



UNIVERSITAS PENDIDIKAN INDONESIA

SEMESTER LEARNING PLAN (RPS)

COURSE IDENTITY

Course Name	Course Code	Credits	Workload	Course Group	Semester	Prerequisite Course	Publication Date
LiDAR (LIGHT DETECTION AND RANGING)	SA542	2	90	Elective Course of Study Program	6	Cartography, Geographic Information Systems, Photogrammetry	2025-09-09 11:26:56

Prepared by Lecturer	Reviewed by Study Program Academic Quality Team	Approved by Head of Study Program
Haikal Muhammad Ihsan, M.Sc.	Shafira Himayah, S.Pd., M.Sc.	Dr. Lili Somantri, S.Pd., S.S., M.Si.

COURSE DESCRIPTION AND GRADUATE LEARNING OUTCOMES

Course Description	This course is an advanced elective for undergraduate students in the Study Program of Geographic Information Science. It covers LiDAR (Light Detection and Ranging) technology, its fundamental principles, applications, and the use of LiDAR data in various fields such as mapping, geospatial analysis, and 3D modeling. The course is divided into two parts: theory and practicum, focusing on technology introduction, data collection processes, and the application and analysis of LiDAR data. Students are expected to apply the conceptual and procedural aspects of LiDAR technology as a large-scale mapping method for producing base and thematic digital maps.		
Graduate Learning Outcomes	1	Capable of applying LiDAR (Light Detection and Ranging) technology to support geospatial mapping.	
	2	Capable of identifying, selecting, and utilizing various geospatial data and information sources to support planning, implementation, monitoring, and evaluation of geospatial activities.	
	3	Capable of analyzing and interpreting spatial data using geographic science and technology.	
	4	Capable of presenting processed and analyzed data results as information that is readily comprehensible.	
Course Learning Outcomes (CPMK)	1	Capable of explaining the basic principles of LiDAR (Light Detection and Ranging) technology.	
	2	Capable of explaining the theory and working principles of LiDAR technology as a support for geospatial mapping.	
	3	Capable of explaining and understanding LiDAR system and platform sensors.	
	4	Capable of explaining the concepts of Navigation Systems, Data Correction, and LiDAR Data Processing.	
	5	Capable of understanding procedures and performing LiDAR data processing.	
	6	Capable of applying LiDAR applications in mapping and monitoring to provide basic and thematic geospatial information in the field of geospatial mapping.	
Sub-CPMK	1	CPMK - 1	LiDAR Course Syllabus and Introduction to LiDAR Technology, LiDAR Working Principles, LiDAR Systems and Platforms.
	2	CPMK - 2	Understanding Navigation Systems, Data Correction, and LiDAR Data Processing.
	3	CPMK - 3	Understanding LiDAR Applications in 3D Modeling.
	4	CPMK - 4	Understanding the Advantages, Disadvantages, and Challenges of LiDAR.
	5	CPMK - 5	Capable of recognizing LiDAR devices and preparation for measurement.
	6	CPMK - 6	Conducting LiDAR Data Collection (Aerial Platform) and LiDAR Data Collection (Ground Platform), LiDAR Data Processing, Data Analysis through 3D Modeling.
	7	CPMK - 6	Applying LiDAR Applications in Mapping and Monitoring.

Course Materials	1	LiDAR Course Syllabus and Introduction to LiDAR Technology
	2	LiDAR Working Principles
	3	LiDAR Systems and Platforms
	4	Navigation Systems and Data Correction
	5	LiDAR Data Processing
	6	LiDAR Applications in 3D Modeling
	7	Advantages, Disadvantages, and Challenges of LiDAR
	8	Mid-Term Examination (UTS)
	9	Introduction to LiDAR Devices and Measurement Preparation
	10	LiDAR Data Collection (Aerial and Ground Platforms)
	11	LiDAR Data Processing (Week 1)
	12	LiDAR Data Processing (Week 2)
	13	Data Analysis and 3D Modeling
	14	LiDAR Applications in Mapping and Monitoring
	15	Practicum Results Presentation and Discussion
	16	Final Examination (UAS)
Learning Outcomes Demonstrable at the End of the Course *)	The learning output of the LiDAR course is that students are capable of understanding the basic concepts, working principles, and applications of LiDAR technology across various fields. They can operate LiDAR devices, perform point cloud data acquisition and preprocessing, and analyze and interpret the results using specialized software. Students are also able to produce outputs such as digital elevation models (DEM/DTM), vegetation mapping, building structure analysis, and 3D surface modeling. Furthermore, they possess the skills to integrate LiDAR data with geographic information systems (GIS) to support decision-making in geospatial, environmental, and regional planning fields.	
Learning Strategy		Case Method
	✓	Team based Project
		Others

Learning Steps	Learning in the LiDAR course begins with an introduction to the basic concepts of LiDAR, including its working principles, components, and types of sensors used. Students are then provided with an understanding of the data acquisition process, whether through drones, aircraft, or satellites. This is followed by an exploration of preprocessing techniques, such as geometric correction and point cloud filtering, before moving on to data analysis for various applications, such as topographic mapping, land change detection, and 3D modeling. Students are also trained in the use of LiDAR data processing software, such as LAStools, CloudCompare, or ArcGIS. Finally, case studies and a final project are conducted, enabling students to apply their skills in analyzing and interpreting LiDAR data for real-world problems.	
References	1	1. Edward, MH, Introduction to Modern Photogrammetry, John Wiley & Sons, 2001
	2	2. Fadh Abany, Advanced Photogrammetry, Modul Kuliah, 2007 3
	3	3. Teguh Hariyanto, LIDAR Overview, Modul Kuliah, 2013, Geomatika ITS.
	4	4. G. Konecny, Photogrammetri, 2nd edition, Sprin verlag, 2005.
	5	5. Koerth Sijmons, Introduction on Photogrammetry, ITC Enschede, Holland

LEARNING PLAN

Week	Sub-CPMK	Sub-CPMK Achievement Indicators Demonstrable by Students	Course Materials	Assessment		Learning Methode		Durati on (hrs)	Ref.	Acces s Time
				Assessm ent Form (test/non-test)	Weight (%)	Synchron ous	Asynchrono us			
1	LiDAR Course Syllabus and Introduction to LiDAR Technology, LiDAR Working Principles, LiDAR Systems and Platforms.	Students are able to understand the course syllabus/RPS of LiDAR and explain LiDAR Technology (definition and history of LiDAR, fundamental principles of LiDAR technology, main components of the LiDAR system (sensor, platform, GPS, IMU)).	LiDAR Course Syllabus and Introduction to LiDAR Technology	Observation	5	Face-to-face	Individ ual assign ment	3	1,2,3	04-02-2025 13:00
2	Understanding Navigation Systems, Data Correction, and LiDAR Data Processing.	Students are able to explain the basic principles of LiDAR (distance measurement using the time-of-flight principle, distance measurement using the frequency shift principle, and understanding of lasers and their interaction with objects).	LiDAR Working Principles	Participatory	5	Face-to-face	Individ ual assign ment	3	2,3	11-02-2025 13:00
3	Understanding LiDAR Applications in 3D Modeling.	Students are able to explain LiDAR Systems and Platforms.	LiDAR Systems and Platforms	Participatory	5	Face-to-face	Individ ual assign ment	3	3,4	18-02-2025 13:00
4	Understanding LiDAR Applications in 3D Modeling.	Students are able to explain Navigation Systems and Data Correction (use of GPS and IMU (Inertial Measurement Unit), correction of LiDAR position and orientation, and the influence of external factors on data accuracy).	Navigation Systems and Data Correction	Participatory	5	Face-to-face	Individ ual assign ment	3	4,5	25-02-2025 13:00

Week	Sub-CPMK	Sub-CPMK Achievement Indicators Demonstrable by Students	Course Materials	Assessment		Learning Methode		Duration (hrs)	Ref.	Access Time
				Assessment Form (test/non-test)	Weight (%)	Synchronous	Asynchronous			
5	Capable of recognizing LiDAR devices and preparation for measurement.	Students are able to explain LiDAR Data Processing (related to LiDAR data format (point cloud), initial data processing: filtering and registration, coordinate transformation and coordinate reference systems, segmentation and classification of point cloud data, identification of objects and features from LiDAR data (ground, vegetation, buildings), through to topographic analysis and mapping).	LiDAR Data Processing	Observation	5	Face-to-face	Individual assignment	3	1,4	04-03-2025 13:00
6	Capable of recognizing LiDAR devices and preparation for measurement.	Students are able to explain LiDAR Applications in 3D Modeling (creation of 3D models from LiDAR data, use of LiDAR in urban mapping and landscape analysis, and LiDAR applications in remote sensing and geospatial mapping).	LiDAR Applications in 3D Modeling	Observation	5	Face-to-face	Project	3	3,5	11-03-2025 13:00
7	Capable of recognizing LiDAR devices and preparation for measurement.	Students are able to understand the Advantages, Disadvantages, and Challenges of LiDAR (advantages of LiDAR compared to other mapping technologies such as photogrammetry, challenges in LiDAR data collection and processing, and latest trends and innovations in LiDAR technology).	Advantages, Disadvantages, and Challenges of LiDAR	Participatory	5	Face-to-face	Individual assignment	3	2,3	18-03-2025 13:00
8	MID-TERM EXAMINATION (UTS)				15					25-03-2025 13:00

Week	Sub-CPMK	Sub-CPMK Achievement Indicators Demonstrable by Students	Course Materials	Assessment		Learning Methode		Duration (hrs)	Ref.	Access Time
				Assessment Form (test/non-test)	Weight (%)	Synchronous	Asynchronous			
9	Conducting LiDAR Data Collection (Aerial Platform) and LiDAR Data Collection (Ground Platform), LiDAR Data Processing, Data Analysis through 3D Modeling.	Students are able to explain the components of LiDAR devices and measurement preparation (explanation of the LiDAR devices used in practicum (e.g., drone-based LiDAR or ground-based devices), instrument setup, calibration, and determination of measurement area, and preparing data processing software).	Introduction to LiDAR Devices and Measurement Preparation	Multiple Choice	5	Practicum	Project	3	3,4	01-04-2025 13:00
10	Conducting LiDAR Data Collection (Aerial Platform) and LiDAR Data Collection (Ground Platform), LiDAR Data Processing, Data Analysis through 3D Modeling.	Students are able to collect LiDAR Data (drone flight and LiDAR data collection in the field, programming drone flight routes for mapping specific areas, monitoring and data quality control).	LiDAR Data Collection (Aerial and Ground Platforms)	Observation	5	Practicum	Project	3	2,5	08-04-2025 13:00
11	Applying LiDAR Applications in Mapping and Monitoring.	Students are able to perform LiDAR Data Processing (Week 1), for example: importing point cloud data into LiDAR data processing software (e.g., CloudCompare, LAStools); filtering and preprocessing data: removing noise and irrelevant data; registering data from multiple sources (e.g., merging data from multiple drone flights).	LiDAR Data Processing (Week 1)	Observation	5	Practicum	Project	3	3,5	15-04-2025 13:00

Week	Sub-CPMK	Sub-CPMK Achievement Indicators Demonstrable by Students	Course Materials	Assessment		Learning Methode		Duration (hrs)	Ref.	Access Time
				Assessment Form (test/non-test)	Weight (%)	Synchronous	Asynchronous			
12	Applying LiDAR Applications in Mapping and Monitoring.	Students are able to perform LiDAR Data Processing (Week 2): segmentation and classification of point cloud data (including object recognition); use of software for 3D visualization of LiDAR data; production of digital terrain models (DTM) and digital elevation models (DEM).	LiDAR Data Processing (Week 2)	Participatory	5	Practicum	Project	3	3,4	22-04-2025 13:00
13	Applying LiDAR Applications in Mapping and Monitoring.	Students are able to conduct Data Analysis and 3D Modeling (use of LiDAR data for feature and object analysis (e.g., vegetation analysis, buildings, etc.); creation of topographic maps and 3D object visualization; application of analytical techniques to extract further information from LiDAR data).	Data Analysis and 3D Modeling	Observation	5	Practicum	Project	3	2,4	29-04-2025 13:00
14	Applying LiDAR Applications in Mapping and Monitoring.	Students are able to apply LiDAR in Mapping and Monitoring (case studies of LiDAR applications for geospatial mapping and environmental monitoring; use of LiDAR data for monitoring topographic and vegetation changes; application of LiDAR in infrastructure mapping and smart cities).	LiDAR Applications in Mapping and Monitoring	Observation	5	Practicum	Project	3	3,4	06-05-2025 13:00
15	Applying LiDAR Applications in Mapping and Monitoring.	Students are able to present Practicum Results and Discussion.	Practicum Results Presentation and Discussion	Observation	5	Practicum	Project	3	2,4	13-05-2025 13:00
16	FINAL EXAMINATION (UAS)				15					20-05-2025 13:00

STUDENT LEARNING TIME (WORKLOAD)

	Learning Activity	Synchronous (Face-to-face / Online)	Asynchronous (Structured / Independent)	Student Learning Preparation	Total Student Learning and Teaching Time
Learning	Lectures/Tutorials	25 x 50 min = 1,250 min	19 x 15 min = 285 min	-x-	1,535 min (25.6 hrs)
	Project-based Learning	25 x 50 min = 1,250 min	20 x 15 min = 300 min	-x-	1,550 min (25.8 hrs)
	Discussion (Case-based Learning)	20 x 10 min = 200 min	14 x 15 min = 210 min	-x-	410 min (6.8 hrs)
	SUBTOTAL				3,495 min (58.3 hrs)
Assessment		Continuous Assessment			
	Participation During Learning	7 x 35 min = 245 min	7 x 30 min = 210 min	15 x 30 min = 450 min	905 min (15.1 hrs)
	Project Work	7 x 50 min = 350 min	7 x 50 min = 350 min	-x-	700 min (11.7 hrs)
	Assignments	5 x 10 min = 50 min	5 x 10 min = 50 min	-x-	100 min (1.7 hrs)
	Quiz	-x-	-x-	-x-	0 min (0.0 hrs)
	Formative				100 min (1.7 hrs)
	Summative				100 min (1.7 hrs)
	SUBTOTAL				1,905 min (31.8 hrs)
Total Workload					5,400 Minutes (90 Hours)
Ideal Total Hours					90 Hours
Credits					2
Consistency with Number of Credits					CONSISTENT

COURSE LEARNING OUTCOME (CPMK) ASSESSMENT CRITERIA

No	CPMK	CPL				Taxonomy	Weight	CPMK Achievement Criteria
		CPL-1	CPL-2	CPL-3	CPL-4			
1	Capable of explaining the basic principles of LiDAR (Light Detection and Ranging) technology.					5	5	40% of all students achieve a minimum score of 60 (on a 100-point scale)
2	Capable of explaining the theory and working principles of LiDAR technology as a support for geospatial mapping.					5	5	40% of all students achieve a minimum score of 60 (on a 100-point scale)
3	Capable of explaining and understanding LiDAR system and platform sensors.					10	10	40% of all students achieve a minimum score of 60 (on a 100-point scale)
4	Capable of explaining the concepts of Navigation Systems, Data Correction, and LiDAR Data Processing.					5	0	40% of all students achieve a minimum score of 60 (on a 100-point scale)
5	Capable of understanding procedures and performing LiDAR data processing.					15	15	40% of all students achieve a minimum score of 60 (on a 100-point scale)
6	Capable of applying LiDAR applications in mapping and monitoring to provide basic and thematic geospatial information.					35	35	40% of all students achieve a minimum score of 60 (on a 100-point scale)

COLLABORATIVE TASK DESIGN

Task Title	
Learning Method	Team based Project
Time	
Assessment Weight	40
SUB-CPMK	LiDAR Course Syllabus and Introduction to LiDAR Technology, LiDAR Working Principles, LiDAR Systems and Platforms.

Task Description
Students will work in groups of 3 to 5 people to process and analyze LiDAR data in the context of geospatial mapping. Each group will choose one of the following topics: Topographic Mapping and Digital Elevation Modeling (DEM/DTM); Detection and Analysis of Land Use Change Using LiDAR; Utilization of LiDAR for Vegetation and Land Cover Identification; 3D Modeling of Urban or Natural Areas Using LiDAR; Integration of LiDAR Data with GIS for Spatial Analysis.
Task Steps
Steps for Completing the Task: 1. Division of Responsibilities: Each group member is responsible for a specific aspect (e.g., data acquisition, preprocessing, analysis, interpretation, and report writing). 2. Data Acquisition and Preprocessing: Using LiDAR datasets provided or downloaded from open sources. Performing data cleaning and filtering to remove noise. 3. Data Analysis: Using software such as LAStools, CloudCompare, QGIS, or ArcGIS to analyze LiDAR data in accordance with the chosen topic. Presenting results in the form of maps, 3D models, or other visualizations. 4. Discussion and Interpretation of Results: Compiling a report containing the methodology, analysis results, and a discussion of the benefits and limitations of LiDAR technology in the chosen context. 5. Results Presentation: Groups present their analysis results in a seminar or scientific poster format. A question-and-answer session will be held to discuss findings and challenges encountered during the task.
Expected Outputs

Written report (5-10 pages) covering methodology, analysis results, and data interpretation.
Map or visualization model based on LiDAR data analysis.
Group presentation in the form of slides or a poster.

Indicators, Criteria, and Assessment Weights

Assessment Criteria:

- 1. Accuracy and precision of LiDAR data analysis (30%)
- 2. Quality of visualization and mapping of analysis results (25%)
- 3. Teamwork and contribution within the group (15%)
- 4. Clarity and systematization of the written report (15%)
- 5. Quality of presentation and discussion (15%)

Implementation Schedule

Note: The number of days in one semester is $16 \times 7 = 112$ days. The schedule may be set based on a day-count basis.

Activity	Implementation Time
Others	

References

- 1. 1. Edward, MH, Introduction to Modern Photogrammetry, John Wiley & Sons, 2001
- 2. 2. Fadh Abany, Advanced Photogrammetry, Modul Kuliah, 2007 3
- 3. 3. Teguh Hariyanto, LIDAR Overview, Modul Kuliah, 2013, Geomatika ITS.
- 4. 4. G. Konecny, Photogrammetri, 2nd edition, Sprin verlag, 2005.
- 5. 5. Koerth Sijmons, Introduction on Photogrammetry, ITC Enschede, Holland