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

SEMESTER LEARNING PLAN (SLP)

COURSE NAME	**CODE**	**COURSE GROUP**	**CREDITS (SKS)**		**SEMESTER**	**Date of Preparation**
Spatial Programming	CM235029	Geoinformatics	**T=2**	**P=1**	5	-

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-6	Able to identify, formulate, analyze and solve problems in the fields of Geodesy and Surveying, Hydrography, Photogrammetry and Remote Sensing also Geographic Information Systems and Cadastral.
ELO-7	Able to perform spatial data acquisition using modern measurement methods, geospatial data processing, using industry standard software, and making standard designs and analyzes in the fields of Geodesy and Surveying, Hydrography, Photogrammetry and Remote Sensing also Geographic Information Systems and Cadastral.

Course Learning Outcomes (CLO)

CLO-1	Students are able to recognize spatial information data (vector and raster) and various ways according to metadata standards in the geospatial industry
CLO-2	Students are able to document and develop spatial programs in certain programming languages
CLO-3	Students are able to apply spatial algorithms according to the geospatial industry
CLO-4	Students are able to develop and analyze spatial programs in providing solutions to certain spatial information problems

Matrix ELO – CLO

CLO	ELO-6	ELO-7
CLO-1		V
CLO-2	V	

		CLO -3		V
		CLO -4	V	V
Course Description	This course explains the basics of programming with spatial data using several programming languages and environments such as Python and R. Many application problems in spatial information cannot be solved with standard tools but require programming for fast and effective solutions. Using case studies, this course will enable students to develop software programs that address specific spatial information problems, starting with learning the syntax, program structure and data types of an object-oriented programming language. This course assumes that students are familiar with spatial information data and the various ways used by various stakeholders. Also, applications are used in GIS programming and customization. This course will introduce students to basic programming concepts, libraries for working with spatial data, geospatial APIs, and techniques for building spatial data processing pipelines.			
Course Materials	1. Introduction to programming with spatial data 2. Introduction and basics of programming with Python and R Basic data types : Numeric and integer values, Character values, Logical values Basic data structures : Matrix, 3. Programming basics – variables, data structures, functions, flow control 4. Read and write files (I/O files, csv) 5. Install and use the library 6. Using the web API (openrouteservice) 7. Introduction to modern data science libraries (numpy, pandas) 8. Introduction to spatial analysis (geopandas) 9. Using raster data (rasterio) 10. Create scripts and automate workflows			
References	**Main:**			
	1. Ghilani, C. C and P. R. Wolf. 2015. Elementary Surveying: An Introduction to Geomatics. Pearson Prentice Hall, Inc. 2. Chaowei Yang. 2017. Introduction to GIS Programming and Fundamentals with Python and ArcGIS. CRC Press 3. Hadley Wickham. 2017. R for data science : Import, Tidy, Transform, Visualize, And Model Data 4. The Python Book: The ultimate guide to coding with Python Kindle Edition by Various Authors 5. Lansley, G and Cheshire, J. 2016. An Introduction to Spatial Data Analysis and Visualisation in R			
	Additional:			
	1. https://rspatial.org/ 2. https://www.python.org/ 3. https://geocompr.robinlovelace.net/			
Lecturer	1. Hepi Hapsari Handayani, S.T., M.Sc, Ph.D 2. Agung Budi Cahyono, S.T., M.Sc, DEA 3. Nurwatik, S.T., M.Sc			

	4. Dr. Aldila Syariz, S.T., M.S., Ph.D						
Prerequisite	Computer Programming						
Class/ Week	**Lesson Learning Outcome (Sub-CLO)**	**Valuation**		**Learning Forms, Learning Methods, Student Assignments/Task, [Estimated Time]**		**Learning Materials [References]**	**Weight (%)**
		Indicators	**Criteria**	**Offline**	**Online**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Students know and are able to explain the concept of spatial programming algorithms	Accuracy in applying the basic Python programming algorithm	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lectures and Discussions [1 x 50'] 2. *Literature Review* [1 x 50'] 3. *Blended Learning* through MyITS-learning [1 x 50']		1. Writing Rules in Python programming language 2. Python installation 3. Environment Python 4. Jupyter-Notebook	5
2 – 3	Students are able to explain basic programming with Python and R	Accuracy and correctness of results in programming with Python and R	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lectures and Discussions [2 x 50'] 2. *Literature Review* and Basic Programming Practicum Data Type [2 x 50'] 3. *Blended Learning* through MyITS-learning [2 x 50']		1. Basic data structures : Matrix, List, Read and write files 2. Data exploration : Summary and table 3. Functions : Spatial, Vector, Raster 4. Graphics : Scatter plots, Histograms	15
4 - 5	Students are able to read and write files	Accuracy and correctness of read and write files in programming	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lectures and Discussions [2 x 50'] 2. *Problem based,* solving problems in sets [2 x 50'] 3. Demo and Practicum Data frame Indexing [2 x 50']		Read and write files (file I/O, csv)	10
6 – 7	Students are able to do installing and use the library with Python	Accuracy and correctness of results in solving condition	1. Completeness of the material 2. Depth of explanation and	1. Lectures and Discussions [2 x 50'] 2. Demo and Practicum basic programming Factorization [2 x 50']		Installing and use the library with Python	10

		problems in Python programming	effectiveness of communication	3. *Blended Learning* through MyITS-learning [2 x 50']			
8	**Midterm Evaluation / Midterm Exam**						**40**
9	Students are able explain modern data science libraries	Accuracy in explain modern data science libraries	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lectures and Discussions [1 x 50'] 2. Demo Complex control control programming practicum with statistical calculations [1 x 50'] 3. *Blended Learning* through MyITS-learning [1 x 50']		Introduction to modern data science libraries	10
10 – 11	Students are able to create programs for spatial analysis with vector data	The precision of creating programs using vector data interaction	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lectures and Discussions [2 x 50'] 2. Simulation, Programming practicum using input file [2 x 50'] 3. *Blended Learning* through MyITS-learning [2 x 50']		1. Measurement 2. Classification 3. Buffer 4. Overlay	15
12 - 13	Students are able to create programs for spatial analysis with raster data	Accuracy of creating programs using raster data interaction	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lectures and Discussions [2 x 50'] 2. *Case study probllem based* and practicum simulation [2 x 50'] 3. *Blended Learning* through MyITS-learning [2 x 50'] 4. Task 3		1. Data Type 2. Image Data 3. Raster Operations	15
14	Students are able to create scripts and workflow automation	Accuracy of exploring spatial data to create scripts and workflow automation	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lectures and Discussions [1 x 50'] 2. Programming practicum demo [1 x 50'] 3. *Blended Learning* through MyITS-learning [1 x 50']		Create scripts and workflow automation	10

15	Students are able to explore spatial data	Accuracy of exploring spatial data to Using web APIs	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lectures and Discussions [1 x 50'] 2. Programming practicum demo [1 x 50'] 3. *Blended Learning* through MyITS-learning [1 x 50']		Using web APIs : 1. Design a project 2. Objects and hierarchies in R 3. Create an application figure/window 4. Create a Uicontrol object, Uipanel	10
16	**Final Semester Evaluation / Final Semester Examination**						**100**