	INSTITUT TEKNOLOGI SEPULUH NOPEMBER **FACULTY OF CIVIL, PLANNING AND GEO ENGINEERING** **DEPARTMENT OF GEOMATICS ENGINEERING** **UNDERGRADUATE PROGRAM**	**Document Code**

SEMESTER LEARNING PLAN (SLP)

COURSE NAME	**CODE**	**COURSE GROUP**	**CREDITS (SKS)**		**SEMESTER**	**Date of Preparation**
Applied Photogrammetry	CM234990	Geoinformatics	**T=2**	**P=1**	Elective Course	-

AUTHORIZATION	**SLP Developer**	**Course Group Coordinator**	**Head of Study Program**
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Learning Outcomes (LO)		
	Expected Learning Outcomes (ELO) that Imposed in the Course	
	ELO-4	Able to apply mathematics, science, and engineering in the fields of Geodesy and Surveying, Hydrography, Photogrammetry and Remote Sensing also Geographic Information Systems and Cadastral to gain a thorough understanding of the principles of engineering.
	ELO-5	Able to design survey and mapping activities using the latest technology in the fields of geodesy, surveying, hydrographic, remote sensing, photogrammetry, and cadastral.
	ELO-6	Able to identify, formulate, analyze and solve problems in the fields of Geodesy and Surveying, Hydrography, Photogrammetry and Remote Sensing, as well as Geospatial and Land Information.
	ELO-7	Able to perform spatial data acquisition using modern measurement methods, geospatial data processing, using industry standard software, and making standard designs and analyses in the fields of Geodesy and Surveying, Hydrography, Photogrammetry and Remote Sensing, as well as Geospatial and Land Information.
	Course Learning Outcomes (CLO)	
	CLO-1	Students are able to know and understand the flow of mapping work using aerial and close range photorametry methods
	CLO-2	Students are able to know and understand the data collection of mapping work with aerial methods and close range photogrammetry
	CLO-3	Students are able to understand and take mapping work data with aerial methods and close range photogrammetry
		Matrix ELO – CLO

		CPMK	ELO-4	ELO-5	ELO-6	ELO-7
		CLO-1	V	V	V	V
		CLO-2	V	V	V	V
		CLO-3	V	V	V	V
Course Description	In this course, students are expected to be able to apply the concepts and procedures of photogrammetric science and techniques as one of the methods in surveying and mapping for various field applications. The learning process will cover digital photogrammetry, which will be categorized based on its application in data acquisition and photo data processing to produce spatial data in both 2D and 3D, for aerial, terrestrial, and aquatic surveys.					
Course Materials	1. Definition and application of digital photogrammetry techniques, basic electro-optical concepts (CCD and CMOS) for digital cameras 2. Calibration of metric and non-metric digital cameras using IMU 3. Theory of interior and exterior orientation in digital form with 3D mathematical models, theory and implementation of digital aerial triangulation 4. Theory and implementation of collinearity and coplanarity condition models in digital photography 5. Theory and application of LiDAR data for generating DSM, DTM, and DEM, and basic concepts of Digital Photogrammetry Workstation					
References	**Main:**					
	1. Edward, MH,Introduction to Modern Photogrammetry,John Wiley&Sons,2001 2. Fadh Abany,Advanted Photogrametry, Modul Lecture, 2007 3. Teguh Hariyanto, LIDAR Overview, Modul Lecture, 2013, Geomatika ITS. 4. G.Konecny, Photogrammetri, 3nd edition, Sprin verlag, 2014. 5. Koerth Sijmons, Introduction on Photogrametry, ITC-Enschede,Holland,2008					
	Additional :					
	1. Luhmann - Robson - Boehm, 2020. Close-Range Photogrammetry and 3D Imaging 2. Underwater Photogrammetry, http://3d-underwater.cut.ac.cy/ dan https://www.intechopen.com/chapters/36197 3. Ramırez - Martınez-Carricondo, UAV Photogrammetry & Remote Sensing. Open access journal Remote Sensing (ISSN 2072-429)					
Lecturer	1. Dr-Ing. Ir. Teguh Hariyanto, MSc 2. Agung Budi Cahyono, S.T., M.Sc, DEA 3. Hepi Hapsari Hndayani, S.T., M.Sc, PhD 4. Husnul Hidayat, S.T., M.T.					
Prerequisite	Photogrammetry					

Class/ Week	Lesson Learning Outcome (Sub-CLO)	Evaluation	Forms of Learning, Learning methods,Student Assignments/Task, [Estimated Time]	Learning Materials [References]	Weight (%)

		Indicators	Criteria and Form	Offline	Online		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Able to explain the concept of digital photogrammetry as a large-scale mapping technique using digital photo data	Correctness of procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [1 x 45'] 2. Discussion [1 x 45'] 3. Response, Result presentation Discussion [1 x 45']		Definition, components, and use of digital aerial photo products	10
2 - 3	Able to explain the basic concepts of metric and non-metric digital cameras	1. Accuracy in using camera componen 2. Correctness of procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 45'] 2. Discussion [2 x 45'] 3. Response, Task [2 x 45']		Fundamentals of electro-optics and wave propagation, components of digital cameras including CCD and CMOS systems	20
4 - 5	Able to explain the platform of sensor systems	1. Accuracy in using tools 2. Correctness of procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 45'] 2. Discussion [2 x 45'] 3. Response/Latihan [2 x 45']		Basic implementation of sensor platform systems (UAV, Airborne, Satellite) along with IMU equipment	10
6 - 7	Able to explain the concept of mathematical models of digital photo orientation processes and their corrections to support the stereoscopic concept	1. Accuracy in using formula 2. Correctness of procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 45'] 2. Discussion [2 x 45'] 3. Response, Result presentation [2 x 45']		Basic calculation of digital aerial photography using collinearity and coplanarity principles to represent the photo model relationship	10
8	**Midterm Evaluation / Midterm Exam**						**50**

9 - 10	Able to explain the concept of triangulation for densification of minor control points	Accuracy in using formula	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 45'] 2. Discussion [2 x 45'] 3. Response, Result presentation [2 x 45']		Basic concepts, derivation/linearization, and calculations using	20
11 - 12	Able to explain the coordinate calculation process using the principles of digital aerial photography with 3D transformation	1. Accuracy in using formula 2. Correctness of procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 45'] 2. Discussion contoh hitungan [2 x 45'] 3. Response, Result presentation [2 x 45']		Basic concept and derivation/linearization of 3D transformation from digital photo coordinates to object coordinates in the map coordinate system	10
13 - 14	Able to explain the process of obtaining Z coordinates using the LiDAR system	1. Accuracy in using formula 2. Correctness of procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 45'] 2. Discussion Task [2 x 45'] 3. Response, Result presentation [2 x 45']		Basic concept of wave propagation, data acquisition model, preprocessing and processing of LiDAR data to produce DSM, DTM, DEM, elevation points, and contours	10
15	Able to explain the mapping process using a Digital Photogrammetry Workstation (DPW)	1. Accuracy in using formula 2. Correctness of procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [1 x 45'] 2. Discussion Task [1 x 45'] 3. Response, Result presentation [1 x 45']		Basic concept of equipment, hardware, software, operating system, and outputs from Digital Photogrammetry Workstation (DPW)	10
16	**Final Semester Evaluation / Final Semester Examination**						**100**