



**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
Lidargrametry		CM234993	Geoinformatics	T=1	P=1	Elective Course	-
AUTHORIZATION		SLP Developer		Course Group Coordinator		Head of Study Program	
		Hepi Hapsari Handayani, S.T., M.Sc., Ph.D.		Agung Budi Cahyono, S.T., M.Sc, DEA		Putra Maulida, S.T., M.T., Ph.D.	
Learning Outcomes (LO)	Expected Learning Outcomes (ELO) that Imposed in the Course						
	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 understand the principles of the LiDAR system					
	CLO-2	Students are able to make acquisitions with non-manned aerial and terrestrial LiDAR					
	CLO-3	Students are able to carry out the basic principles of geo-referencing and LiDAR data processing					
	CLO-4	Students are able to explain quantitative and qualitative methods as well as industry quality standards, assessment, assurance, and accuracy of LiDAR derivative data products					
CLO-5	Students are able to apply acquired knowledge and critical thinking skills to solve real-world problems, appropriate LiDAR data processing and analysis methods						

		Matrix ELO - CLO		
		CPMK	ELO-6	ELO-7
		CLO-1	V	
		CLO-2		V
		CLO-3	V	
		CLO-4		V
		CLO-5	V	
Course Description	<p>Aims to study LiDAR data by measuring the quality of derived spatial data and the impact of reduced photo interpretability from comparisons to commonly used photogrammetric stereo models. Lidar, which stands for Light Detection and Ranging, is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (varying distances) to Earth. These light pulses—combined with other data recorded by the airborne system—result in accurate three-dimensional information about the Earth's shape and surface characteristics. A lidar instrument consists of a laser, a scanner, and a special GPS receiver. Airplanes and helicopters are the most commonly used platforms for acquiring lidar data over large areas. There are two types of lidar, namely topographic and bathymetric lidar. Topographic lidar typically uses near-infrared lasers to map land, while bathymetric lidar uses green light that can penetrate water to measure the height of the seabed and riverbeds. In this course, students will study the acquisition and processing of LiDAR topography both terrestrially, such as measurements using a Terrestrial Laser Scanner (TLS), and non-terrestrially, both aerial mapping and unmanned aircraft.</p>			
Course Materials	<ol style="list-style-type: none"> 1. Definition, principles of Laser and LiDAR 2. Physical principles of LiDAR 3. LiDAR sensor and data characteristics 4. LiDAR data acquisition and processing 5. Sources of LiDAR errors 6. LiDAR Applications 			
References	Main:	<ol style="list-style-type: none"> 1. Pinliang Dong and Qi Chen, 2018. LiDAR Remote Sensing and Applications, by Taylor & Francis Group, CRC 2. Press Paul McManamon, 2019. LiDAR Technologies and Systems by SPIE - the International Society for Optical Engineering 3. Jie Shan and Charles K. Toth. 2018. Topographic Laser Ranging and Scanning Principles and Processing, Second Edition. By Taylor & Francis Group, CRC Press. 4. Rodríguez-Cielos, R.; Galán-García, J.L.; Padilla-Domínguez, Y.; Rodríguez-Cielos, P.; Bello-Patricio, A.B.; LópezMedina, J.A. LiDARgrammetry: A New Method for Generating Synthetic Stereoscopic Products from Digital Elevation Models. Appl. Sci. 2017, 7, 906. https://doi.org/10.3390/app7090906 		
	Additional :			
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Lecturer		1. Agung Budi Cahyono, S.T., M.Sc, DEA 2. Hepi Hapsari Handayani, S.T., M.Sc, PhD					
Prerequisite		Digital 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 and technology of LiDAR as a large-scale mapping technique with LiDAR data	Correctness of the procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [1 x 45'] 2. Discussion [1 x 45']		<ul style="list-style-type: none"> • Definition and components • Principle of LiDAR • Topographic LiDAR • Bathymetric LiDAR • Multiple return LiDAR 	10
2 – 3	Able to explain the concept of laser and LiDAR	1. Accuracy of wearing equipment 2. Correctness of the procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 45'] 2. Discussion [1 x 45'] 3. Task [1 x 45']		Electro basis for types of range measurement	20
4 – 5	Able to explain the concept of sensor system platform	1. Accuracy of wearing equipment 2. Correctness of the procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 45'] 2. Discussion [2 x 45']		Basic application of Geolocation of LiDAR footprint sensor system	10
6 – 7	Able to explain the concept of mathematical models of LiDAR processes	1. Accuracy in using formulas 2. Correctness of the procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 45'] 2. Discussion, Task [1 x 45'] 3. Response/Exercise [1 x 45']		Basic LiDAR calculation	10

8	Midterm Evaluation / Midterm Exam						50
9 – 10	Able to explain the concept of LiDAR Scanning pattern	1. Accuracy in using formulas 2. Correctness of the procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 45'] 2. Discussion, Task [1 x 45'] 3. Response [1 x 45']		Basic concepts, derivation/linearization and calculations using strip conditions, triangulation model blocks as mathematical models	20
11 – 12	Able to explain the calculation process of correction using calibration, requirements of the laser for altimetric LiDAR and LiDAR power and pulse firing rate	1. Accuracy in using formulas 2. Correctness of the procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 45'] 2. Discussion, Task [1 x 45'] 3. Response/exercise [1 x 45']		Basic concept and linearization of LiDAR power and pulse firing rate transformations	10
13 – 14	Able to explain the basic processing process of LiDAR	1. Accuracy in using formulas 2. Correctness of the procedure	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 45'] 2. Discussion, Task [1 x 45'] 3. Response/exercise [1 x 45']		The concept of preprocessing and processing LiDAR data to produce STM, DTM/DEM, high points and contour formation	10
15	Able to explain the mapping process using LiDAR for Floods, Coastal, Bathymetric, Glacier and Avalanche, Landslides, Forest mapping, Urban applications, Mining	1. Accuracy in using formulas 2. Correctness of the 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']		Basic concepts using airborne altimetric LiDAR applications/software	10
16	Final Semester Evaluation / Final Semester Examination						100