ENGR 4390.005
Selected Topics in Engineering:
Introduction to UAS for Agricultural Applications

Spring 2017

A. COURSE INFORMATION

Course number/section: ENGR 4390.005
Class meeting time: TR 12:30-1:45PM
Class location: EN-214
Course Website: Accessed via Blackboard (Bb): https://bb9.tamucc.edu/

B. INSTRUCTOR INFORMATION

Instructors: Dr. Jinha Jung
Assistant Professor
School of Engineering and Computing Sciences
Director of the Unmanned System Lab

Office location: EN 207A
Office hours: TR 9:15 AM - noon
Telephone: 361.825.3294
Office e-mail: Jinha.jung@tamucc.edu
Appointments: Schedule by email, phone, or stop by my office.

C. COURSE DESCRIPTION

Provides the foundations to acquire remote sensing data using Unmanned Aircraft Systems (UAS) and to interpret, process, and apply remotely sensed data for agricultural applications. Principles of remote sensing, digital image processing, and geospatial analysis will be covered. Emphasis will be on the use of UAS remote sensing technology for various disciplines in agricultural sciences including plant breeding, plant physiology, crop scouting, pest management and entomology.

D. PREREQUISITES AND COREQUISITES

Prerequisites

Prior experience in computer programming, GIS concepts and software is helpful but not required.
Corequisites
None

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Textbook
None. Readings will be based on lecture notes, handouts, and peer-reviewed journal articles.

Software
This course will use GIS and photogrammetric software for processing and analysis.

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.

It is anticipated that this course will help you to:
1. Understand how to safely operate and use UAS technology for remote sensing.
2. Design UAS survey missions to collect appropriate spatial and spectral resolution data
3. Understand spatial accuracy, georeferencing, and field methods required for research projects
4. Pre-process UAS data to generate geospatial data products such as orthomosaic images, 3D point cloud data, and Digital Surface Model (DSM)
5. Perform calculations from DSM’s to estimate crop growth characteristics
6. Derive estimates of crop health and map prescriptions from multispectral image products
7. Synthesize multiple data types from varying sources,
8. Adapt algorithms to improve efficiency, and
9. Develop a tool kit for future use in research, education, and/or professional work.

G. INSTRUCTIONAL METHODS AND ACTIVITIES

Approach: weekly readings including journal papers followed by group discussion. Problem sets including programming with Matlab will occasionally be given. Course will be designed around a semester long project.
H. MAJOR COURSE REQUIREMENTS AND GRADING

Your final grade will be based on the following point distribution:

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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<tbody>
<tr>
<td>Project Proposal</td>
<td>25%</td>
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<tr>
<td>Progress Reports (2)</td>
<td>10%</td>
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<tr>
<td>Journal Paper Reviews (4)</td>
<td>10%</td>
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<tr>
<td>Computing Assignments (3)</td>
<td>10%</td>
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<tr>
<td>Final Project Report and Presentation</td>
<td>45%</td>
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I. COURSE CONTENT/SCHEDULE

SCHEDULE is tentative and subject to change. Weekly readings will be posted to Bb.

<table>
<thead>
<tr>
<th>DATE (BY DAY OR WEEK)</th>
<th>TOPIC</th>
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<tbody>
<tr>
<td>1</td>
<td>UAS platforms and sensors</td>
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<td>2</td>
<td>Basic remote sensing principles</td>
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<tr>
<td></td>
<td><strong>Journal Paper Review 1 Due</strong></td>
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<tr>
<td>3</td>
<td>Safety for UAS operation</td>
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<tr>
<td>4</td>
<td>UAS mission planning</td>
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<tr>
<td>5</td>
<td>Structure from Motion principle</td>
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<tr>
<td></td>
<td><strong>Project Proposal Due</strong></td>
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<tr>
<td>6</td>
<td>Structure from Motion principle</td>
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<tr>
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<td><strong>Journal Paper Review 2 Due</strong></td>
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<td>7</td>
<td>SfM using Pix4D</td>
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<tr>
<td>8</td>
<td>SfM using Photoscan</td>
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<td><strong>Programming Assignment 1 Due</strong></td>
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<tr>
<td></td>
<td>SfM using OpenDroneMap</td>
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<td><strong>Progress Report 1 Due</strong></td>
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<td>9</td>
<td>Classification of remote sensing data</td>
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<tr>
<td></td>
<td><strong>Programming Assignment 2 Due</strong></td>
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<tr>
<td>10</td>
<td>Classification of remote sensing data</td>
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<td></td>
<td><strong>Journal Paper Review 3 Due</strong></td>
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<tr>
<td>11</td>
<td>3D point cloud data processing</td>
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<tr>
<td>12</td>
<td>3D point cloud data processing</td>
</tr>
<tr>
<td></td>
<td><strong>Programming Assignment 3 Due</strong></td>
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<tr>
<td>13</td>
<td>Crop growth analysis</td>
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<tr>
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<td><strong>Progress Report 2 Due</strong></td>
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<tr>
<td>14</td>
<td>Crop health analysis</td>
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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
Regular attendance is expected. In-person students are expected to attend face-to-face lectures and distance students are normally not permitted to attend in-person lectures without prior approval first. Recorded lectures may be restricted to distance students at discretion of the instructor (e.g. in-person attendance is poor due to students watching online as opposed to attending class). Online student attendance will be gauged based on regular Blackboard access.

Assignments and Late Work Policy
You are expected to work individually on all assignments/exams unless otherwise stated. Assignment due dates will be specified for each assignment.

Effective as of 12:00 AM ET on the day following the assignment due date:
- 1 to 3 days late - Minus 3% per day past due
- 4 to 7 days - Minus 4% per day past due
- Over 1 week late – Minus 30%
- Over 2 weeks late - 0

If you are not able to meet a particular deadline, you must notify me before the due date to request an extension. Reduced penalty extensions will be granted on a case-by-case basis and will be refused for repeat offenders.

Cell Phone Use
Cell phones must be TURNED OFF and not utilized during class.

Missed Presentation/Report
You are expected to present your report when scheduled. Make-up presentations will only be permitted under department approved circumstances.

My Decree
If you are having a problem finishing an assignment or other concerns, please talk to me. My goal is to help you succeed in the course.
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.