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

SEMESTER LEARNING PLAN (SLP)

COURSE NAME	**CODE**	**COURSE GROUP**	**CREDITS (SKS)**		**SEMESTER**	**Date of Preparation**
Linear Algebra	CM234101		**T=2**	**P=1**		-

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, surveying, hydrography, remote sensing, photogrammetry, geographic information systems, and cadastral to gain a thorough. understanding of the principles of engineering.
Course Learning Outcomes (CLO)	
CLO-1	Student able to calculate mathematical operation related to matrix and vector
CLO-2	Student able to understand and calculate an eigenvalue and eigenvector
CLO-3	Student able to understand and create a linear equation system by using its solution
CLO-4	Student able to create and complete an elementer row operation
CLO-5	Student able to understand and perform complex vector space calculations

Matrix ELO – CLO

CLO	ELO-4
CLO-1	V
CLO-2	V
CLO-3	V

		CLO-4 V CLO-5 V
Course Description	The course explains about matrices and vectors, eigenvalues and eigenvectors, System of Linear Equations (SPL) and their solutions, elementary row operations, as well as vector space complexes.	
Course Materials	1. Matrices 2. Vectors and Vector Spaces 3. Vector and Matrix Operations 4. Determinants, Transpose, and Inverse 5. Eigenvalues and Eigenvectors 6. Linear Systems of Equations (LSE) 7. Elementary Row Operations 8. Gauss and Gauss-Jordan Elimination 9. LU, Cholesky, and SVD (Singular Value Decomposition) 10. Complex Vector Spaces	
References	**Main:**	
	1. Howard Anton and Chris Rorres, 2005, Elementary Linier Algebra, John Wiley & Sons 2. Larson, Edwards, and Falvo, 2009, Elementary Linier Algebra, Houghton Mifflin Harcourt 3. Leslie Hogben, HANDBOOK OF LINEAR ALGEBRA SECOND EDITION, Taylor & Francis 4. R. Gunawan Santosa, 2009, Aljabar Linear Dasar, ANDI Yogyakarta	
	Additional:	
	1. Indah Emilia Wijayanti, Sri Wahyuni, dan Yeni Susanti, 2021, Dasar-Dasar Aljabar Linear dan Penggunaannya dalam Berbagai Bidang, UGM Press	
Lecturer	1. Dr-Ing.Noorlaila Hayati, S.T., M.T. 2. Cherie Bhekti Pribadi, S.T., M.T. 3. Dr. Filsa Bioresita, S.T., M.T.	
Prerequisite		

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	Students are able to explain the concept of matrices	Accuracy in able to explaining the concept of matrices	Completeness of material, depth of explanation, effectiveness of communication, accuracy of attitude	Lecture [1 x 50'] Discussion [1 x 50'] Exercise [1 x 50']		Syllabus explanation Lecture rules and regulations Introduction to linear algebra Matrices	5
2 – 3	Students are able to explain the concept of vectors and vector spaces	Accuracy in able to explaining the concept of vectors and vector spaces	Completeness of material, depth of explanation, effectiveness of communication, accuracy of attitude	Lecture [2 x 50'] Discussion [2 x 50'] Exercise [2 x 50'] Response Task		Vectors and vector spaces Vectors in R^2, R^3, R^n Basis and dimension Inner product spaces	15
4	Students are able to perform calculations involving vector and matrix operations	Accuracy in performing calculations involving vector and matrix operations	Completeness of material, depth of explanation, effectiveness of communication, accuracy of attitude	Lecture [1 x 50'] Discussion [1 x 50'] Exercise [1 x 50']		Matrix equations Matrix addition and subtraction Scalar multiplication and division of matrices Matrix multiplication	10
5	Students are able to perform calculations of determinants, transpose, and inverse	Accuracy in performing calculations of determinants, transpose, and inverse	Completeness of material, depth of explanation, effectiveness of communication, accuracy of attitude	Lecture [1 x 50'] Discussion [1 x 50'] Exercise [1 x 50']		Determinant Transpose Inverse	10
6 – 7	Students are able to perform calculations of eigenvalues and eigenvectors	Accuracy in performing calculations of eigenvalues	Completeness of material, depth of explanation, effectiveness of communication,	Lecture [2 x 50'] Discussion [2 x 50'] Exercise [2 x 50'] Task-1		Eigenvalues and eigenvectors Diagonalization Orthogonal	10

		and eigenvectors	accuracy of attitude			diagonalization and symmetric matrices	
8	**Midterm Evaluation / Midterm Exam**						**50**
9	Students are able to explain and construct linear systems of equations (LSE)	Accuracy in explaining and construct linear systems of equations (LSE)	Completeness of material, depth of explanation, effectiveness of communication, accuracy of attitude	Lecture [1 x 50'] Discussion [1 x 50'] Exercise [1 x 50'] Response Task		Geometric meaning of linear systems Homogeneous linear systems	5
10	Students are able to explain and perform elementary row operations	Accuracy in explaining and perform elementary row operations	Completeness of material, depth of explanation, effectiveness of communication, accuracy of attitude	Lecture [1 x 50'] Discussion [1 x 50'] Exercise [1 x 50']		Row echelon matrices Solving linear systems using elementary row operations	5
11	Students are able to explain and perform Gauss and Gauss-Jordan elimination	Accuracy in explaining and performing Gauss and Gauss-Jordan elimination	Completeness of material, depth of explanation, effectiveness of communication, accuracy of attitude	Lecture [1 x 50'] Discussion [1 x 50'] Exercise [1 x 50']		Matrix reduction Diagonal matrices Gauss and Gauss-Jordan elimination	10
12 – 13	Students are able to explain LU, Cholesky, and SVD (Singular Value Decomposition) decomposition	Accuracy in explaining LU, Cholesky, and SVD (Singular Value Decomposition) decomposition	Completeness of material, depth of explanation, effectiveness of communication, accuracy of attitude	Lecture [2 x 50'] Discussion [2 x 50'] Exercise [2 x 50'] Task - 2		LU decomposition – non-singular matrices, L matrix, and U matrix Cholesky decomposition – matrix factorization, forward and backward substitution Projection matrices, Singular Value	15

						Decomposition, and Least Squares	
14 – 15	Students are able to explain complex vector spaces	Accuracy in explaining complex vector spaces	Completeness of material, depth of explanation, effectiveness of communication, accuracy of attitude	Lecture [2 x 50’] Discussion [2 x 50’] Exercise [2 x 50’]		Complex numbers Conjugation and division of complex numbers Polar form and DeMoivre's Theorem Complex vector spaces and inner products Unitary and Hermitian matrices	15
16	**Final Semester Evaluation / Final Semester Examination**						**100**