	SEMESTER LEARNING PLAN **DEPARTMENT OF GEOMATICS ENGINEERING** **FACULTY OF CIVIL, PLANNING, and GEO ENGINEERING**		
PROGRAM	**UNDERGRADUATE**		
COURSE NAME	**Underground Surveying**	**CODE**	**RM184931**
SEMESTER	**8 (eight)**	**CREDITS**	**2 (three)**
LECTURERS	**Ir.Yuwono.MS**		
	Akbar Kurniawan, ST, MT		

COURSE MATERIALS	1	Mapping Theory
	2	Direction and Orientation
	3	Horizontal Position Determination
	4	Leveling
	5	Detailed Measurement of Situations
	6	Volume calculation
	7	Underground Surveying Equipment
	8	Terrestrial Laser Scanner
	9	Ground Penetrating Radar and Geoelectric
	10	Layout for Line and Grade
	11	Underground Survey Application
EXPECTED LEARNING OUTCOMES THAT IMPOSED IN THE COURSE	C	Able to identify, formulate, analyze and solve problems in the fields of geodesy, surveying, hydrographic, remote sensing, photogrammetry, and cadastral.
	D	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.
	G	Able to plan, perform and evaluate the process of surveying and mapping activities using the latest technology in the fields of geodesy, surveying, hydrographic, remote sensing, photogrammetry, and cadastral.
COURSE LEARNING OUTCOMES	1	Students are able to understand the measurement methods in underground surveys
	2	Students are able to find out the equipment that can be used in underground surveys
	3	Students are able to know and understand science and technology in underground survey activities

ABILITY CATEGORIES	*Cognitive Prosecess*	*Analyse*
	Knowledge Domain	*Procedural*
	Psychomotor	*Conscious control*
	Affective	*Change of attitude*

Class	Lesson learning outcome	Criteria dan Assessment Indicator	Weight	Learning Materials	Learning Experience	Learning Methods	Estimated Time
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Able to understand the concepts and theories in terrestrial mapping	Material completeness, depth of explanation, effectiveness of communication, accuracy of attitude	5%	1. Explanation of syllabus, teaching plan, assignments and evaluation 2. Terrestrial mapping concept	Lecture Discussion practice	Teacher-centered learning Student-centered learning Problem-based learning	1 x 50' 1 x 50' 1 x 50'

2	Able to explain the application of Direction and orientation in the Underground Survey	Material completeness, depth of explanation, effectiveness of communication, accuracy of attitude	5%	1. Explanation of Azimuth, Bearing and orientation direction 2. Unity of horizontal, vertical and azimuth magnitude	Lecture Discussion practice	Teacher-centered learning Student-centered learning Problem-based learning	1 x 50' 1 x 50' 1 x 50'
3	Able to explain the application of leveling in underground surveys	Material completeness, depth of explanation, effectiveness of communication, accuracy of attitude	10%	1. Height Difference Measurement Method 2. Height Difference Calculation Method 3. Height Difference Measurement Quality 4. Height Difference Measurement Equipment	Lecture Discussion practice	Teacher-centered learning Student-centered learning Problem-based learning	1 x 50' 1 x 50' 1 x 50'
4	Able to explain the concept of determining horizontal positions in underground surveys	Material completeness, depth of explanation, effectiveness of communication, accuracy of attitude	10%	1. determining the position of the polygon method 2. determining the position using intersection method 3. determining the position of the resection method 4. The reference of the measurement	Lecture Discussion practice	Teacher-centered learning Student-centered learning Problem-based learning	1 x 50' 1 x 50' 1 x 50'
5	Able to explain explain the concept of measuring detailed situation in an underground survey	Material completeness, depth of explanation, effectiveness of communication, accuracy of attitude	10%	1. measurement of tachimetry 2. measurement of trigonometry 3. use of Total Station and Theodolite in the measurement of detailed situations	Lecture Discussion practice	Teacher-centered learning Student-centered learning Problem-based learning	1 x 50' 1 x 50' 1 x 50'
(6-7)	Able to explain the concept of volume calculation in underground surveys	Material completeness, depth of explanation, effectiveness of communication, accuracy of attitude	10%	1. Volume calculation method 2. Borrow pit, trapezoidal and contour methods	Lecture Discussion practice	Teacher-centered learning Student-centered learning Problem-based learning	2 x 50' 2 x 50' 2 x 50'
8	Evaluasi						
9	Able to explain underground survey equipment	Material completeness, depth of explanation, effectiveness of communication, accuracy of attitude	5%	1. Theodolite gyro 2. Waterpass 3. Total Station, 4. Terrestrial Laser Scanner, 5. Geoelectric, 6. Ground Penetraring Radar	Lecture Discussion practice	Teacher-centered learning Student-centered learning Problem-based learning	1 x 50' 1 x 50' 1 x 50'

(10-11)	Able to explain the use of Terrestrial Laser Scanner in underground surveys	Material completeness, depth of explanation, effectiveness of communication, accuracy of attitude	15%	1. The concept of using TLS 2. TLS Data Acquisition 3. Portrayal of TLS data	Lecture Discussion practice	Teacher-centered learning Student-centered learning Problem-based learning	2 x 50' 2 x 50' 2 x 50'
(12-13)	Able to explain the use of Geoelectric and Ground Penetrating Radar in underground surveys	Material completeness, depth of explanation, effectiveness of communication, accuracy of attitude	15%	1. Geoelectric measurement concept 2. Geoelectric Data Acquisition 3. Geoelectric survey drawing 4. GPS measurement concept 5. GPS data acquisition 5. GPR data drawing	Lecture Discussion practice	Teacher-centered learning Student-centered learning Problem-based learning	2 x 50' 2 x 50' 2 x 50'
14	Able to explain the concept of Layout for line and grade in an underground survey	Material completeness, depth of explanation, effectiveness of communication, accuracy of attitude	10%	1. Methods of designing and making Line and Grade in underground surveys 2. Line and Grade equipment	Lecture Discussion practice	Teacher-centered learning Student-centered learning Problem-based learning	1 x 50' 1 x 50' 1 x 50'
15	Able to explain the application of Underground Survey in the field of Construction	Material completeness, depth of explanation, effectiveness of communication, accuracy of attitude	5%	Tunnel Construction, Sewer Construction, Underground Mine Construction, Pipeline Construction	Lecture Discussion practice	Teacher-centered learning Student-centered learning Problem-based learning	2 x 50' 2 x 50' 2 x 50'
16							
						TOTAL	100%