



UNIVERSITAS PENDIDIKAN INDONESIA

SEMESTER LEARNING PLAN (RPS)

COURSE IDENTITY

Course Name	Course Code	Sks	Workload	Course Group	Semester	Prerequisite Course	Publication Date
REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS FOR HYDROLOGY AND WATERSHEDS	SA534	2	90		6		2025-09-09 11:26:56

Prepared by	Reviewed by	Approved by
Prof. Dr. Ir. Dede Rohmat, MT.	Shafira Himayah, S.Pd., M.Sc.	Dr. Lili Somantri, S.Pd., S.S., M.Si.

COURSE DESCRIPTION AND GRADUATE LEARNING OUTCOMES

Course Description	Remote Sensing and GIS for Hydrology and Watersheds is an advanced course intended for students who already have a foundation in remote sensing and geographic information systems (GIS). This course equips students with the concepts, techniques, and applications of remote sensing and GIS in hydrological analysis and watershed management. In this course, students will study how to utilize remote sensing data to analyze various aspects of hydrology, including rainfall, land cover, and surface runoff dynamics. In addition, students will be provided with skills in GIS-based hydrological modeling for identifying watershed problems and watershed health indices. Upon completing this course, students are expected to possess competence in processing, analyzing, and interpreting spatial data to produce hydrological and watershed thematic maps.		
Graduate Learning Outcomes	1	S6. Capable of working collaboratively and possessing social sensitivity and concern for society and the environment.	
	2	P4. Proficient in the theoretical concepts of remote sensing, encompassing both active and passive remote sensing systems, visual and digital image interpretation concepts, and remote sensing applications for geospheric information.	
	3	P5. Proficient in the theoretical concepts of geographic information systems, spatial database concepts, and spatial modeling concepts.	
	4	KU5. Capable of making sound decisions in the context of problem-solving within the domain of expertise based on the results of information and data analysis.	
	5	KK3 and KK4. Capable of planning, interpreting, analyzing, classifying, extracting, validating, and visualizing data and information derived from remote sensing and GIS based on science and technology.	
Course Learning Outcomes (CLO/CPMK)	1	Students are able to understand the fundamental concepts of the watershed (DAS) and its relationship to hydrology and ecology, including the identification of river territories (WS) and micro-watersheds using spatial data.	
	2	Students are able to analyze hydrological processes within a watershed based on remote sensing data and GIS, such as the hydrological cycle, water movement, and the hydrological interaction with watershed morphology.	
	3	Students are able to apply remote sensing and GIS techniques in watershed hydrological studies, including the analysis of water discharge, water balance, and other hydrological parameters based on spatial data.	
	4	Students are able to identify watershed problems using remote sensing data and GIS, such as land degradation, erosion, sedimentation, and land use changes affecting hydrological balance.	
	5	Students are able to evaluate watershed health based on the watershed criticality index by utilizing remote sensing and GIS technology, including the analysis of water quality and sediment discharge within the watershed.	
	6	Students are able to apply remote sensing and GIS technology in real-world case studies through group-based projects to analyze watershed health indices in accordance with the selected study location.	
Sub-CPMK	1	CPMK - 1	Students understand the syllabus, the course format, and the fundamental concepts of watershed (DAS), river territory (WS), and micro-watershed in a hydrological and ecological context.

	2	CPMK - 1	Students are able to identify river territories (WS) and watersheds (DAS) using GIS methods and remote sensing data for hydrological case studies.
	3	CPMK - 2	Students understand the concept of hydrological interaction within the watershed, including the hydrological cycle, watershed morphology, and the factors controlling water flow.
	4	CPMK - 3	Students are able to apply remote sensing and GIS techniques in watershed hydrological analysis, such as rainfall estimation, infiltration, and percolation.
	5	CPMK - 3	Students are able to perform calculations and mapping of river discharge and water balance based on remote sensing and GIS.
	6	CPMK - 4	Students are able to identify watershed problems, including the analysis of flood-prone areas, drought, and sedimentation using spatial data.
	7	CPMK - 5	Students are able to assess watershed health based on the watershed criticality index using a geospatial approach, including the analysis of water quality parameters and sediment discharge.
	8	CPMK - 6	Students are able to implement remote sensing and GIS technology in real-world case studies, as well as compile reports related to the watershed health index in accordance with the selected study location.
Course Materials	1	Introduction, scope, and fundamental concepts of watershed (DAS), river territory (WS), and micro-watershed in a hydrological and ecological context.	
	2	Identification of river territories (WS) and watersheds (DAS) for hydrological case studies.	
	3	Concepts of the Hydrological Interaction Process with Watershed Morphology and Morphometry.	
	4	The Role and Function of Remote Sensing and GIS in Hydrological and Watershed Studies, sources of hydrological and meteorological data.	
	5	Integration of Remote Sensing/Empirical (ground) data and GIS-based visualization.	
	6	Estimation of watershed potential through discharge, infiltration, and percolation calculations based on remote sensing and GIS data.	
	7	Potential of Water Storage and Renewable Energy within Watersheds Based on RS and GIS.	
	8	Midterm Examination (UTS)	
	9	Study of drought within watersheds and critical land analysis based on remote sensing and GIS data.	
	10	Analysis of water quality and sediment discharge within watersheds based on remote sensing and GIS data.	
	11	Evaluation of watershed health/criticality indices using spatial parameters.	
	12	Final Project: Implementation of Remote Sensing and GIS in Hydrological and Watershed Studies.	
	13	Final Project: Implementation of Remote Sensing and GIS in Hydrological and Watershed Studies.	
	14	Final Project: Implementation of Remote Sensing and GIS in Hydrological and Watershed Studies.	
	15	Final Project: Implementation of Remote Sensing and GIS in Hydrological and Watershed Studies.	

	16	Final Examination (UAS)
Demonstrable Learning Outcomes at the End of the Course *)	Students are able to understand the concepts of hydrology and watersheds, and are able to apply them in map production using remote sensing and GIS techniques.	
Learning Strategy	✓	Case Method
		Team based Project
		Others
Learning Steps	Learning in this course is conducted systematically through a combination of theoretical lectures, practicum sessions, discussions, and case studies. This learning approach ensures that students not only master the theory but also possess technical skills in spatial data processing, hydrological modeling, and comprehensive analytical capabilities in watershed studies grounded in science and technology. This course accordingly encourages students to apply logical, critical, systematic, and innovative thinking in geospatial-based water resource management, and to make data-driven decisions for sustainable watershed planning.	
References	1	Asdak, C. (1995). Hidrologi dan Pengolahan Daerah Aliran Sungai. Gadjah Mada University Press. Yogyakarta.
	2	Black, Peter E. (1991). Watershed Hydrology,.Prentice Hall. Englewood Cliffs, New Jersey.
	3	Kodoatie, R.J. dan Roestam Sjarief. (2005). Pengelolaan Sumber Daya Air Terpadu. Yogyakarta: Andi.
	4	Raudkivi, A. (1979). Hydrology an Advanced Introduction to Processes and Modeling. Pergamon Press, Oxford, New York, Toronto, Sydney, Paris, Frankfurt.
	5	Sharma, T., Kiran, P. V. S., Singh, T. P., Trivedi, A. V., & Navalgund, R. R. (2001). Hydrologic response of a watershed to land use changes: A remote sensing and GIS approach. International Journal of Remote Sensing, 22(11), 2095–2108. https://doi.org/10.1080/01431160117359
	6	Prafull, S., Ankit, G., & Madhulika, S.. (2014). Hydrological inferences from watershed analysis for water resource management using remote sensing and GIS techniques, The Egyptian Journal of Remote Sensing and Space Science, Volume 17, Issue 2, Pages 111-121, ISSN 1110-9823, https://doi.org/10.1016/j.ejrs.2014.09.003 .
	7	Kumar, G., Sena, D. R., Kurothe, R. S., Pande, V. C., Rao, B. K., Vishwakarma, A. K., Bagdi, G. L., & Mishra, P. K. (2014). Watershed impact evaluation using remote sensing. Current Science, 106(10), 1369–1378. http://www.jstor.org/stable/24102483
	8	Bingfang, W.U., Weiwei, Z.H.U., Hongwei, Z., Nana, Y., Sheng, C., & Xinfeng, Z. (2020). Watershed remote sensing: definition and prospective[J]. Advances in Water Science, 31(5): 654-673. DOI: 10.14042/j.cnki.32.1309.2020.05.003
	9	Schmugge, T. J., Kustas, W.P., Ritchie, J.C., Jackson, T.C., & Al Rango. (2002). Remote sensing in hydrology, Advances in Water Resources, Volume 25, Issues 8–12, Pages 1367-1385, ISSN 0309-1708, https://doi.org/10.1016/S0309-1708(02)00065-9 .
	10	Tang, Q., Gao, H., Lu, H., & Lettenmaier, D. P. (2009). Remote sensing: hydrology. Progress in Physical Geography: Earth and Environment, 33(4), 490-509. https://doi.org/10.1177/0309133309346650

11	Schultz, G., A. (1988). Remote sensing in hydrology, Journal of Hydrology, Volume 100, Issues 1–3, 1988, Pages 239-265, ISSN 0022-1694, https://doi.org/10.1016/0022-1694(88)90187-4 .
12	Rango, A. (1994). Application of remote sensing methods to hydrology and water resources. Hydrological Sciences Journal, 39(4), 309–320. https://doi.org/10.1080/02626669409492752
13	Dong, C. (2018). Remote sensing, hydrological modeling and in situ observations in snow cover research: A review, Journal of Hydrology, Volume 561, Pages 573-583, ISSN 0022-1694, https://doi.org/10.1016/j.jhydrol.2018.04.027 .

LEARNING PLAN

Week	Sub-CPMK	Sub-CLO Achievement Indicators Demonstrable by Students	Course Material	Assessment		Learning Form and Method		Duration(mi n)	Ref.No.	AccessTime
				Assessm ent Form(test /non-test)	Weight(%)	Synchronous(F ace-to-Face& Online)	Asynchronou s(Individual &Group Tasks)			
1	Students understand the syllabus, lecture form, as well as the basic concepts of watersheds, watersheds and micro watersheds in the context of hydrology and ecology	Students are able to explain the concepts of watershed (DAS), river territory (WS), and micro-watershed, and link them to ecology and hydrology.	Introduction, scope, and fundamental concepts of watershed (DAS), river territory (WS), and micro-watershed in a hydrological and ecological context.	Participator y	2	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	1,2,3	03-02-2025 10:20
2	Students are able to identify WAS and DAS using GIS methods and remote sensing data for hydrological case studies	Students are able to identify river territories (WS) and watersheds (DAS) using spatial data, GIS, and remote sensing.	Identification of river territories (WS) and watersheds (DAS) for hydrological case studies.	Participator y	2	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	1,9	10-02-2025 10:20
3	Students understand the concept of hydrological interactions in watersheds, including the hydrological cycle, watershed morphology, and factors controlling water flow	Students are able to explain hydrological processes within the watershed and the factors influencing water flow.	Concepts of the Hydrological Interaction Process with Watershed Morphology and Morphometry.	Participator y	2	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	1,2	17-02-2025 10:20

Week	Sub-CPMK	Sub-CLO Achievement Indicators Demonstrable by Students	Course Material	Assessment		Learning Form and Method		Duration(mi n)	Ref.No.	AccessTime
				Assessm ent Form(test /non-test)	Weight(%)	Synchronous(F ace-to-Face& Online)	Asynchronou s(Individual &Group Tasks)			
4	Students are able to apply remote sensing and GIS techniques in watershed hydrological analysis, such as estimating rainfall, infiltration and percolation	Students are able to apply GIS and remote sensing technology in watershed analysis and conduct hydrological analysis based on spatial data.	The Role and Function of Remote Sensing and GIS in Hydrological and Watershed Studies, sources of hydrological and meteorological data.	Participator y	2	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	5,6,7,9	24-02-2025 10:20
5	Students are able to apply remote sensing and GIS techniques in watershed hydrological analysis, such as estimating rainfall, infiltration and percolation	Students are able to use remote sensing and GIS data to validate hydrological data.	Integration of Remote Sensing/Empirical (ground) data and GIS-based visualization.	Participator y	2	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	2,6	03-03-2025 10:20
6	Students are able to calculate and map river discharge and water balance based on remote sensing and GIS	Students are able to estimate discharge, infiltration, and water balance, and analyze the potential water storage capacity within a watershed using GIS and remote sensing.	Estimation of watershed potential through discharge, infiltration, and percolation calculations based on remote sensing and GIS data.	Participator y	2	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	1,5	10-03-2025 10:20

Week	Sub-CPMK	Sub-CLO Achievement Indicators Demonstrable by Students	Course Material	Assessment		Learning Form and Method		Duration(mi n)	Ref.No.	AccessTime
				Assessm ent Form(test /non-test)	Weight(%)	Synchronous(F ace-to-Face& Online)	Asynchronou s(Individual &Group Tasks)			
7	Students are able to calculate and map river discharge and water balance based on remote sensing and GIS	Students are able to analyze the water storage potential and renewable energy opportunities based on hydrology within the watershed using GIS and RS methods.	Potential of Water Storage and Renewable Energy within Watersheds Based on RS and GIS.	Participator y	2	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	1,10	17-03-2025 10:20
8	MIDTERM EXAMINATION				25					24-03-2025 10:20
9	Students are able to identify watershed problems, including analyzing areas prone to flooding, drought and sedimentation using spatial data	Students are able to identify flood-prone areas, drought, and sedimentation based on remote sensing and GIS data.	Study of drought within watersheds and critical land analysis based on remote sensing and GIS data.	Participator y	2	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	2,3	14-04-2025 10:20
10	Students are able to identify watershed problems, including analyzing areas prone to flooding, drought and sedimentation using spatial data	Students are able to analyze water quality and sedimentation within the watershed using GIS and remote sensing methods.	Analysis of water quality and sediment discharge within watersheds based on remote sensing and GIS data.	Participator y	2	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	1,2	21-04-2025 10:20

Week	Sub-CPMK	Sub-CLO Achievement Indicators Demonstrable by Students	Course Material	Assessment		Learning Form and Method		Duration(mi n)	Ref.No.	AccessTime
				Assessm ent Form(test /non-test)	Weight(%)	Synchronous(F ace-to-Face& Online)	Asynchronou s(Individual &Group Tasks)			
11	Students are able to assess watershed health based on the watershed criticality index using a geospatial approach, including analysis of water quality parameters and sediment discharge	Students are able to assess the watershed health index based on spatial parameters, water quality, and land use.	Evaluation of watershed health/criticality indices using spatial parameters.	Participator y	5	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	1,2,3,12,13	28-04-2025 10:20
12	Students are able to implement remote sensing and GIS technology in real case studies, as well as prepare reports related to watershed health indices according to the selected study location	Students are able to design a watershed hydrological study using remote sensing and GIS data.	Final Project: Implementation of Remote Sensing and GIS in Hydrological and Watershed Studies.	Participator y	5	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	7,11,12	05-05-2025 10:20
13	Students are able to implement remote sensing and GIS technology in real case studies, as well as prepare reports related to watershed health indices according to the selected study location	Students are able to conduct analysis and mapping of watershed conditions based on hydrological and spatial parameters.	Final Project: Implementation of Remote Sensing and GIS in Hydrological and Watershed Studies.	Participator y	6	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	10,11,12	12-05-2025 10:20

Week	Sub-CPMK	Sub-CLO Achievement Indicators Demonstrable by Students	Course Material	Assessment		Learning Form and Method		Duration(mi n)	Ref.No.	AccessTime
				Assessm ent Form(test /non-test)	Weight(%)	Synchronous(F ace-to-Face& Online)	Asynchronou s(Individual &Group Tasks)			
14	Students are able to implement remote sensing and GIS technology in real case studies, as well as prepare reports related to watershed health indices according to the selected study location	Students are able to compile a report based on the results of remote sensing and GIS analysis in watershed hydrological studies.	Final Project: Implementation of Remote Sensing and GIS in Hydrological and Watershed Studies.	Participator y	6	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	10,11,12	19-05-2025 10:20
15	Students are able to implement remote sensing and GIS technology in real case studies, as well as prepare reports related to watershed health indices according to the selected study location	Students are able to present the results of the final project study regarding the implementation of remote sensing and GIS in watershed analysis.	Final Project: Implementation of Remote Sensing and GIS in Hydrological and Watershed Studies.	Participator y	10	Face-to-face expository using lecture methods and interactive media to create interactions that provide critical thinking experiences	Group material exploration	2	11,12,13	20-05-2025 10:20
16	FINAL EXAMINATION				25					22-05-2025 10:20

STUDENT LEARNING TIME (WORKLOAD)

	Activity	Synchronous(Face-to-Face / Online)	Asynchronous(Structured / Independent)	Student LearningPreparation	Total Student Learningand Instructional Time
LEARNING	Lectures / Recitation / Tutorial	7 × 120 min = 840 min	7 × 90 min = 630 min	7 × 30 min = 210 min	1,680 min (28.0 hrs)
	Project-Based Learning	2 × 120 min = 240 min	2 × 120 min = 240 min	2 × 60 min = 120 min	600 min (10.0 hrs)
	Discussion (Case-Based Learning)	4 × 60 min = 240 min	4 × 60 min = 240 min	4 × 30 min = 120 min	600 min (10.0 hrs)
	SUBTOTAL				2,880 min (48.0 hrs)
ASSESSMENT	Continuous Assessment				
	Participation During Learning	7 × 60 min = 420 min	7 × 30 min = 210 min	7 × 30 min = 210 min	840 min (14.0 hrs)
	Project Work	4 × 60 min = 240 min	4 × 90 min = 360 min	4 × 30 min = 120 min	720 min (12.0 hrs)
	Assignment	4 × 60 min = 240 min	4 × 60 min = 240 min	4 × 30 min = 120 min	600 min (10.0 hrs)
	Quiz	2 × 30 min = 60 min	2 × 30 min = 60 min	2 × 30 min = 60 min	180 min (3.0 hrs)
	Formative				90 min (1.5 hrs)
	Summative				90 min (1.5 hrs)
	SUBTOTAL				2520 min (42.0 hrs)
TOTAL WORKLOAD					5400 Min (90 Hrs)
IDEAL CREDIT HOURS					90 Hours
CREDITS (SKS)					2
CONFORMITY WITH CREDIT LOAD					COMPLIANT

CLO ASSESSMENT CRITERIA

No	CPMK	CPL					Taxonomy	Weight	CLO Achievement Criteria
		CPL-1	CPL-2	CPL-3	CPL-4	CPL-5			
1	Students are able to understand the fundamental concepts of the watershed (DAS) and its relationship to hydrology and ecology, including the identification of river territories (WS) and micro-watersheds using spatial data.						4	4	75% of all students achieve a minimum score of 65 (on a scale of 100)
2	Students are able to analyze hydrological processes within a watershed based on remote sensing data and GIS, such as the hydrological cycle, water movement, and hydrological interaction with watershed morphology.						3	2	75% of all students achieve a minimum score of 65 (on a scale of 100)
3	Students are able to apply remote sensing and GIS techniques in watershed hydrological studies, including the analysis of water discharge, water balance, and other hydrological parameters based on spatial data.						2	8	75% of all students achieve a minimum score of 65 (on a scale of 100)
4	Students are able to identify watershed problems using remote sensing data and GIS, such as land degradation, erosion, sedimentation, and land use changes affecting hydrological balance.						2	4	75% of all students achieve a minimum score of 65 (on a scale of 100)
5	Students are able to evaluate watershed health based on the watershed criticality index by utilizing remote sensing and GIS technology, including the analysis of water quality and sediment discharge within the watershed.						4	5	75% of all students achieve a minimum score of 65 (on a scale of 100)
6	Students are able to apply remote sensing and GIS technology in real-world case studies through group-based projects to analyze watershed health indices in accordance with the selected study location.						4	27	75% of all students achieve a minimum score of 65 (on a scale of 100)

COLLABORATIVE ASSIGNMENT DESIGN

Assignment Title	Hydrology and Watershed Study using Remote Sensing and GIS
Learning Method	Case Method
Time	
Assessment Weight	30
SUB-CPMK	Students are able to implement remote sensing and GIS technology in real-world case studies, as well as compile reports related to the watershed health index in accordance with the selected study location.

TASK DESCRIPTION
Students will apply remote sensing and GIS methods in studying hydrological aspects of watersheds. This assignment encompasses the identification of river territories (WS), analysis of water flow patterns, rainfall estimation, and identification of flood-prone or erosion-prone areas. Each group will be provided with a satellite imagery dataset and hydrological data related to the selected watershed. The assignment report must present map-based analysis results and scientific interpretation supporting the watershed hydrological study.
TASK COMPLETION STEPS
1. Preparation and Selection of the Study Location and Topic. 2. Collection of Remote Sensing and GIS Data. 3. Data Processing in GIS Software. 4. Data Analysis and Map Production. 5. Interpretation of Results and Report Preparation. 6. Presentation of Results.
DETAILED EXPECTED OUTPUTS
Report and presentation of results
ASSESSMENT INDICATORS, CRITERIA, AND WEIGHTS

1. Data Processing
2. Data Analysis
3. Map Presentation and Visualization
4. Report
5. Presentation and Subject Matter Comprehension

IMPLEMENTATION SCHEDULE

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

Activity	Time of Implementation
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ADDITIONAL NOTES

LIST OF REFERENCES

1. Schmugge, T. J., Kustas, W.P., Ritchie, J.C., Jackson, T.C., & Al Rango. (2002). Remote sensing in hydrology, *Advances in Water Resources*, Volume 25, Issues 8–12, Pages 1367-1385, ISSN 0309-1708, [https://doi.org/10.1016/S0309-1708\(02\)00065-9](https://doi.org/10.1016/S0309-1708(02)00065-9).
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5. Dong, C. (2018). Remote sensing, hydrological modeling and in situ observations in snow cover research: A review, *Journal of Hydrology*, Volume 561, Pages 573-583, ISSN 0022-1694, <https://doi.org/10.1016/j.jhydrol.2018.04.027>.