



UNIVERSITAS PENDIDIKAN INDONESIA

SEMESTER LEARNING PLAN (RPS)

COURSE INFORMATION

Course Name	Course Code	Credits	Workload	Course Group	Semester	Prerequisite Course	Date of Issue
SPATIAL DATABASE MANAGEMENT AND BIG DATA	SA216	2	90	Core Course of the Study Program	2	Geographic Information Systems, Spatial Programming, Remote Sensing	2025-09-09 11:26:56

Prepared by	Reviewed by	Approved by
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COURSE DESCRIPTION AND LEARNING OUTCOMES

Course Description	The Spatial Database Management and Big Data course discusses concepts, technologies, and methods for managing spatial data at a large scale. Students will learn the fundamental principles of spatial database management systems, spatial data models, as well as techniques for storing, processing, and analyzing location-based data. In addition, this course also teaches how to handle big data in a geospatial context, including system architecture, the utilization of cloud computing, as well as optimization and data analysis techniques using machine learning and distributed computing technologies. Students are expected to be able to understand, design, and implement efficient spatial database solutions for various applications, such as spatial planning, disaster mitigation, and environmental management.		
Program Learning Outcome Assigned in the Course	1	• Possess the competence and ability to make appropriate and professional decisions based on the results of data and information analysis, and to select various alternative solutions independently and in groups in solving problems in the work environment in accordance with the context to achieve the best results.	
	2	• Possess the ability to process survey data in the field of resources (natural, social, and cultural) and present it in the form of maps.	
	3	• Possess the ability to acquire and analyze resource data (natural, social, and cultural) using remote sensing technology.	
	4	• Possess the ability to analyze resource data (natural, social, and cultural) using Geographic Information System technology for decision-making..	
Course Learning Outcome (CPMK)	1	• Able to understand the concepts, principles, and objectives of databases.	
	2	• Able to understand and manage database systems.	
	3	• Able to develop databases to be integrated with geographic information systems.	
Sub-CPMK	1	CPMK - 1	• Able to understand the concepts, principles, and objectives of databases.
	2	CPMK - 2	• Able to understand and manage database systems.
	3	CPMK - 3	• Able to develop databases to be integrated with geographic information systems.
Course Materials	1	a. Course syllabus b. Course rules c. Introduction to geospatial databases	
	2	a. Definition of geospatial databases b. Basic concepts of geospatial databases c. Elements of geospatial databases	
	3	a. Definition of DBMS b. Functions of DBMS c. Components of DBMS d. Languages in DBMS e. Objectives of DBMS f. Types of DBMS	
	4	a. Object-based data model b. Record-based data model c. Physical data model	
	5	a. Definition of geodatabase b. Types of geodatabase c. Advantages and disadvantages of geodatabase	
	6	a. Geodatabase data inventory b. Geodatabase structure design	
	7	a. Multiuser geodatabase b. Enterprise/server geodatabase c. Multiuser management	

	8	Midterm Examination
	9	a. Installation of PostgreSQL and QGIS b. Concepts of QGIS software and PostgreSQL language c. Advantages and disadvantages
	10	a. Database connection b. Functions of tools in PostgreSQL c. Creating database tables
	11	a. Table relationships in databases: one-to-one, many-to-one, one-to-many, many-to-many b. Simulation of table data connections
	12	a. Basic queries in PostgreSQL b. Functions of queries in PostgreSQL c. Creating databases using queries
	13	a. Introduction to PostGIS plugin b. Connection between PostgreSQL and QGIS c. Management of database connections in PostgreSQL and QGIS
	14	a. Introduction to dashboard plugin in QGIS b. Designing dashboards in QGIS based on PostgreSQL connections c. Geodatabase visualization
	15	a. Geodatabase management in ArcGIS b. Connection between PostgreSQL geodatabase and ArcGIS c. Geodatabase visualization
	16	Final Examination
Learning outcomes demonstrated at the end of the course *)	After completing the Spatial Database Management and Big Data course, students are expected to have an in-depth understanding of the concepts and technologies for managing spatial data at a large scale. Students are able to design, implement, and manage spatial database systems using various software and current technologies, such as PostgreSQL/PostGIS, Hadoop, and Spark. In addition, they are able to process, analyze, and visualize spatial data to support decision-making in various fields, such as regional planning, disaster mitigation, and environmental management. Students will also have the skills to optimize spatial database management systems and apply big data concepts to handle data with high volume, variety, and velocity. The outputs of this course include data-driven spatial analysis capabilities, case study-based projects, as well as a portfolio of spatial database system implementations that can be applied in industry and research.	
Learning Strategy	✓	Case Method
		Team based Project
		Lainnya
Learning Stages	Through a systematic combination of theory and practice, students will begin by understanding the fundamental concepts of spatial databases, data models, and database management system architecture. Subsequently, the course focuses on techniques for storing, processing, and analyzing spatial data at a large scale using big data and cloud computing technologies. Practical sessions will involve the use of GIS software, spatial database systems (such as PostgreSQL/PostGIS), as well as big data processing platforms (such as Hadoop and Spark). Students will also work on case studies and real data-based projects to develop analytical and problem-solving skills. Course evaluation is conducted through assignments, quizzes, final projects, as well as theoretical and practical examinations to ensure comprehensive understanding of the material.	
References	1	Eddy Prahasta (2001). Basic Concepts of Geographic Information Systems. Bandung: Informatika.
	2	Environmental System Research Institute (ESRI), 1995. Understanding GIS, The ArcInfo Method. USA.
	3	Agus Suryanyoto (2013). Integration of Geographic Information System Applications. Yogyakarta: Ombak Publisher.
	4	Eddy Prahasta (2001). Basic Concepts of Geographic Information Systems. Bandung: Informatika.
	5	Environmental System Research Institute (ESRI), 1995. Understanding GIS, The ArcInfo Method. USA.
	6	Agus Suryanyoto (2013). Integration of Geographic Information System Applications. Yogyakarta: Ombak Publisher.

7	Adi Nugroho, ST., MMSI, 2004. Database System Design Concepts. Andi Offset, Yogyakarta.
8	Fathansyah, Ir., 2002. Database. Informatika, Bandung.
9	Jogiyanto H.M., 2002. Analysis and Design of Information Systems. Andi Offset, Yogyakarta.
10	Bambang Hariyanto, Ir., MT., 2004. Database Management Systems. Informatika, Bandung.
11	Kristanto, H. 2004. Database Concepts and Design. Andi Publisher: Yogyakarta.
12	Sutanta, E. 2003. Database Systems. Graha Ilmu: Yogyakarta.

LEARNING PLAN

Week -	Sub-CPMK	Learning Indicator	Course Material	Assessment		Learning Method		Duration (hours)	Reference	Access Time
				Assessment Methode (test/non-test)	Assessment Weighting (%)	Synchronous	Asynchronous			
1	• Able to understand the concepts, principles, and objectives of databases.	Introduction to Geospatial Database Course	a. Course syllabus b. Course rules c. Introduction to geospatial databases	Observation	5	Face-to-face	Independent assignment	3	1,2,3,7	05-02-2025 08:40
2	• Able to understand the concepts, principles, and objectives of databases.	Definition, Basic Concepts of Geospatial Database Systems, Elements of Geospatial Database Systems	a. Definition of geospatial databases b. Basic concepts of geospatial databases c. Elements of geospatial databases	Observation	5	Face-to-face	Independent assignment	3	3,4,5	12-02-2025 08:40
3	• Able to understand the concepts, principles, and objectives of databases.	Database Management System (DBMS)	a. Definition of DBMS b. Functions of DBMS c. Components of DBMS d. Languages in DBMS e. Objectives of DBMS f. Types of DBMS	Observation	5	Face-to-face	Independent assignment	3	5,6,7	19-02-2025 08:40
4	• Able to understand the concepts, principles, and objectives of databases.	Data Model	a. Object-based data model b. Record-based data model c. Physical data model	Participatory	5	Face-to-face	Independent assignment	3	7,8,9	26-02-2025 08:40
5	• Able to understand and manage database systems	Geodatabase and Big Data	a. Definition of geodatabase b. Types of geodatabase c. Advantages and disadvantages of geodatabase	Observation	5	Face-to-face	Independent assignment	3	8,9,10	05-03-2025 08:40
6	• Able to understand and manage database systems	Multiuser Geodatabase Management	a. Geodatabase data inventory b. Geodatabase structure design	Participatory	5	Face-to-face	Independent assignment	3	10,11,12	12-03-2025 08:40

Week -	Sub-CPMK	Learning Indicator	Course Material	Assessment		Learning Method		Duration (hours)	Reference	Access Time
				Assessment Methode (test/non-test)	Assessment Weighting (%)	Synchronous	Asynchronous			
7	• Able to understand and manage database systems	Map Album	a. Multiuser geodatabase b. Enterprise/server geodatabase c. Multiuser management	Observation	5	Face-to-face	Independent assignment	3	2,5,9,11	19-03-2025 08:40
8	Midterm Examination (UTS)				15					26-03-2025 08:40
9	• Able to develop databases to be integrated with geographic information systems.	Introduction and installation of PostgreSQL and QGIS	a. Installation of PostgreSQL and QGIS b. Concepts of QGIS software and PostgreSQL language c. Advantages and disadvantages	Participatory	5	Practicum	Project	3	4,6,10	02-04-2025 08:40
10	• Able to develop databases to be integrated with geographic information systems.	Creating tables and explanation of functions in PostgreSQL	a. Database connection b. Functions of tools in PostgreSQL c. Creating database tables	Observation	5	Practicum	Project	3	7,8,9,10	09-04-2025 08:40
11	• Able to develop databases to be integrated with geographic information systems.	Database relationships in PostgreSQL	a. Table relationships in databases: one-to-one, many-to-one, one-to-many, many-to-many b. Simulation of table data connections	Observation	5	Practicum	Project	3	8,9,10	16-04-2025 08:40
12	• Able to develop databases to be integrated with geographic information systems.	Query/scripting/coding in PostgreSQL	a. Basic queries in PostgreSQL b. Functions of queries in PostgreSQL c. Creating databases using queries	Observation	5	Practicum	Project	3	9,10,12	23-04-2025 08:40

Week -	Sub-CPMK	Learning Indicator	Course Material	Assessment		Learning Method		Duration (hours)	Reference	Access Time
				Assessment Methode (test/non-test)	Assessment Weighting (%)	Synchronous	Asynchronous			
13	• Able to develop databases to be integrated with geographic information systems.	Connection between PostgreSQL and QGIS	a. Introduction to PostGIS plugin b. Connection between PostgreSQL and QGIS c. Management of database connections in PostgreSQL and QGIS	Observation	5	Practicum	Project	3	3,5,12	05-05-2025 08:40
14	• Able to develop databases to be integrated with geographic information systems.	Creating dashboard visualization in QGIS and PostgreSQL	a. Introduction to dashboard plugin in QGIS b. Designing dashboards in QGIS based on PostgreSQL connection c. Creating geodatabase visualization	Participatory	5	Practicum	Project	3	3,4,7	07-05-2025 08:40
15	• Able to develop databases to be integrated with geographic information systems.	PostgreSQL connection in ArcGIS and geodatabase visualization	a. Geodatabase management in ArcGIS b. Connection between PostgreSQL geodatabase and ArcGIS c. Geodatabase visualization	Participatory	5	Practicum	Project	3	4,6,12	14-05-2025 08:40
16	Final Examination (UAS)				15					21-05-2025 08:40

STUDENT LEARNING TIME (WORKLOAD)

	ACTIVITIES	SYNCHRONOUS (Face-to-Face / Virtual Meeting)	ASYNCHRONOUS (Structured / Independent)	STUDENT LEARNING PREPARATION	TOTAL STUDENT LEARNING AND INSTRUCTION TIME
LEARNING	Lectures/Responses/Tutorials	25 x 50 minutes = 1250 minutes	19 x 15 minutes = 285 minutes	-x-	1535 minutes (25.6 hours)
	Project-based learning	25 x 50 minutes = 1250 minutes	20 x 15 minutes = 300 minutes	-x-	1550 minutes (25.8 hours)
	Discussion (case-based learning)	20 x 10 minutes = 200 minutes	14 x 15 minutes = 210 minutes	-x-	410 minutes (6.8 hours)
	TOTAL				3495 minutes (58.3 hours)
ASSESSMENT	Continuous Assessment				
	Participation During Learning	7 x 35 minutes = 245 minutes	7 x 30 minutes = 210 minutes	15 x 30 minutes = 450 minutes	905 minutes (15.1 hours)
	Project Completion	7 x 50 minutes = 350 minutes	7 x 50 minutes = 350 minutes	-x-	700 minutes (11.7 hours)
	Assignments	5 x 10 minutes = 50 minutes	5 x 10 minutes = 50 minutes	-x-	100 minutes (1.7 hours)
	Quizzes	-x-	-x-	-x-	0 minutes (0.0 hours)
	Formative				100 minutes (1.7 hours)
	Summative				100 minutes (1.7 hours)
	TOTAL				1905 minutes (31.8 hours)
TOTAL WORKLOAD					5400 minutes (90 hours)
TOTAL IDEAL HOURS					90 hours
CREDITS					2
CONFORMITY WITH THE NUMBER OF CREDITS					APPROPRIATE

CPMK ASSESSMENT CRITERIA

No	CPMK	CPL				TAXONOMY	Weight	CPMK ACHIEVEMENT CRITERIA
		CPL-1	CPL-2	CPL-3	CPL-4			
1	• Able to understand the concepts, principles, and objectives of databases.					30	20	40% of the total students obtain a minimum score of 60 (on a scale of 100)
2	• Able to understand and manage database systems.					25	15	40% of the total students obtain a minimum score of 60 (on a scale of 100)
3	• Able to develop databases to be integrated with geographic information systems.					45	35	40% of the total students obtain a minimum score of 60 (on a scale of 100)

COLLABORATIVE ASSIGNMENT DESIGN

ASSIGNMENT TITLE	Implementation and Analysis of Database Systems for Big Data Management
LEARNING METHOD	Case Method
TIME	
ASSESSMENT WEIGHT	40
SUB-CPMK	• Able to develop databases to be integrated with geographic information systems.

ASSIGNMENT DESCRIPTION
Each group will develop a database system to manage large-scale data (big data) from a specific case study. This task includes the design, implementation, optimization, and performance analysis of the database system in handling large volumes of data.
TASK COMPLETION STEPS

Work Stages

1. Selection of Case Study

- Choose an application domain that requires big data management, such as:
 - E-commerce systems (customer transaction analysis)
 - IoT (sensor data management)
 - Social media (sentiment analysis)
 - Healthcare data (electronic medical records)
- Collect a large dataset (it can be obtained from open sources such as Kaggle, Google Dataset Search, or generated independently using simulated data).

2. Database Design

- Determine the database model to be used (Relational/SQL such as PostgreSQL, MySQL or NoSQL such as MongoDB, Cassandra, Hadoop).
- Create an ERD (Entity Relationship Diagram) and database schema.
- If using Big Data, define the data pipeline architecture (for example, using Apache Spark, Hadoop, or Google BigQuery).

3. Implementation and Data Processing

- Create the database and perform the ETL (Extract, Transform, Load) process to input the data.
- Apply performance optimization techniques (indexing, partitioning, sharding, caching).
- Conduct data analysis using programming languages such as Python (pandas, PySpark) or advanced SQL queries.

4. Evaluation and Data Visualization

- Compare the performance of various database approaches in handling big data.
- Create dashboards or data visualizations using Power BI, Tableau, or Python (Matplotlib, Seaborn).

5. Documentation and Presentation

- Prepare a final report that includes the design, implementation, analysis results, as well as the challenges and solutions encountered.
- Prepare a presentation of the project results in the form of a video or slides.

DETAILS OF EXPECTED OUTPUTS

Expected Outputs

- ? Implemented database (SQL dump or NoSQL file).
- ? Program code for data processing and analysis.
- ? Dashboard or data visualization in graphical/interactive form.
- ? Final report (PDF) covering design through evaluation results.
- ? Presentation (slides or project explanation video).

INDICATORS, CRITERIA, AND ASSESSMENT WEIGHT

Assessment Criteria

- ? Database Design and Implementation (30%)
- ? Optimization and Efficiency of Data Management (30%)
- ? Data Analysis and Visualization (20%)
- ? Documentation and Presentation (20%)

IMPLEMENTATION SCHEDULE

Note: The total number of days in one semester is $16 \times 7 = 112$ days. The schedule implementation can be determined based on the number of days.

Activities	Implementation Time
Studio Practicum	60

OTHERS

Assignments are adjusted based on innovation

REFERENCES

1. Zeichner, K.M., & Liston, D.P . (2014). Reflective Teaching: An Introduction. New York: Routledge.
2. 1. Eddy Prahasta (2001). Konsep-konsep Dasar Sistem Informasi Geografis. Bandung: Informatika.
3. 2. Environmental System Research Institut (ESRI), 1995. Understanding GIS, The Arc Info Method. USA.
4. 3. Agus Suryanyoto (2013) Integrasi Aplikasi Sistem Informasi Geografis. Yogyakarta : Penerbit Ombak.
5. 4. Eddy Prahasta (2001). Konsep-konsep Dasar Sistem Informasi Geografis. Bandung: Informatika.
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8. 7. Adi Nugroho, ST., MMSI, 2004, Konsep Perancangan Sistem Basis Data, Andi Offset, Yogyakarta
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