	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**
Microwave Remote Sensing	CM234975	Geospatial	**T=2**	**P=1**	Elective Course	-

AUTHORIZATION	**SLP Developer**	**Course Group Coordinator**	**Head of Study Program**
	Dr.-Ing. Noorlaila Hayati, S.T., M.T.	Prof. Lalu Muhamad Jaelani, ST, M.Sc, Ph.D	Putra Maulida, ST, MT, Ph.D

Learning Outcomes (LO)

Expected Learning Outcomes (ELO) that Imposed in the Course	
ELO-2	Able to study and utilize science and technology in order to apply it to the areas of expertise in Geodesy and Surveying, Hydrography, Photogrammetry, and Remote Sensing, as well as Geospatial and Land Information, and able to make appropriate decisions from the results of their own work or group work in the form of a final project report or other forms of learning activities whose outcomes are equivalent to the final project through logical, critical, systematic and innovative thinking.
ELO-4	Able to apply mathematics, science, and engineering in the fields of geodesy, surveying, hydrography, remote sensing, photogrammetry, geographic information systems, and cadastral to gain a thorough. understanding of the principles of engineering.
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, surveying, hydrography, remote sensing, photogrammetry, and cadastral.
Course Learning Outcomes (CLO)	
CLO-1	Students have knowledge about the main objectives of active remote sensing science.
CLO-2	Students have knowledge of the basic theory and methods of SAR image processing
CLO-3	Students are able to analyze Radar images using SAR images and Interferometry techniques for spatial data acquisition
CLO-4	Students are able to utilize active sensing technology (Radar) for natural resource management and disaster mitigation

Matrix ELO – CLO

CPMK	ELO-2	ELO-4	ELO-7
CLO-1	v		
CLO-2	v		
CLO-3		v	
CLO-4			v

Course Description	This course will provide students with science and engineering in studying one of the active remote sensing technologies or in the microwave spectrum, namely radar. The basic concept of radar remote sensing will be introduced and the components/equipment of active sensors will be explained, especially in the space geodesy category. One implementation of this active remote sensing technique is Synthetic Aperture Radar (SAR) where in this course we will discuss the acquisition process, frequency, polarization, band types, and identification of SAR data. There are two main technical components that will be explained in this course, namely: a) the backscatter process in SAR along with mathematical models and applications (e.g. flood monitoring and changes in land use / land cover (LULC)); b) the interferometry process along with mathematical models and their applications (e.g. deformation monitoring and creating digital elevation models (DEM)).
Course Materials	1.
References	**Main:**
	1.
	Additional :
	1.
Lecturer	1. Dr.-Ing. Noorlaila Hayati, S.T., M.T.
Prerequisite	

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	Introduction, Basic understanding of Radar. Radar Image Active Remote Sensing Concept.		1. Completeness of the material 2. Depth of explanation and	1. Lecture [1 x 50'] 2. Discussion [1 x 50']		•	5

			effectiveness of communication				
2	Microwave electromagnetic waves (properties of microwave) Phase, Amplitude and Wavelength. Radar Conventions, Microwave spectrum and Signal Propagation.	1.	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 50'] 2. Discussion [1 x 50'] 3. Task [1 x 50']			5
3	RAR and SAR, SAR Geometry, SAR Acquisition	1.	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 50'] 2. Discussion [2 x 50']			10
4	InSAR concept, InSAR for topography, InSAR for deformation	1.	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 50'] 2. Discussion, Task [1 x 50'] 3. Response/Exercise [1 x 50']			10
5-6	SAR Interferometry Stages InSAR image processing Radar Image Processing Application (InSAR)		1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 50'] 2. Discussion [2 x 50']			10

7	Real examples of InSAR case studies in Indonesia and outside Indonesia, introduction to advanced InSAR techniques (time series analysis)		1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 50'] 2. Discussion, Task [1 x 50'] 3. Response/Exercise [1 x 50']			10
8	**Midterm Evaluation / Midterm Exam**						**50**
9	Sigma nought, backscattering, volume scattering, polarization	1.	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 50'] 2. Discussion, Task [1 x 50'] 3. Response [1 x 50']			10
10 -11	Processing stages: Geocoding, Radiometric and Terrain Calibration, Speckle Noise, Speckle Filtering	1.	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 50'] 2. Discussion, Task [1 x 50'] 3. Response/exercise [1 x 50']			10
12 – 13	Case study of puddle or object detection, Mapping Inundation using Thresholding Techniques, A Threshold-Based Surface Water Mapping Approach	1.	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 50'] 2. Discussion, Task [1 x 50'] 3. Response/exercise [1 x 50']			20
15	Surface Water Signatures, Results and discussion of puddle or	1.	1. Completeness of the material	1. Lecture [1 x 50'] 2. Discussion, Task [1 x 50']			10

	object detection using SAR backscattering		2. Depth of explanation and effectiveness of communication				
16	**Final Semester Evaluation / Final Semester Examination**						**100**