ME143 Unmanned Aircraft Systems
Fall 2018 Offering
School of Engineering, University of California, Merced
SYLLABUS

"Unmanned Aerial Systems" (UAS) prepares students with essential foundational, design, integration and operational knowledge to meet emerging UAS workforce demands. Topics: UAS history, classification, applications, safety compliance; UAS components, basic aerodynamics, flight dynamics, navigation and control, payload integration, mission planning, sense-n-avoid; UAS use cases and other selected emerging topics. (4 credits with labs.)

This course is lab-intensive. 150 min. lectures per week (two 75 min. lectures) and 3 hours lab session per week. 3 extra hours for self-study (book reading, home works, literature review, report writing etc.)

Prerequisites:
• ENGR 057 and ENGR 065 or Instructor approval. Letter grade only. Laboratory included.

Text Books and Other Required Materials:
- None

Supplementary Materials
- Douglas M. Marshall, Richard K. Barnhart, Stephen B. Hottman, Eric Shappee, Michael Thomas Most. **Introduction to Unmanned Aircraft Systems, 2nd Edition**. CRC Press. 2016 by CRC Press; Textbook – 395 pages; ISBN 9781482263930
- 14 CFR 107 Small Unmanned Aircraft Systems
- AC107-2 – Small Unmanned Aircraft Systems, FAA Advisory Circular

Instructor:
Dr. Brandon Stark, Director, UC Center of Excellence on UAS Safety,
http://ucop.edu/enterprise-risk-management/resources/centers-of-excellence/unmanned-aircraft-systems-safety.html
Email: bstark2@ucmerced.edu. Office: Facilities B, Rm 185

Office Hours:
Monday 12:00 PM - 1:30 PM
Tuesday 1:30 PM - 3:00 PM
or by appointment.

TA:
Derek Hollenbeck
Email: dhollenbeck@ucmerced.edu

Course Offerings

Lecture	**TR**	**12:00-1:15pm**	**COB114**	**Brandon Stark**
ME-143-02L	Sat	9:00-11:50am	TBD	Derek Hollenbeck
ME-143-02L	Sat	2:00-4:50pm	TBD	Derek Hollenbeck

Final Exam

Thursday, December 14th – 8:00AM, **COB114**

Course Objectives and Student Learning Outcomes:

ME143 Unmanned Aerial Systems (UAS) prepares students with foundational, design, integration and operational knowledge to meet emerging UAS workforce demands. The course covers UAS history, classification, applications, safety compliance; UAS components, basic aerodynamics, flight dynamics, navigation and control, payload integration, mission planning, sense-n-avoid; UAS use cases and other selected emerging topics.

Course Goals:

1. To develop an overall understanding of UAS history, UAS types, and civilian small UAS applications;
2. To develop a firm understanding of UAS operational safety and rule-compliance requirements.
3. To understand basic UAS elements;
4. To obtain basic knowledge of UAS aerodynamics and flight dynamics;
5. To obtain basic knowledge of UAS guidance, navigation and control;
6. To obtain basic knowledge of UAS payloads and the enabled ConOps (concept of operations);
7. To obtain basic knowledge of UAS mission planning, GCS operations;
8. To obtain basic knowledge of UAS UTM (UAS Traffic Management), BVLOS (beyond visual line-of-sight) requirement and sense-and-avoid techniques;
9. To obtain basic knowledge of UAS use cases and drone entrepreneurial process.

Learning Outcomes:

1. To be able to understand typical civilian low cost UAS systems;
2. To be able to operate typical civilian low cost UAS systems;
3. To be able to understand and comply FAA regulations on small UAS operations;
4. To be able to integrate typical mission sensors in typical civilian low cost UAS systems;
5. To be able to get ready for applying for an FAA's Remote Pilot Certificate with a Small UAS rating
6. To be able to get ready to create UAS related engineering practice/service or to join UAS work force.

Contributions to Engineering Program Learning Outcomes (A-K)

(A)An ability to apply knowledge of informatics, mathematics, science, and engineering
(B)An ability to design and conduct experiments, as well as to analyze and interpret data
(K)An ability to use the techniques, skills, and modern engineering and scientific tools necessary for engineering practice.

Topics: (selected)

- History
- UAS Applications
- The "System" in UAS
- UAS Sensing: Theory and Practice
- U.S. Aviation Regulatory System
- Human Factors in Unmanned Aerial Systems
- Safety Assessments
- Export Control and ITAR
- Unmanned Aircraft System Design
- UAS Airframe and Powerplant Design
- UAS Subsystem Nexus: The Electrical System
- Communication Systems
- Command and Control
- Unmanned Aircraft Subsystem Integration
- Detect and Avoid
- Policy and Public Perception
- The Future of Unmanned Aircraft Systems

Course Outline

Week	*Lecture*	*Lab*
1	Introductions to Drones	Lab Safety, Flight Practice
2	Drone History & Applications	No Lab (Labor Day)
3	Drone Components	Mission Planning
4	Drone Regulations	Mapping Exercise
5	UAS Safety & Risk Management	Vernal Pool Project
6	Payloads & Applications	Campus Drone Project
7	Industrial & Remote Sensing	Search & Rescue Sim.
8	Midterm	No Lab (Midterm)
9	UAS Aerodynamics	Intel Aero Simulation
10	Control Systems	Intel Aero Programming
11	Sensors and Sensor fusion	Final Project
12	Navigation Algorithms	No Lab (Veteran's Day)
13	Path Planning and Avoidance	Final Project
14	Privacy & Advanced Topics	No Lab (Thanksgiving)
15	Traffic Management & UTM	Final Project Presentation
16	Advanced Topics	

Grading Policy by the numbers

	Number	*% of Grade*	*Grade per Assignment*
Quizzes	11	11 %	1 %
Homework	11	22 %	2 %
Lab	8	24 %	3 %
Lab Final Project	1	8 %	8 %
Midterm	1	15 %	15 %
Final	1	20 %	25 %

Grade Distribution

GRADE	TOTAL SCORE (%)
A+	97+
A	93-96
A-	90-92
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	63-66
D-	60-62
F	<60

CATCOURSES

All class information, including syllabus, homework assignments, lab assignments and grades will be posted on CATCOURSES. With the exception of the midterm and final exam, all homework and lab assignments must be submitted to CATCOURSES.

In the event that CATCOURSES is down within 24 hours of an assignment deadline, the deadline will be extended by 24 hours after service is restored.

Course Policies:

1. Be on time to class. Tardiness is discouraged. Quizzes will be on Tuesdays from 12:00-12:20pm, no exception.
2. No late assignments will be accepted. Medical or family emergency will be considered on case-by-case basis.
3. In the event that CATCOURSES is down within 24 hours of an assignment deadline, the deadline will be extended by 24 hours after service is restored.
4. All homework and lab assignments must be submitted to CATCOURSES. Do not email assignments to instructor or TAs.
5. No make-up quizzes except due to medical or family emergency.
6. No make-up exams. If you miss an exam a zero score will be assigned to the missed exam. No electronic devices other than a calculator will be allowed for the exams.
7. If you miss a class due to personal emergency or medical reasons, please be sure to inform the instructor by e-mail in advance.
8. Homework assignments are to be submitted by the due date/time. You may discuss homework questions with your classmates, but you are responsible for your own work. Points may be deducted for repetitive discussion topics.
9. After an assignment grade has been posted online, students must see the instructor within one week if they wish to discuss the assignment and their work.

10. University's rules on academic honesty concerning exams and individual assignments will be strictly enforced. See UC Conduct Standards: http://studentlife.campuscms.ucmerced.edu/content/uc-conduct-standards

Academic Dishonesty Statement:

1. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's *own* work.
2. You are encouraged to studytogether and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e mail, an e mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.
3. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

Disability Statement:

Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. Any student who feels he or she may need an accommodation based on the impact of a disability should contact me privately to discuss his or her specific needs. Also contact Disability Services at (209) 228-7884 as soon as possible to become registered and thereby ensure that such accommodations are implemented in a timely fashion.