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

SEMESTER LEARNING PLAN (SLP)

COURSE NAME	CODE	COURSE GROUP	CREDITS		SEMESTER	COMPILATION DATE
Coordinate System and Transformation	CM234417	Geodesy and Geomatics	T=2	P=1	4	-

AUTHORIZATION	SLP DEVELOPER	COURSE GROUP COORDINATOR	HEAD OF UNDERGRADUATE PROGRAM
	Dr. Eko Yuli Handoko, S.T., M.T.	Prof. Dr. Eko Yuli Handoko, ST, MT	Putra Maulida, ST, MT, Ph.D

Learning Outcome (LO)		
	Expected Learning Outcomes (ELO) that Imposed in the Course	
	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-5	Able to design survey and mapping activities using the latest technology in the fields of geodesy, surveying, hydrographic, remote sensing, photogrammetry, and cadastral.
	ELO-6	Able to identify, formulate, analyze and solve problems in the fields of geodesy, surveying, hydrographic, remote sensing, photogrammetry, and cadastral.
	Course Learning Outcomes (CLO)	
	CLO-1	Able to explain the concept of a geodetic reference/datum system
	CLO-2	Be able to explain the basic concepts of coordinate transformation and differentiate between various coordinate transformation methods

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<tr><td></td><td>CLO-3</td><td>Able to carry out 2-dimensional and 3-dimensional coordinate transformations in the field of geodesy/geomatics</td></tr>
<tr><td></td><td>CLO-4</td><td>Able to explain the concept of transformation between datums and perform datum transformation calculations</td></tr>
<tr><td></td><td>CLO-5</td><td>Able to carry out coordinate transformations between zones in a certain projected coordinate system</td></tr>
<tr><td></td><td></td><td>Matrix ELO – CLO
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<tr><td>CLO</td><td>ELO-4</td><td>ELO-5</td><td>ELO-6</td></tr>
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<tr><td>CLO-2</td><td>V</td><td>V</td><td></td></tr>
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<tr><td>CLO-5</td><td></td><td>V</td><td>V</td></tr>
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<tr><td>Course Description</td><td colspan="2">This course covers the fundamental concepts and applications of coordinate systems in the fields of geodesy and geomatics, including geodetic reference systems and datums. Students will study spherical and ellipsoidal geometry, various types of map projections, and calculation methods on projection planes and ellipsoids. Additionally, the course teaches two- and three-dimensional coordinate transformations, as well as transformations between datums and projection zones. Through this material, students are expected to understand and accurately apply coordinate transformation principles in modern surveying and mapping contexts.</td></tr>
<tr><td>Course Materials</td><td colspan="2">1 Introduction and Review of Geodesy Science
2 Coordinate System
3 Spherical &; Ellipsoidal Geometry
4 Geodesy Datum
5 Map Projection
6 Calculation on the Projection Field
7 Calculations on the Ellipsoidal Field (Solving Geodesy Main Problems)
8 Coordinate Transformations (2D and 3D)
9 Datum Transformation (Datum Shift)
10 Coordinate Transformation between Projection Zones</td></tr>
<tr><td>References</td><td colspan="2">Main References :

Additional References :</td></tr>
</table>

Lecturer	Dr. Eko Yuli Handoko, ST, MT Ira Mutiara Anjasmara, ST, M.Phil, Ph.D Akbar Kurniawan, ST, MT Putra Maulida, ST, MT, 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 (%)**
		Indicator	**Criteria**	**Offline**	**Online**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Able to explain and distinguish various coordinate systems used in the field of geodesy / geomatics		Completeness of material, depth of explanation, accuracy of answers, effectiveness of communication, accuracy of attitude	Lecture Teacher-Centered Learning 2 x 50' Discussion Student-Centered Learning 1 x 50' Practice / Quiz Problem-based learning 1 x 50'		Introduction (geodesy science review) Coordinate System 1. Coordinate system parameters 2. 2-dimensional coordinate system (cartesian, polar, conversion between coordinate systems) 3. 3-dimensional coordinate system (geocentric cartesian, topocentric cartesian, sphere, ellipsoid)	5

2	Able to explain the concept of spherical and ellipsoidal geometry, as well as perform calculations on the plane of the sphere and ellipsoida		Completeness of material, depth of explanation, effectiveness of communication, accuracy of answers, accuracy of attitude	Lecture Teacher-Centered Learning 2 x 50' Discussion Student-Centered Learning 1 x 50' Practice / Quiz Problem-based learning 1 x 50'		1. Spherical geometry (plane of the ball wedge, angle on the ball, spherical triangle, arc distance) 2. Ellipsoidal geometry (longitude, geodetic and geocentric latitude, ellipsoidal parameters, radius on ellipsoid, parallel distance, meridian distance, geodesic, and normal slice)	5
3	Able to explain the concept of geodesy reference system / datum		Completeness of material, depth of explanation, effectiveness of communication, accuracy of attitude, accuracy of application	Lecture Teacher-Centered Learning 2 x 50' Discussion Student-Centered Learning 1 x 50' Practice / Quiz Problem-based learning 1 x 50'		Geodesy Datum 1. Reference System and Terms of Reference 2. Understanding Geodesy Datum 3. Global Geodesy Datum (GRS80, WGS84, ITRF, etc) 4. Local Geodesy Datum	5

						(National Datum in Indonesia: Genuk, Monconglowe, ID74, DGN95, SRGI2013)	
4-5	Able to explain the concept of map projection, distinguish types of map projections, and determine projections appropriate for specific applications		Completeness of the material, depth of explanation, effectiveness Communication,accuracy of attitude, accuracy of answers	Lecture Teacher-Centered Learning 4 x 50' Discussion Student-Centered Learning 2 x 50' Practice / Quiz Problem-based learning 2 x 50'		Map Projection 1. Introduction to Map Projection (definition, provision, linear distortion, point scale factor) 2. Map Projection Classification and Selection - According to the projection field used (azimuthal, cone, cylinder) - According to the position of the axis of plane symmetry Projections used (normal, oblique, traversal) - According to the position of the projection plane against the earth (cut, offend)	25

						- According to geometric terms (equidistan, conform, equivalent) 3. Map Projections used in Indonesia - Polyeder projection - Mercator Projection (UTM, TM-3°)	
6	Able to reduce geodetic size (angle and distance) from ellipsoidal plane to projection plane / flat plane		Completeness of the material, depth of explanation, effectiveness of communication, accuracy of answers, accuracy of attitude	Lecture Teacher-Centered Learning 2 x 50' Discussion Student-Centered Learning 1 x 50' Practice / Quiz Problem-based learning 1 x 50'		Calculations on the projection plane - Grid Convergence - Correction of curvilinear distance to arc distance (arc-to-cord correction) - Convert Azimuth to Department Corner and vice versa	5
7	Able to perform geodetic calculations above the ellipsoidal plane and projection plane / flat plane		Completeness of material, depth of explanation, effectiveness of communication, accuracy of answers, accuracy of attitude	Lecture Teacher-Centered Learning 2 x 50' Discussion Student-Centered Learning 1 x 50' Practice / Quiz		Calculations on the Ellipsoidal Plane (Geodesy Main Problem Solving) 1. Direct Problem (SPG 1) 2. Inverse Problem (SPG 2)	5

				Problem-based learning 1 x 50'			
8	**Midterm Evaluation / Midterm Exam**						50
9	Able to explain the basic concepts of coordinate transformation and distinguish various coordinate transformation methods		Completeness of the material, depth of explanation, effectiveness of communication, accuracy of answers, accuracy of attitude	Lecture Teacher-Centered Learning 2 x 50' Discussion Student-Centered Learning 1 x 50' Practice / Quiz Problem-based learning 1 x 50'		Coordinate Transformation 1. Understanding and purpose of coordinate transformation 2. Coordinate transformation parameters (translation, rotation, scale) 2-dimensional Coordinate Transformation 1. 2D Conform Transformation 2. 2D Affine Transformation	10
10-12	Able to calculate 2-dimensional and 3-dimensional coordinate transformations in the field of geodesy / geomatics		Completeness of material, depth of explanation, effectiveness of communication, accuracy of answers, accuracy of attitude	Lecture Teacher-Centered Learning 6 x 50' Discussion Student-Centered Learning 3 x 50'		3-dimensional Coordinate Transformation 1. Transformation between Coordinate Systems Geodetic and Cartesian Coordinates	25

				Practice / Quiz Problem-based learning 3 x 50'		-Bowring Forward (Geodetic to Cartesian) -Bowring Reverse (Cartesian to Geodetic) 2. Transformation between Projection Coordinate System and Geodetic Coordinates -Use tables -Using Redfearn formulas 3.Transformation between Geodetic and Geocentric Coordinate Systems 4.Transformations between Coordinate Systems Geocentric and Topocentric	
13-14	Able to explain the concept of transformation between datums and perform datum transformation calculations		Completeness of material, depth of explanation, effectiveness of communication, accuracy of	Lecture Teacher-Centered Learning 4 x 50' Discussion Student-Centered Learning		Datum Transformation (Datum Shift) - Understanding and purpose of datum transformation	10

			answers, accuracy of attitude	2 x 50' Practice / Quiz Problem-based learning 2 x 50'		- Wolf Exchange Conform Transformation - Molodensky-Badekas Konform transformation	
15	Able to perform coordinate transformations between zones in a specific projection coordinate system		Completeness of material, depth of explanation, effectiveness of communication, accuracy of answers, accuracy of attitude	Lecture Teacher-Centered Learning 2 x 50' Discussion Student-Centered Learning 1 x 50' Practice / Quiz Problem-based learning 1 x 50'		Coordinate Transformation between Projection Zones - On UTM projection - At TM-3° projection	5
16	**Final Semester Evaluation / Final Semester Examination**						**100**