



**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				
Meteorological Geodesy		CM234964	Geodesy and Geodinamics	T=1	P=1	Elective Course	-				
AUTHORIZATION		SLP Developer		Course Group Coordinator		Head of Study Program					
		Prof. Dr. Eko Yuli Handoko, S.T., M.T.		Prof. Dr. Eko Yuli Handoko, S.T., M.T.		Putra Maulida, S.T., M.T., 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-6	Able to identify, formulate, analyze and solve problems in the fields of Geodesy and Surveying, Hydrography, Photogrammetry and Remote Sensing, as well as Geospatial and Land Information.									
	ELO-7	Able to perform spatial data acquisition using modern measurement methods, geospatial data processing, using industry standard software, and making standard designs and analyses in the fields of Geodesy and Surveying, Hydrography, Photogrammetry and Remote Sensing, as well as Geospatial and Land Information.									
	ELO-8	Able to compile scientific reports and provide solutions based on leadership, creativity and communication skills as well as being responsible for the work done.									
	Course Learning Outcomes (CLO)										
	CLO-1	Students are able to explain the characteristics of the troposphere and meteorological phenomena									
	CLO-2	Students are able to explain the characteristics of the ionosphere and its phenomena									
	CLO-3	Students are able to analyze the results of GNSS data processing for atmospheric studies (troposphere and ionosphere)									
	CLO-4	Students are able to explain the influence of the troposphere and ionosphere medium on GNSS signal propagation									

		Matrix ELO – CLO					
		CPMK	ELO-2	ELO-6	ELO-7	ELO-8	
		CLO-1	V	V	V		
		CLO-2	V	V	V		
		CLO-3		V	V	V	
		CLO-4		V	V	V	
Course Description							
Course Materials		1. Hydro-meteorological phenomena 2. The characteristics of the atmosphere 3. Atmosphere physical properties 4. Atmosphere influence on wave propagation 5. Atmosphere phenomena					
References		Main:					
		1. ATMOSPHERE, OCEAN, AND CLIMATE DYNAMICS: AN INTRODUCTORY TEXT, John Marshall and R. Alan Plumb, Elsevier Academic Press, 2008					
		2. GNSS Remote Sensing Theory, Methods and Applications, Shuanggen Jin, Springer, 2014					
		3. Atmospheric effect in space geodesy, Johannes Bohm, Harald schuh, Springer, 2013					
		Additional :					
		GNSS meteorologi. Dudy D. Wijaya, ITB Press, 2020					
Lecturer		1. Dr. Eko Yuli Handoko, S.T., M.T. 2. Putra Maulida, S.T., M.T., Ph.D.					
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	Students are able to explain hydro-meteorological phenomena and the	Accuracy in explaining hydro-	1. Completeness of the material	1. Kuliah [1 x 45'] 2. Diskusi [1 x 45'] 3. Tugas [1 x 45']		Definition of weather and climate; parameters influencing weather and	5

	parameters that influence the dynamics of weather and climate	meteorological phenomena and the parameters that drive weather and climate dynamics	2. Depth of explanation and effectiveness of communication			climate; temperature, pressure, humidity, hydrological cycle, clouds; El Niño and La Niña phenomena; Indian Ocean Dipole	
2	Students are able to describe the characteristics of the atmosphere based on altitude, including its physical properties, the effects on wave propagation, and the phenomena occurring within each atmospheric layer	Accuracy in describing atmospheric characteristics based on altitude, including physical properties, their influence on wave propagation, and the phenomena occurring within each atmospheric layer	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Kuliah [1 x 45'] 2. Diskusi [1 x 45'] 3. Presentasi [1 x 45']		Definition of the atmosphere; physical characteristics of the atmosphere based on altitude; neutral and ionized atmosphere; electromagnetic and microwave wave propagation; atmospheric influence on wave propagation	10
3-4	Students are able to explain GPS/GNSS observation systems, identify sources of error, and describe methods to reduce those errors	Accuracy in explaining GPS/GNSS observation systems, identifying sources of error, and methods to	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Kuliah [2 x 45'] 2. Diskusi [2 x 45'] 3. Tugas, Presentasi [2 x 45']		Review of the GPS system; GPS signals; sources of GPS errors; methods of GPS error mitigation; double differencing; Precise Point Positioning (PPP)	10

		mitigate those errors					
5	Students are able to explain the physical properties of the tropospheric layer and its influence on GPS/GNSS signal propagation	Accuracy in describing the physical properties of the troposphere and their effects on GPS/GNSS signal propagation	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Kuliah [1 x 45'] 2. Latihan [1 x 45'] 3. Tugas [1 x 45']		Physical properties of the troposphere and their effects on GPS signals; geometric bending; signal propagation delay in the troposphere	10
6-7	Students are able to explain the phenomena that affect water vapor content and the methods used to calculate it	Accuracy in explaining the phenomena that affect water vapor content and the methods used to calculate it	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Kuliah [1 x 45'] 2. Diskusi [1 x 45'] 3. Latihan, Tugas [1 x 45']		Water cycle and its physical properties; the relationship between water vapor content and weather; its influence on GPS signals; troposphere modeling (Hopfield, Saastamoinen); mapping slant to zenith delay (VMF1); radiosonde	15
8	Midterm Evaluation / Midterm Exam						50
9-10	Students are able to analyze the amount of water vapor content and the phenomena influencing its dynamics	Accuracy in analyzing the amount of water vapor content and the phenomena influencing its dynamics	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Kuliah [2 x 45'] 2. Diskusi Kelompok [2 x 45'] 3. Responsi, Latihan dan Tugas [2 x 45']		ZTD (Zenith Total Delay), ZWD (Zenith Wet Delay), methods for calculating ZTD using scientific GPS software, and Precipitable Water Vapor (PWV)	10

11	Students are able to analyze the impact of climate change on the physical weather parameters	Accuracy in analyzing the impact of climate change on the physical parameters of weather	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Kuliah [1 x 45'] 2. Diskusi [1 x 45'] 3. Responsi, Latihan [1 x 45']		Climate and climate change phenomena; climate change analysis using GPS observation data	10
12-13	Students are able to explain the characteristics and physical properties of the space atmosphere, including its spatial and temporal variations	Accuracy in explaining the characteristics and physical properties of the space atmosphere, including its spatial and temporal variations	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Kuliah [2 x 45'] 2. Diskusi [2 x 45'] 3. Responsi, Latihan dan Tugas [2 x 45']		Characteristics of the ionized atmosphere; composition of the ionospheric layers; phenomena affecting ion density in the atmosphere; Total Electron Content Unit (TECU); magnetosphere; daily and annual variation characteristics of the ionospheric layer; ionospheric characteristics at low, mid, and high latitudes; ionospheric layers E and F	15
14-15	Students are able to explain the influence of the ionospheric layer on GPS/GNSS signal propagation	Accuracy in explaining the influence of the ionospheric layer on GPS/GNSS	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Kuliah [1 x 45'] 2. Diskusi [1 x 45'] 3. Responsi, Latihan [1 x 45']		The influence of ionospheric bias on signal propagation; GNSS ionospheric concepts, CID (Carrier-to-Noise Ratio Index), ionospheric disturbances	15

		signal propagation					
16	Final Semester Evaluation / Final Semester Examination						100