



National University of Engineering (UNI)
School of Civil Engineering
Syllabus 2027-I

1. COURSE

CE3T1. Aerial Photogrammetry (Mandatory)

2. GENERAL INFORMATION

2.1 Course	: CE3T1. Aerial Photogrammetry
2.2 Semester	: 8 th Semester.
2.3 Credits	: 4
2.4 Hours	: 3 HT; 2 HP;
2.5 Duration of the period	: 16 weeks
2.6 Type of course	: Mandatory
2.7 Learning modality	: Face to face
2.8 Prerequisites	: CE2T3. Geodesy. (7 th Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Aerial Photogrammetry is the geomatics course of the Vialidad, Geomatica y Transporte (DAVG) track, building on the satellite geodesy foundations established in Geodesy (Satellite Geodesy) to address the extraction of geometric measurements from aerial and UAV imagery for civil engineering projects. The course first develops the photogrammetric fundamentals of camera geometry, stereoscopic vision, and flight and acquisition planning; then covers the interior/exterior orientation, bundle adjustment, and ground-control-based georeferencing procedures that tie photogrammetric imagery together geometrically through aerial triangulation; then addresses the processing and generation of digital photogrammetric products (digital elevation/surface models, orthophotos, and dense point clouds), together with the accuracy assessment and quality-control procedures used to validate them; and closes with UAV and close-range photogrammetric acquisition and its interpretation and application to civil engineering projects.

5. GOALS

- Explain camera geometry, the central projection image-formation model, and stereoscopic vision, and plan an aerial or UAV photogrammetric flight with appropriate overlap, flying height, and image scale.
- Select and distribute ground control points, and perform interior and exterior orientation and aerial triangulation to geo-reference a block of photogrammetric imagery.
- Generate digital elevation/surface models, orthophotos, and dense point clouds from oriented photogrammetric imagery, including Structure-from-Motion workflows.
- Evaluate the accuracy of digital photogrammetric products against ground truth and apply quality-control criteria to a photogrammetric project.
- Plan and execute a UAV photogrammetric mission, selecting appropriate sensors and payloads and complying with applicable flight regulations.
- Apply close-range and UAV photogrammetric techniques to document structures, and interpret photogrammetric products in civil engineering applications.

6. COMPETENCES

ABET-1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (Usage)

ABET-2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. (Usage)

ABET-6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. (Usage)

7. TOPICS

Unit 1: Photogrammetric Fundamentals (20 hours)	
Competences Expected: ABET-1,ABET-2	
Topics	Learning Outcomes
• Camera geometry: focal length, principal point, and lens distortion • The central projection image-formation model • Stereoscopic vision and parallax measurement • Flight planning: overlap, flying height, and strip layout • Image scale determination and its relationship to flying height and focal length	• Explain camera geometry and the central projection image-formation model [Familiarity] • Measure parallax on a stereo pair to determine relative elevation [Usage] • Plan an aerial photography flight with appropriate overlap and flying height [Assessment] • Compute image scale from flying height and camera focal length [Usage] • Identify lens distortion effects and their correction [Familiarity]
Readings : [Wolf2014]	

Unit 2: Aerial Triangulation and Georeferencing (8 hours)	
Competences Expected: ABET-1	
Topics	Learning Outcomes
• Ground control point selection, measurement, and distribution • Interior orientation and camera calibration parameters • Exterior orientation and camera position/attitude determination • Bundle adjustment for simultaneous multi-image orientation • Aerial triangulation workflow for large image blocks	• Select and distribute ground control points for a photogrammetric project [Usage] • Explain interior orientation and the role of camera calibration parameters [Familiarity] • Determine exterior orientation parameters for an acquired image [Assessment] • Perform a bundle adjustment over a block of overlapping images [Assessment] • Execute an aerial triangulation workflow for a large image block [Usage]
Readings : [Wolf2014], [ASPRS2013]	

Unit 3: Digital Photogrammetric Products (18 hours)	
Competences Expected: ABET-2,ABET-6	
Topics	Learning Outcomes
• Digital Elevation/Surface Model (DEM/DSM) generation from stereo imagery • Orthophoto production and mosaicking • Dense point cloud generation from photogrammetric image matching • Structure-from-Motion (SfM) workflows for unordered image sets • Accuracy assessment of digital photogrammetric products against ground truth	• Generate a digital elevation/surface model from stereo imagery [Usage] • Produce and mosaic an orthophoto from oriented imagery [Assessment] • Generate a dense point cloud from photogrammetric image matching [Usage] • Apply a Structure-from-Motion workflow to an unordered image set [Assessment] • Evaluate the accuracy of a digital photogrammetric product against ground truth [Assessment]
Readings : [Linder2016], [ASPRS2013]	

Unit 4: UAV and Close-Range Photogrammetry (10 hours)	
Competences Expected: ABET-2	
Topics	Learning Outcomes
• UAV mission planning: flight paths, overlap, and ground sample distance • UAV sensors and payloads for photogrammetric acquisition • Close-range photogrammetry applications (e.g. facade/structure documentation) • Regulatory considerations for UAV survey operations • End-to-end UAV photogrammetric processing workflows	• Plan a UAV photogrammetric mission with appropriate overlap and ground sample distance [Usage] • Select UAV sensors and payloads appropriate to a photogrammetric task [Familiarity] • Apply close-range photogrammetric techniques to document a structure [Assessment] • Comply with applicable UAV survey operation regulations [Familiarity] • Execute an end-to-end UAV photogrammetric processing workflow [Usage]
Readings : [Colomina2014], [ASPRS2013]	

8. WORKPLAN

8.1 Methodology

Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

8.2 Theory Sessions

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

8.3 Practical Sessions

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

9. EVALUATION SYSTEM

***** EVALUATION MISSING *****

10. BASIC BIBLIOGRAPHY