SURV 62 Course Outline as of Fall 2023

CATALOG INFORMATION

Dept and Nbr: SURV 62 Title: INTRO AER REM SENS PHOT
Full Title: Introduction to Aerial Remote Sensing & 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 the fundamentals of Aerial Remote Sensing and Photogrammetry (ARSP) theory and applications related to civil engineering, land surveying, geospatial technology, and related disciplines. The course content will emphasize remote sensing theory and mechanics, aerial mission planning, high accuracy ground control, Global Positioning System/Global Navigational Satellite System (GPS/GNSS) control, datums and coordinate systems, related fixed-wing and rotary technology, related sensor technology, and basic data capture methods.

Prerequisites/Corequisites:
Course Completion or Current Enrollment in APTECH 191, CEST 51, and SURV 60

Recommended Preparation:

Limits on Enrollment:

Schedule of Classes Information:
Description: In this course, students will be introduced to the fundamentals of Aerial Remote Sensing and Photogrammetry (ARSP) theory and applications related to civil engineering, land

surveying, geospatial technology, and related disciplines. The course content will emphasize remote sensing theory and mechanics, aerial mission planning, high accuracy ground control, Global Positioning System/Global Navigational Satellite System (GPS/GNSS) control, datums and coordinate systems, related fixed-wing and rotary technology, related sensor technology, and basic data capture methods. (Grade Only)
Prerequisites/Corequisites: Course Completion or Current Enrollment in APTECH 191, CEST 51, and SURV 60
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. Apply basic aerial remote sensing principles to aerial data management.
2. Plan aerial remote sensing flight paths and missions.
3. Prepare and implement aerial control networks.

Objectives:
At the conclusion of this course, the student should be able to:
1. Define terms related to fundamental aerial remote sensing
2. Identify and describe the purpose of aerial remote sensing equipment
3. Capture and review data and develop aerial flight plans
4. Create basic aerial planning neat models
5. Select the correct coordinate reference system(s) for aerial project
6. Identify the differences between static, real-time kinematic (RTK) and real-time network (RTN) control networks
7. Identify the differences between Federal, State, local, and private Continuous GPS (CGPS) reference stations
8. Develop and set aerial control networks

Topics and Scope:

LECTURE

I. ARSP Fundamentals and Concepts
- A. ARSP theory fundamentals
- B. History of ARSP
  1. Analog
  2. Digital
  3. ARSP terminology
  4. ARSP flight equipment
- C. Aircraft
  1. Fixed wing
  2. Rotary
  3. Hybrid
  4. Sensors
- D. Photogrammetric
  1. Infra-red
  2. Multi-spectral
  3. Hyperspectral
  4. Inertial measurement unit (IMU)
- E. Ground Cockpits
- F. Accessories
  1. Legal Aspects of ARSP
  2. Licensure and Certification
  3. California Business and Professions Code
  4. Legal definitions of land surveying
  5. Legal definitions of photogrammetry
  6. Legal definitions of civil engineering
- G. ARSP scientific applications within Civil Engineering, Surveying, and Geospatial Technology (CESGT)
  1. Land surveying, Geographic Information Systems (GIS) mapping, and geodesy
  2. Civil engineering mapping and inspection

II. ARSP Scientific and Commercial Applications Outside of CESGT
- A. Forestry, agriculture
- B. Fire control, vegetation management
- C. Range management, animal migration
- D. County and municipal change detection
- E. Fleet management
- F. Real Estate, marketing

III. Photographic and Photogrammetric Optical Systems
- A. The nature of light
- B. The electromagnetic spectrum
- C. The optical axis and the three geometric laws
  1. Optical axis and ray-tracing diagrams
  2. Three geometric laws of optics
- D: Photogrammetric cameras and imaging devices

IV. Photogrammetric Theory
- A. Scale
- B. Vertical photographs
- C. Relief displacement
- D. Stereoscopic models
- E. Parallax
- F. Planimetry (definition)
- G. Oblique or tilted photography

V. Datums and Coordinate Systems
   A. Geodesy
   B. Geocentric, geodetic, local coordinates
   C. Reference systems (datums, ellipsoids)
   D. Horizontal and vertical datums
      1. Hybrid
      2. Three-dimensional (3D)
   E. Coordinate transformations
      1. Affine
      2. Similarity
      3. Conformal
      4. Projection
VI. ARSP Mission Planning
   A. Reconnaissance imagery and data
   B. Flight line determination and reconnaissance
   C. Neat model computations and development
      1. End lap
      2. Side lap
      3. Photo scale
   D. Flying height
   E. Seasonality
   F. Specifications
   G. Cost estimation and analysis
VII. ARSP Ground Control
   A. Basic concept of ground control
   B. Ground control targets
   C. Picture points
   D. Basics of GPS ground control capture
VIII. Engineering and Related Applications
   A. Computer-Aided Drafting and Design (CADD) and GIS background layer
   B. Change detection and time series
   C. Surface generation
      1. Digital Terrain Model (DTM)
      2. Digital Elevation Model (DEM)
      3. Digital Surface Model (DSM)
      4. Other elevation surfaces
   D. Topographic and volumetrics
   E. Precision agriculture
   F. Environmental analysis

LAB
I. Introduction to Field Equipment
   A. Drone aircraft
   B. Drone ground cockpit
   C. Payloads
   D. Accessories
II. Licensing Research and the Law
III. Photogrammetry and Optical System
IV. Datums, Coordinate Systems, and Transformations
V. Pre-Flight Reconnaissance
VI. Flight Line Determination and Neat Model Construction
VII. Ground Control Network Development and Techniques

VIII. Imagery Types in CADD and GIS
IX. Surfaces in CADD and GIS

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. Exam(s) (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 map creation 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; map creation 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 ed, Wolf, P and DeWitt, B. 2014 (classic).
Introduction to Modern Photogrammetry,Mikhail, E., 1st ed, Wiley. 2013 (classic).
Analysis and Adjustment of Survey Measurements, 1st ed, Mikhail, E., Gracie, G. 1983 (classic).
Adjustment Computations - Spatial Data Analysis, 6th ed, Ghilani, C., Wiley. 2018.
Instructor prepared materials