- 16% Total
Project Performance	8% each	- 32% Total
Team Effort:	6% each	- 24% Total
Final Team Report	8%	- 8% Total

Teammate Evaluation: You will fill an evaluation form for each of your teammates and submit it in confidence to the faculty after each assignment. Your evaluation will affect your teammates' grade he/she will get from the respective assignment according to the policy provided in the evaluation form. You can see a sample evaluation form for your reference on the last page of this document. The form is subject to change during the semester.

The following scale will be used to assign class grades:

A	90% - 100%
B	80% - 89%
C	70% - 79%
D	60% - 69%
F	less than 60%

Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels.

Expectations for Out-of-Class Study: Beyond the time required to attend each class meeting, students enrolled in this course should expect to spend at least an additional 9 hours per week of their own time in course-related activities, including reading required materials, completing assignments, preparing for project demonstrations and presentations, etc.

Grade Grievances: Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current University catalog.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://www.uta.edu/aao/fao/>).

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including The Americans with Disabilities Act (ADA), The Americans with Disabilities Amendments Act (ADAAA), and Section 504 of the Rehabilitation Act. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of a **letter certified** by the

Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:

The Office for Students with Disabilities, (OSD) www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.

Title IX Policy: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.*

Academic Integrity: Students enrolled in all UTA course are expected to adhere to the UT Arlington Honor Code:

I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System Regents' Rule 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. Additional information is available at <https://www.uta.edu/conduct/>.

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to

resources@uta.edu, or view the information at <http://www.uta.edu/universitycollege/resources/index.php>.

The IDEAS Center (2nd Floor of Central Library) offers **free** tutoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. To schedule an appointment with a peer tutor or mentor email IDEAS@uta.edu or call (817) 272-6593.

The English Writing Center (411LIBR): The Writing Center Offers free tutoring in 20-, 40-, or 60-minute face-to-face and online sessions to all UTA students on any phase of their UTA coursework. Our hours are 9 am to 8 pm Mon.-Thurs., 9 am-3 pm Fri. and Noon-6 pm Sat. and Sun. Register and make appointments online at <http://uta.mywconline.com>. Classroom Visits, workshops, and specialized services for graduate students are also available. Please see www.uta.edu/owl for detailed information on all our programs and services.

The Library's 2nd floor Academic Plaza offers students a central hub of support services, including IDEAS Center, University Advising Services, Transfer UTA and various college/school advising hours. Services are available during the library's hours of operation. <http://library.uta.edu/academic-plaza>

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit <http://www.uta.edu/news/info/campus-carry/>

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as "lecture," "seminar," or "laboratory" shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

Final Review Week: Please note, the Class Project Cumulative Final Report and the Team Project Final Report is due the last day of class, May 7th, 2018, as *specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate. The fourth Class Project Demonstrations and Presentations as well as the Team Project Presentations will be given by the student teams during the official exam period assigned to this class.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit. NH 105 has an emergency exit at the top and back of the room. This exit leads directly outside. If you elect to exit the front of Room NH105 you should turn to the right as you enter the atrium. There will be an exit

out of building immediately in front of you. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.

Website: Blackboard (<http://elearn.uta.edu>)

Tentative Date Course Schedule.

	Topic or Activity	Lead Professor	Supporting Professor
22-Jan	Class Introduction, Discussion of Mechanical Design Challenges, Team Formation	Huff	All
29-Jan	Equipment Distribution, Team Project Discussion, Introduction to APMRover	Huff	All
31-Jan	<i>Census Day</i>		
5-Feb	Safety RC Control Verification & APMRover Setup	Huff	All
12-Feb	Team Demonstrations & Presentations No. 1	Huff	All
19-Feb	GNC Review & Simulink-Hardware SetUp for Waypoint Navigation (WN)	Dogan	All
26-Feb	Parameter Estimation (PE) of UGV & GNC Implementation in NUC for WN	Dogan	All
5-Mar	GNC for WN & Obstacle Avoidance (OA) - WN Competition	Dogan	All
12-Mar	<i>Spring Break</i>		
19-Mar	Team Demonstrations & Presentations No. 2 (WN & OA Competition)	Dogan	All
26-Mar	Sensor Integration, Fusion, and Analysis	Subbarao	All
2-Apr	Extended Kalman Filters and Testing	Subbarao	All
9-Apr	Team Demonstrations & Presentations No. 3	Subbarao	All
16-Apr	Machine Vision, Planning	Huber	All
23-Apr	Path Planning Integration	Huber	All
30-Apr	Vision and Planning Trouble-Shooting	Huber	All
7-May	Final Demonstrations & Presentations (at official exam time 11-1:30 pm)	All	

Date	Class Deliverables	Unit Responsible
6-Feb	Mechanical Design Packages Submitted	Teams
13-Feb	Class Project Write Up No. 1	Teams
27-Feb	Thumper/GNC Hardware Setup	Teams
6-Mar	PE Write Up and WN Write Up	Teams
20-Mar	WN & OA in Simulation and Hardware Demo Write Up	Teams
10-Apr	Class Project Write Up No. 3	Teams
1-May	Class Project Write Up No. 4	Teams
8-May	Final Team Project Report	Teams

The instructors for this course reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course.

Emergency Phone Numbers: In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381

Teammate Evaluation Form
XX{4,5}379 - UVS DEVELOPMENT
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Enter one of the following for items 1-5 in the table below.

SA = Strongly Agree (5)

A = Agree (4)

N = Neutral (3)

D = Disagree (2)

SD = Strongly Disagree (1)

Assignment: _____

		Teammate 1	Teammate 2	Teammate 3	Teammate 4	Teammate 5
	Teammate Name & Last Name					
1	Overall this teammate contributed a lot					
2	This teammate was knowledgeable technically					
3	This teammate communicated clearly					
4	This teammate was reliable in commitments					
5	This teammate was a good team player					
	Write one contribution by this teammate					

Your assignment grade = teammate rate * team assignment grade

teammate rate = 1 if your average evaluation ≥ 3
= 0.7 if $3 > \text{your average evaluation} \geq 2$
= 0.5 if $2 > \text{your average evaluation}$