SURV 63 Course Outline as of Fall 2023

CATALOG INFORMATION

Dept and Nbr: SURV 63 Title: ADV AER REM SENS PHOTOG
Full Title: Advanced Aerial Remote Sensing and Photogrammetry
Last Reviewed: 2/6/2023

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	2.00	17.5	Lecture Scheduled	35.00
Minimum	3.00	Lab Scheduled	3.00	6	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	5.00		Contact Total	87.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 70.00 Total Student Learning Hours: 157.50

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	

Catalog Description:
In this course, students will be introduced to advanced principles of Aerial Remote Sensing and Photogrammetry (ARSP) theory and applications related to Civil Engineering, Surveying, Geospatial Technology (CESGT), and related disciplines. The course content will emphasize advanced remote sensing theory and mechanics, data recovery from aerial sensors and aerial device storage, data storage, data management, data validation, data analysis, model fitting, and data export to Computer-Aided Drafting and Design (CADD) and Geographic Information Systems (GIS) applications.

Prerequisites/Corequisites:
Course Completion of SURV 62 and Course Completion/Current Enrollment in CEST 85, GIS 40 , and SURV 56

Recommended Preparation:

Limits on Enrollment:

Schedule of Classes Information:
Description: In this course, students will be introduced to advanced principals of Aerial Remote

Sensing and Photogrammetry (ARSP) theory and applications related to Civil Engineering, Surveying, Geospatial Technology (CESGT), and related disciplines. The course content will emphasize advanced remote sensing theory and mechanics, data recovery from aerial sensors and aerial device storage, data storage, data management, data validation, data analysis, model fitting, and data export to Computer-Aided Drafting and Design (CADD) and Geographic Information Systems (GIS) applications. (Grade Only)
Prerequisites/Corequisites: Course Completion of SURV 62 and Course Completion/Current Enrollment in CEST 85, GIS 40 , and SURV 56
Recommended:
Limits on Enrollment:
Transfer Credit: CSU;
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**			Effective:	Inactive:
CSU GE:	**Transfer Area**			Effective:	Inactive:
IGETC:	**Transfer Area**			Effective:	Inactive:
CSU Transfer:	Transferable	Effective:	Fall 2023	Inactive:	
UC Transfer:		Effective:		Inactive:	

CID:

Certificate/Major Applicable:
Both Certificate and Major Applicable

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Capture aerial sensor data for use in software applications.
2. Determine trajectory information and tie to ground elevations.
3. Perform serial data analyses that include model-fitting.
4. Export processed data to CADD and GIS software applications.

Objectives:
At the conclusion of this course, the student should be able to:
1. Define terms related to advanced ARSP
2. Identify ARSP software applications
3. Download data from ARSP sensors and devices
4. Process static and Real-time Kinematic Global Navigation Satellite System (RTK GNSS) control data
5. Process Inertial Measurement Unit (IMU) trajectory data
6. Process aero-triangulation data
7. Fit aerial and terrestrial models to ground
8. Export final data models to CADD

Topics and Scope:

Lecture-Related Topics & Scope:

I. Planimetry and Planimetric Mapping
   A. Angular orientation
   B. Ground registration
   C. Photomaps vs Mosaics
      1. Uncontrolled
      2. Semi controlled
      3. Controlled

II. Analytical Photogrammetry
   A. Orientation
   B. Photo control
   C. Collinearity

III. Stereoscopic Methods

IV. ARSP Ground Control
   A. Advanced ground control
   B. Ground control targets
   C. Picture points
   D. GPS capture of ground control
      1. Static
      2. RTK
      3. Real-time Network (RTN)
   E. Post processing

V. Error and Error Propagation
   A. Units
   B. Error
   C. Descriptive statistics
   D. Adjustment
      1. Classical
      2. Least squares
      3. Adjustment applications
         a. Introduction to Star*Net
         b. Introduction to MAGNET tools

VI. ARSP Advanced Concepts
   A. Aero-triangulation
      1. Concept
      2. Mathematics
      3. Mechanics
      4. Methodology
   B. ARSP flight trajectory
      1. IMU purpose and function
      2. Physics of flight trajectory
      3. Trajectory processing software applications

VII. ARSP Data Management
   A. ARSP data and data types
      1. Aerial imagery
      2. Photogrammetric
      3. Light Detection and Ranging (LiDAR)
      4. Other analytical imagery types
         a. Infrared
         b. Multispectral
            i. Normalized Difference Vegetation Index (NDVI)

c. Hyperspectral
ii. Vegetation fingerprinting
B. ARSP data capture
C. ARSP data storage
D. ARSP data management
E. ARSP data validation
VIII. Advanced Elevation Surfaces
A. Creation
B. Analysis
C. Digital Elevation Models (DEM)
1. Bare earth models
2. Hydro flattening
D. Digital Terrain Models (DTM)
1. Features
2. Break lines
3. Topography
E. Digital Surface Models (DSM)
1. Built environment
IX. Introduction to Building Information Models (BIM)
X. ARSP data analysis
A. Model-fitting
B. Goodness-of-fit
XI. Data Export to Other Applications and Environments

Lab-Related Topics & Scope:
I. Neat Model Analysis
II. Ground Control Analysis
III. Error and Error Analysis
A. Descriptive statistics
B. Adjustment methods
1. Classical
2. Least squares
IV. Aero Triangulation Analysis
V. Trajectory Analysis and Ground Control
VI. General Data Management, Archiving
A. Computer hardware
B. Best practices
VII. Ortho Mosaicking
A. Stereo pair data management and processing
B. Orthomosaic data management and processing
C. Orthomosaic comparative analysis
VIII. Other Analytical Imagery Types
A. Infrared, hyperspectral, multispectral
B. NDVI mapping applications
IX. LiDAR Data Management
A. LiDAR data segmentation and storage
B. Statistical model-fitting of LiDAR point clouds
X. Elevation Surface Creation
A. Photogrammetric DEM
1. DTM
2. DSM
B. LiDAR DEM

1. DTM
2. DSM

XI. Data and Model Export to CADD and GIS
XII. Final Model Applications in CADD and GIS
A. Single models
B. Mixed models
C. BIM

Assignment:

Lecture-Related Assignments
1. Textbook readings (1-2 chapters per week)
2. Photogrammetry and surveying homework problem sets (2-6)
3. Quizzes (2-4)
4. Exams (1-2)
5. Final exam

Lab-Related Assignments
1. Lab handout readings (2-10 pages per week)
2. Lab reports (8-12)
3. CADD and GIS mapping projects (2-5)
4. Quizzes (2-5)

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments and skill demonstrations are more appropriate for this course.	Writing 0 - 0%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework problem sets	Problem solving 15 - 30%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

Lab reports; CADD and GIS mapping projects	Skill Demonstrations 40 - 55%

Exams: All forms of formal testing, other than skill performance exams.

Quizzes; exam(s); final exam	Exams 25 - 30%

Other: Includes any assessment tools that do not logically fit into the above categories.

Class participation	Other Category 5 - 10%

Representative Textbooks and Materials:
Elements of Photogrammetry with Applications in GIS. 4th Edition, Wolf, P., DeWitt, B. 2014 (classic).
Introduction to Modern Photogrammetry. 1st Edition. Mikhail, E., Wiley. 2013 (classic).
Analysis and Adjustment of Survey Measurements. 1st Edition, Mikhail, E., Gracie, G. 1983 (classic).
Adjustment Computations - Spatial Data Analysis. 6th Edition, Ghilani, C. Wiley. 2018.
Instructor prepared materials