	SEMESTER LEARNING PLAN **DEPARTMENT OF GEOMATICS ENGINEERING** **FACULTY OF CIVIL, PLANNING, and GEO ENGINEERING**			
PROGRAM	**UNDERGRADUATE**			
COURSE NAME	**Transformation System and Map Projection**		**CODE**	**RM184306**
SEMESTER	**III (three)**		**CREDITS**	**4 (four)**
LECTURERS	**Ira Mutiara Anjasmara [Coord]**			
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COURSE MATERIALS	1	Introduction and Review of Geodesy		
	2	Coordinate System		
	3	Spherical and Ellipsoid Geometry		
	4	Geodetic Datum		
	5	Map Projection		
	6	Calculations in the Projection Field		
	7	Calculations in the Ellipsoid Field (Solving Geodetic Problems)		
	8	Coordinate Transformation (2D and 3D)		
	9	Datum Transformation (Datum Shift)		
	10	Coordinate Transformation between Projection Zones		
EXPECTED LEARNING OUTCOMES THAT IMPOSED IN THE COURSE	**A**	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		
	C	Able to identify, formulate, analyze and solve problems in the fields of geodesy, surveying, hydrographic, remote sensing, photogrammetry, and cadastral.		
COURSE LEARNING OUTCOMES	1	Able to explain and distinguish various coordinate systems which used in the field of geodesy / geomatics		
	2	Able to explain the concepts of spherical and ellipsoid geometry and perform calculations on spherical and ellipsoid fields		
	3	Able to explain the concept of a geodetic reference / datum system		
	4	Able to explain and distinguish types of map projections		
	5	Able to reduce geodetic size (angle and distance) from the ellipsoid plane to the projection plane / flat plane		
	6	Able to perform geodetic calculations in the ellipsoid plane and the projection plane / flat plane		
	7	Able to explain the basic concepts of coordinate transformation and to distinguish various methods of coordinate transformation		
	8	Able to transform 2-dimensional and 3-dimensional coordinates in the field of geodesy / geomatics		
	9	Able to explain the concept of transformation between datums and perform calculations of datum transformations		
	10	Able to transform coordinates between zones in a specific projection coordinate system		
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 explain and distinguish various coordinate systems which used in the field of geodesy / geomatics	Completeness of material, depth of explanation, accuracy of answers, effectiveness of communication, attitude accuracy	5	Introduction (Review of Geodesy)	Lecture	Teacher-centered learning	2 x 50'
				Coordinate System	Discussion	Student-centered learning	1 x 50'
				1. Coordinate system parameters	Practice / Quiz	Problem-based learning	1 x 50'
				2. 2-D coordinate system			
				(cartesian, polar, conversion between coordinate systems)			
				3. 3-D coordinate system			
				(geocentric cartesian, topocentric cartesian, spherical, ellipsoid)			
2	Able to explain the concepts	Completeness of material, depth of	5	**1. Spherical Geometry**	Lecture	Teacher-centered learning	2 x 50'

	of spherical and ellipsoid geometry and perform calculations on spherical and ellipsoid fields	explanation, effectiveness of communication, accuracy of answers, accuracy of attitude		(spherical incision plane, angle on the sphere, spherical triangle, arc distance) **2. Ellipsoid Geometry** (longitude, geodetic and geocentric latitude, ellipsoid parameters, radii on ellipsoids, parallel distances, meridian distances, geodesics, and normal slices)	Discussion Practice / Quiz Task 1	Student-centered learning Problem-based learning	1 x 50' 1 x 50'
3	Able to explain the concept of a geodetic reference / datum system	Completeness of material, depth of explanation, effectiveness of communication, accuracy of attitude, accuracy of application	5	**Geodetic Datum** 1. Reference System and Reference Framework 2. Understanding Geodetic Datum 3. Global Geodetic Datum (GRS80, WGS84, ITRF, etc.) 4. Local Geodetic Datum (National Datum in Indonesia: Genuk, Monconglowe, ID74, DGN95, SRGI2013)	Lecture Group Discussion Practice / Quiz	Teacher-centered learning Student-centered learning Problem-based learning	2 x 50' 1 x 50' 1 x 60'
4-5	Able to explain the concept of map projections, distinguish types of map projections, and determine projections that are appropriate for a particular application	Material completeness, depth of explanation, effectiveness of communication, accuracy of attitude, accuracy of answers	25	**Map Projection** 1. Introduction to Map Projection (understanding, conditions, linear distortion, point scale factor) 2. Classification and Selection of Map Projection >> According to the projection field used (azimuthal, cone, cylinder) >> According to the position of the projection symmetry axis (normal, oblique, traversal) >> According to the position of the projection field towards the earth (cutting off, offending) >> According to geometric provisions (equidistant, conform, equivalent) 3. Map Projection used in Indonesia >> Polyeder Projection >> Mercator Projection (UTM, TM-3°)	Lecture Discussion Practice / Quiz Task 2	Teacher-centered learning Student-centered learning Problem-based learning	4 x 50' 2 x 50' 2 x 50'
6	Able to reduce geodetic size (angle and distance) from the ellipsoid plane to the projection plane / flat plane	Completeness of material, depth of explanation, effectiveness of communication, accuracy of answers, accuracy of attitude	5	**Calculations in the projection field** >> Grid Convergence >> Arc-to-cord correction >> Conversion of Azimuth to Direction and vice versa	Lecture Discussion Practice / Quiz	Teacher-centered learning Student-centered learning Problem-based learning	2 x 50' 1 x 50' 1 x 50'
7	Able to perform geodetic calculations in the ellipsoid plane and the projection plane / flat plane	Completeness of material, depth of explanation, effectiveness of communication, accuracy of answers, accuracy of attitude	5	**Calculations on the Ellipsoid Field** **(Solving Geodetic Issues)** 1. Direct Problem $\phi_1, \lambda_1, A_{12}, s_{12} \Rightarrow \phi_2, \lambda_2, A_{21}$ 2. Inverse Problem $\phi_1, \lambda_1, A_{12}, s_{12} \Rightarrow \phi_2, \lambda_2, A_{21}$	Lecture Discussion Practice / Quiz	Teacher-centered learning Student-centered learning Problem-based learning	2 x 50' 1 x 50' 1 x 50'
8				**Mid Semester Evaluation**	**Evaluation**		**2 x 50'**
9	Able to explain the basic concepts of coordinate transformation and to	Completeness of material, depth of explanation, effectiveness of communication, accuracy of	10	**Coordinate Transformation** 1. Definition and purpose of coordinate transformation	Lecture Discussion Practice / Quiz	Teacher-centered learning Student-centered learning Problem-based learning	2 x 50' 1 x 50' 1 x 50'

	distinguish various methods of coordinate transformation	answers, accuracy of attitude		2. Coordinate transformation parameters			
				(translation, rotation, scale)			
				Transformation of 2-dimensional coordinates			
				1. 2D Conform Transformation			
				2. 2D Affine Transformation			
10-12	Able to transform 2-dimensional and 3-dimensional coordinates in the field of geodesy / geomatics	Completeness of material, depth of explanation, effectiveness of communication, accuracy of answers, accuracy of attitude	25	**Transformation of 3-dimensional coordinates**	Lecture	Teacher-centered learning	6 x 50'
				1. Transformation between Geodetic and Cartesian	Discussion	Student-centered learning	3 x 50'
				Coordinate Systems	Practice / Quiz	Problem-based learning	3 x 50'
				>> Bowring Forward (Geodetic to Cartesian)	Task 3		
				>> Bowring Reverse (Cartesian to Geodetic)			
				2. Transformation between Projection and Geodetic			
				Coordinate Systems			
				>>Using tables			
				>> Using the Redfearn formula			
				3. Transformation between Geodetic and Geocentric			
				Coordinate Systems			
				4. Transformation between Geocentric and Topocentric			
				Coordinate Systems			
13-14	Able to explain the concept of transformation between datums and perform calculations of datum transformations	Completeness of material, depth of explanation, effectiveness of communication, accuracy of answers, accuracy of attitude	10	**Datum Shift**	Lecture	Teacher-centered learning	4 x 50'
				>> Definition and purpose of datum shift	Discussion	Student-centered learning	2 x 50'
				>> Conform transformation Bursa-Wolf	Practice / Quiz	Problem-based learning	2 x 50'
				>> Conform transformation Molodensky-Badekas			
15	Able to transform coordinates between zones in a specific projection coordinate system	Completeness of material, depth of explanation, effectiveness of communication, accuracy of answers, accuracy of attitude	5	**Coordinate Transformation between Projection Zones**	Lecture	Teacher-centered learning	2 x 50'
				>> in UTM projection	Discussion	Student-centered learning	1 x 50'
				>> in TM-3° projection	Practice / Quiz	Problem-based learning	1 x 50'
16				**Final Semester Evaluation**	**Evaluation**		**2 x 50'**
100							