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

SEMESTER LEARNING PLAN (SLP)

COURSES	**CODE**	**COURSE GROUP**	**CREDITS (SKS)**		**SEMESTER**	**Date of Preparation**
Global Navigation Satellite System Survey	CM235028	Geodesy and geodynamics	**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-4	Able to apply mathematics, science, and engineering in the fields of Geodesy and Surveying, Hydrography, Photogrammetry and Remote Sensing also Geographic Information Systems and Cadastral to gain a thorough understanding of the principles of engineering.
	ELO-5	Able to design survey and mapping activities using the latest technology in the fields of Geodesy and Surveying, Hydrography, Photogrammetry and Remote Sensing also Geographic Information Systems and Cadastral.
	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	Capable of acquiring spatial data using modern measurement methods, processing geospatial data with industry-standard software, and performing standard design and analysis in the fields of geodesy, surveying, hydrography, remote sensing, photogrammetry, and cadastre.
	ELO-9	Able to plan, execute, and evaluate survey and mapping activities by utilizing the latest technologies in the fields of geodesy, surveying, hydrography, remote sensing, photogrammetry, and cadastre.
	Course Learning Outcomes (CLO)	
	CLO-1	Able to understand the basic concepts of GNSS and Able to understand the propagation of signals in the ionosphere and troposphere as well as the biases and errors of propagation.
	CLO-2	Able to understand the procedures, have knowledge and experience in measuring and calculating distance using either pseudorange or using phase.

	CLO-3	Able to explain errors and biases in 3 GNSS segments along with how to eliminate these errors.
	CLO-4	Able to perform measurements using several methods on GNSS survey and Able to perform data processing using scientific and commercial software.

		Matrix ELO – CLO CLO / ELO-4 / ELO-5 / ELO-6 / ELO-7 / ELO-9 CLO-1: V CLO-2: V / V / V CLO -3: V / V / V / V CLO -4: V / V / V
Course Description	This course examines the concepts, signal propagation, distance measurement by phase, orbital system, error, bias and measurement methods of the Global Satellite Navigation System along with its use in the field of geomatics and teaches students how to manage it using both commercial and scientific software.	
Course Materials	1. GNSS concept and positioning technology. 2. GNSS signal propagation and distance measurement using GNSS signals by using phase signals and codes. 3. Different types of differentials in GNSS data. 4. Types of bias and error in all three segments of GNSS technology. 5. Measurement method using GNSS technology. 6. GNSS survey steps. 7. GNSS data processing techniques use commercial and scientific software. 8. GNSS measurement procedure in the field. 9. The concept of GNSS measurement in each application is different.	
References	**Main:**	
	1. Abidin, H.Z., 2005. Satellite Geodesy 2. Abdiin, H.Z., 2005. Satellite Survey	
	Additional:	
	1. Wolf, 2010. Elementary Surveying	
Lecturer	1. Prof. Mokhamad Nurcahyadi, S.T., M.Sc, Ph.D 2. Dr. Eko Yuli Handoko, S.T., M.T. 3. Khomsin, S.T., M.T. 4. Akbar Kurniawan, S.T., M.T.	

Prerequisite	Satellite Geodesy

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	Able to explain the basic concepts of GNSS	Accuracy in explaining the basic concepts of GNSS	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [1 x 50'] 2. Discussion [1 x 50'] 3. Exercise [1 x 50']		1. Syllabus Explanation, Lecture Rules, 2. Definition and concept of GNSS 3. Definition and concept of earth technology	10
2	Able to know and understand signal propagation	Accuracy in knowing and understanding signal propagation	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [1 x 50'] 2. Discussion [1 x 50'] 3. Exercise [1 x 50']		1. The development of signal technology 2. Electromagnet signal in GNSS signal 3. Distance measurement using phase and code in GNSS measurement	10
3	Able to understand differential GNSS data	Accuracy in understanding differential GNSS data	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [1 x 50'] 2. Discussion [1 x 50'] 3. Exercise [1 x 50']		1. The development of GNSS technology in this case is differential data 2. Inter-satellite differentials 3. Differential between epochs 4. Differentials between receivers	10

4 - 5	Able to understand and minimize bias and error in the three segments of GNSS technology	Accuracy in understanding and minimizing bias and error in the three segments of GNSS technology	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [2 x 50'] 2. Discussion [2 x 50'] 3. Exercise [2 x 50'] 4. Task 1: Determine the types of bias and error in GNSS observations and their error contributions to observations		1. The validity of satellite clocks 2. Orbital error 3. Atmospheric bias 4. Satellite clock error 5. Multipath errors 6. Cycleslips 7. Precise ephemeris 8. SBAS and WAAGS	10
6 - 7	Able to understand measurement methods using GNSS	Accuracy in understanding measurement methods using GNSS	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [2 x 50'] 2. Discussion [2 x 50'] 3. Exercise [2 x 50']		1. Static method 2. Rapid static method 3. Kinematic method 4. Stop and go method 5. Net measurement 6. Radial measurement	10
8	**Midterm Evaluation / Midterm Exam**						**50**
9 – 10	Able to explain survey steps on GNSS measurements	Accuracy in explaining survey steps on GNSS measurements	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [2 x 50'] 2. Discussion [2 x 50'] 3. Exercise [2 x 50'] 4. Task 2: Design and plan meting and radial measurements		1. Field Orientation 2. Calculates the number of points and is proportional to the area 3. Calculating costs 4. Drop and select points 5. Personnel mobility	10
11 - 12	Able to understand GNSS data processing techniques using scientific and commercial software	Accuracy in understanding GNSS data processing techniques using scientific and	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [2 x 50'] 2. Discussion [2 x 50'] 3. Exercise [2 x 50'] 4. Task 3: Processing GNSS using commercial and scientific software		1. Processing using scientific software 2. Processing using commercial software	10

		commercial software	3. Attitude accuracy				
13 – 14	Able to carry out GNSS measurements in the field	Accuracy in carrying out GNSS measurements in the field	1. Completeness of the material 2. Depth of explanation and effectiveness of communication 3. Attitude accuracy	1. Lecture [2 x 50'] 2. Discussion [2 x 50'] 3. Exercise [2 x 50'] 4. Task 4: Measurement of GNSS with baseline and radial methods on the ITS campus		1. Measurement using radial method 2. Measurement using the net method	15
15	Able to explain the concept of GNSS measurement in various different applications	Accuracy in explaining the concept of GNSS measurement in various different applications	1. Completeness of the material 2. Depth of explanation and effectiveness of communication	1. Lecture [1 x 50'] 2. Discussion [1 x 50'] 3. Exercise [1 x 50']		1. GNSS Measurement for RTRW 2. GNSS measurement on soil parcels	15
16	**Final Semester Evaluation / Final Semester Examination**						**100**