



**Course Master Syllabus**

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**CATALOG DESCRIPTION:** This course will provide students a foundational understanding encompassing all elements of an unmanned aircraft system (UAS). Students will be provided the knowledge and necessary skill set to support UAS applications. Students learn the foundations of remote sensing and data analysis; acquiring knowledge of the characteristics of various sensors and remote sensing applications applicable to civil unmanned aircraft system (UAS) operations. Emphasis is placed on data acquisition and processing.

**PREREQUISITE(S):** UAS 101 Unmanned Systems; UAS 105 Remote Pilot Operations

**COREQUISITE(S):** UAS 202 Analysis of Spatial Data & Photography

**CREDITS:** 3    **HOURS:** 3

**REQUIRED TEXT(S):** Lillesand, T., Kiefer, R.W., & Chipman, J. (2015). Remote Sensing and Image Interpretation 7th Edition. Wiley.

**ISBN:** 13: 978-1118343289

**SUPPLEMENTAL MATERIALS (Required):**

Unmanned aerial systems for photogrammetry and remote sensing: A review, available at:  
<https://www.sciencedirect.com/science/article/pii/S0924271614000501>

**INSTRUCTOR INFORMATION:**

**OFFICE HOURS:**



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<b>CORE COMPETENCIES:</b> The following core competencies are embedded in this curriculum: Communicate effectively in both speech and writing; Apply appropriate mathematical and statistical concepts and operations to interpret data to solve problems; Use computer systems or other appropriate forms of technology to achieve educational and personal goals; Address an information need by locating, evaluating and effectively using information.	
<b>LEARNING ASSESSMENT</b>	
<b><i>Student Learning Outcomes:</i></b>	<b><i>Suggested Means of Assessment:</i></b>
Demonstrate a practical understanding of remote sensing systems, their respective capabilities, and their relationship to unmanned aircraft systems (UAS).	Homework, Tests
Describe the consideration, tools and products related to the processing of unmanned aircraft systems (UAS) collected data.	Homework, Tests
Provide a technical overview of unmanned aircraft systems (UAS) -based remote sensing technologies and the applicability of collected data to help solve real world problems.	Homework, Tests
Demonstrate the ability to apply knowledge of key UAS sensors and system applications to execute during UAS operations. This includes installation, trouble shooting, and data collection.	Practical Experience
Demonstrate a foundational understanding of key UAS components and the science behind their function.	Homework, Tests
Demonstrate knowledge of UAS sensors and systems on applicable UAS platforms.	Tests
<b>GRADING SYSTEM:</b>	
A = 90 < 100	C+ = 77 < 80
B+ = 87 < 90	C = 70 < 77
B = 80 < 87	D = 60 < 70
	F = Below 60

**DISABILITY SERVICES STATEMENT:** Warren County Community College is committed to providing all students equal access to learning opportunities. Student Services is the campus office that works with students who have disabilities to provide and/or arrange reasonable accommodations. Students who have, or think they may have, a disability (e.g. mental health, learning, vision, hearing, physical or systemic), are invited to contact Student Services to arrange a confidential discussion at (908) 835-2300 or by email at StudentServices@Warren.edu as soon as possible. Students registered for Disability Services with Student Services, who have



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requested accommodations for the current semester will be provided with an electronic letter detailing individual accommodations and are encouraged to contact the instructor early in the semester to discuss accommodations outlined in their letter.

**INSTRUCTIONAL SUPPORT CENTER:** The Instructional Support Center (ISC), located in Room 105 across from the library, provides academic support at no cost to WCCC students and is available for courses in which they are currently enrolled. The ISC is staffed with trained professional and peer tutors who are ready to help you understand and succeed. For scheduling or further information, visit the ISC in person, online at <http://www.warren.edu/tutoring/> or by telephone at (908)835-2354.

**STATEMENT AND POLICY ON CHEATING, PLAGIARISM AND ACADEMIC DISHONESTY:** Students are required to perform all the work specified by the instructor, and are responsible for the content and integrity of all academic work submitted. A violation of academic integrity will occur if a student: (1) knowingly represents work of others as one's own, (2) uses or obtains unauthorized assistance in any academic work, (3) gives fraudulent assistance to another student, or (4) furnishes false information or other misuse of college documents.

In cases of suspected violation of academic integrity, the incident is to be reported to the Office of Academics. A student found guilty of violating the rule of academic integrity by the Vice President of Academics will be considered to have failed in personal obligation to the College; such failure will be subject to disciplinary action by the College. Unless otherwise notified, the instructor will allow students who are pending disciplinary action to attend class.

**REQUIRED FORMAT FOR RESEARCH PAPERS:** Research papers written for any Warren County Community College class must conform to the required documentation style. Papers written for humanities (and some social science) classes will follow the most recent edition of the Modern Language Association (MLA) in-text citation and bibliographic methods. Social science and science papers will require the use of the most recent edition of the American Psychological Association (APA) in-text citation and bibliographic methods. History papers will require the use of the most recent edition of the Chicago Manual of Style (CMS) footnotes, citations and bibliographic methods.

Please consult with your instructor regarding the correct documentation style to use in his/her class.

**ATTENDANCE POLICY:** Students are expected to attend all class sessions of courses in which they are enrolled and are responsible for all material presented in class and all homework assignments.

Grades are based on the quality of work completed in meeting the requirements for a particular course, as stated in the course syllabus and catalog description.



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Excessive absence may be considered sufficient cause for dismissal from class by an instructor or other appropriate college staff member. Any decision to exclude a student from class or the College due to excessive absence shall be subject to review by the President in accordance with established procedures. Students who have not attended class are not entitled to a refund of tuition.

**WCCC HAYTAIAN & MAIER LIBRARY:** (908) 835-2336 <http://warren.libguides.com>

### Library Hours

Monday-Thursday 8am-8pm

Friday 8am-3pm

Check the Academic Calendar for specific holiday dates. Exceptions may apply during breaks and summer sessions. Any changes to the Library's hours are posted on the Library's web page and near the Library doors.

- **Passwords and Log-Ins-**The Library is responsible for resetting passwords for your Network account (email, computers, Wi-Fi, library resources, and printing). This cannot be reset over the phone. Please stop by the Library for help.
- **College IDs-**College IDs are required for all students. The Library is responsible for producing all ID cards. To get an ID card you must bring to the Library a current copy of your class schedule and another form of ID. Your student ID is also your library card and is needed to check materials out of the Library. Your first ID card is free and replacement cards are issued at a cost to the student.
- **Inter-Library Loan (ILL)-**The Library participates in a nation-wide inter-library loan program which is available free to all students and faculty. You can either submit ILL requests via the Internet (form available on the Library's web page) or in person at the circulation desk.

### **TOPICAL OUTLINE:**

1. Brief history of remote sensing
2. Electromagnetic spectrum overview
3. Mapping Cameras: Understanding of lenses, physics of light and cameras, other photography concepts, such as ISO, shutters, exposure time etc.
4. Overview of Photogrammetry
5. Overview of Aerial mapping and orthorectification
6. Overview of computer vision photogrammetry
7. Traditional Platforms used for Aerial Acquisition & Link to UAS
8. Image Interpretation
9. Image Scale
10. Image Resolution, including spatial, spectral, radiometric, temporal
11. Ground Control Points, including Root Mean Square Error (RMSE)



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12. Accuracy and Precision of Imagery
13. Variety of common payloads and how these tie into the spectrum, including:
  - a. Electro-Optical (EO)
  - b. Near-Infrared (NIR)
  - c. Multi/Hyperspectral (MSI/HSI)
  - d. Light Detection and Ranging (LiDAR)
  - e. Lenses, physics of light, and cameras in context of remote sensing
  - f. Other photography concepts, such as International Organization of Standards (ISO) for film speed, shutters, exposure time etc.
14. Types of algorithms and applications commonly used to exploit data
  - a. Change detection
  - b. Normalized Digital Vegetation Index (NDVI)
  - c. Classification of material
  - d. Object recognition
15. Examples of Applications
  - a. Plant Sciences
  - b. Earth Sciences
  - c. Hydrospheric Sciences
  - d. Land Use
  - e. Aerial mapping: purpose, map scale etc.
16. Flight control sensor and payload systems
17. Propulsion systems
18. Ground and autopilot systems
19. Launch and recovery systems
20. UAS applications

**GRADING METHODS:**

**ITINERARY:**