	Universitas Negeri Surabaya **Faculty of Engineering,** **Undergraduate Study Program in Informatics Engineering**	**Document Code**

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Linear and Matrix Algebra	5520203002		T=3	P=0	ECTS=4.77	1	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	PLO-1	Able to analyze complex computing problems to identify technology project management solutions in the field of informatics/computer science by considering insights into the development of transdisciplinary science (KNO-01)
	PLO-4	Have the ability to work in a team (SKI-01)
	Program Objectives (PO)	
	PO - 1	Students can complete Matrix Operations
	PO - 2	Students can complete Systems of Linear Equations
	PO - 3	Students can complete Vector Operations
	PO - 4	Students can complete Numerical Linear Algebra
	PO - 5	Students are able to implement linear algebra theory using software (Matlab)
	PLO-PO Matrix	

P.O	PLO-1	PLO-4
PO-1		
PO-2		
PO-3		
PO-4		
PO-5		

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PO-1																
PO-2																
PO-3																
PO-4																
PO-5																

Short Course Description	The Linear Algebra course is a course with a basis in Mathematics, which is taught to support other courses in the departments of MI (Information Management), PTI (Information Technology Education), SI (Information Systems) and IT (Information Engineering).	
References	**Main :**	

	1. Kolman, Bernard. 2004.Elementary Linear Algebra. NewJearsey: Prentice Hall 2. Anton, Howard. 2010.Elementary Linear Algebra.John Wiley & Sons, Inc 3. ElementaryLinear Algebra.The SailorFoundation. 4. Matthews, K. R. 2013.ElementaryLinear Algebra.University of Queensland. 4. Sibaroni,Yuliant. 2002Buku Ajar Aljabar Linear. STT Telkom
	Supporters:
	1. Sibaroni,Yuliant. 2002Buku Ajar Aljabar Linear. STT Telkom
Supporting lecturer	Dr. Yuni Yamasari, S.Kom., M.Kom. Naim Rochmawati, S.Kom., M.T.

Week-	**Final abilities of each learning stage (Sub-PO)**	**Evaluation**		**Help Learning, Learning methods, Student Assignments, [Estimated time]**		**Learning materials [References]**	**Assessment Weight (%)**
		Indicator	**Criteria & Form**	**Offline (*offline*)**	**Online (*online*)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Understand the concept of matrices and be able to operate matrices	1. Explain the concept of a matrix 2. Explain the types of matrices 3. Be able to complete matrix operations 4. Explain the properties of matrix operations	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises		**Material:** 1. Explain the concept of a matrix 2. Explain the types of matrices 3. Be able to complete matrix operations 4. Explain the properties of matrix operations **Reader:** *Sibaroni, Yuliant. 2002Textbook of Linear Algebra. STT Telkom*	5%
2	Determining the inverse of a matrix	1. Explain the meaning of matrix inverse 2. Explain the properties of matrix inverse 3. Find the inverse of a matrix of order 2x2 4. Find the inverse of a matrix of order nxn with a cofactor matrix 5. Find the inverse of a matrix of order nxn with elementary row transformations	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 6 X 50 exercises		**Material:** Explaining the meaning of inverse matrix **References:** *Kolman, Bernard. 2004. Elementary Linear Algebra. NewJearsey: Prentice Hall*	5%
3	Determining the inverse of a matrix	1. Explain the meaning of matrix inverse 2. Explain the properties of matrix inverse 3. Find the inverse of a matrix of order 2x2 4. Find the inverse of a matrix of order nxn with a cofactor matrix 5. Find the inverse of a matrix of order nxn with elementary row transformations	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 6 X 50 exercises		**Material:** Explaining the meaning of inverse matrix **References:** *Kolman, Bernard. 2004. Elementary Linear Algebra. NewJearsey: Prentice Hall*	5%

4	Determining the determinant of a matrix	1. Explain the meaning of determinant 2. determine the value of the determinant of a matrix of order 2x2 3. determine the value of the determinant of a matrix of order 3x3 4. explain the properties of the determinant 5. determine the value of the determinant of a matrix of order nxn with a cofactor matrix 6. determine the value of the determinant of a matrix of order nxn with row transformation elementary (TBE)	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values **Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 6 X 50 exercises		**Material:** Explaining the meaning of determinant. **References:** *Kolman, Bernard. 2004. Elementary Linear Algebra. NewJearsey: Prentice Hall*	5%
5	Determining the determinant of a matrix	1. Explain the meaning of determinant 2. determine the value of the determinant of a matrix of order 2x2 3. determine the value of the determinant of a matrix of order 3x3 4. explain the properties of the determinant 5. determine the value of the determinant of a matrix of order nxn with a cofactor matrix 6. determine the value of the determinant of a matrix of order nxn with row transformation elementary (TBE)	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values **Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 6 X 50 exercises		**Material:** Explaining the meaning of determinant. **References:** *Kolman, Bernard. 2004. Elementary Linear Algebra. NewJearsey: Prentice Hall*	5%
6	Can determine the solution of SPL (System of Linear Equations)	1. Explain the meaning of SPL 2. Explain the types of SPL 3. Explain the types of SPL solutions 4. Determine the SPL solution with 2 equations and 2 variables 5. Determine the SPL solution with n equations and n variables using the matrix method 6. Determine the solution SPL with n equations and n variables using the Cramer method 7. Determine the solution of SPL with n equations and n variables using the TBE method	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values **Form of Assessment** : Project Results Assessment / Product Assessment	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises			5%
7	Students can complete Homogeneous SPL and SPL where there are many equations with many variables	1. Determine the SPL solution where there are many equations for the number of variables. 2. Determine the homogeneous SPL solution	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises			5%

8	Can determine the solution to SPL using Matlab and can use SPL for everyday problems	1. Able to operate Matlab 2. Determine SPL solutions using Matlab 3. Solve SPL with everyday problem cases	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises			15%
9	Can determine the solution to SPL using Matlab and can use SPL for everyday problems	1. Able to operate Matlab 2. Determine SPL solutions using Matlab 3. Solve SPL with everyday problem cases	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises			5%
10	Understand vector concepts and be able to operate vectors	1. Explain the meaning of vector 2. Explain how to express vectors 3. Explain equivalent vectors, zero vectors and negative vectors 4. Complete vector operations - Addition of vectors - Subtraction of vectors - Multiplication of vectors with scalars 5. Explain the properties of vector operations 6. Explain norms vector	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values **Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises			5%
11	Able to operate vectors	1. Explain the operation of multiplying vector dot product and cross product 2. Determine the angle between two vectors 3. Implement recursion in several cases	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values **Form of Assessment** : Project Results Assessment / Product Assessment	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises			5%
12	Determining the general vector space from a set of vectors	1. Explaining real vector spaces 2. Explaining subspaces 3. Explaining linear combinations 4. Building/stretching 5. Linear independence 6. basis	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises			5%
13	Students can use PGS to change non-orthonormal bases into orthonormal bases	1. Explain orthogonal sets and orthonormal sets 2. Explain the Gram Schmidt process	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises			5%
14	Can determine Linear Transformation, Kernel and Range of a vector	1. Explain Linear transformation 2. Explain Kernel and range	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values **Form of Assessment** : Project Results Assessment / Product Assessment	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises			5%

15	Can determine the eigenvalues and eigenvectors of a matrix	1. Explaining eigenvalues 2. Explaining eigenvectors 3. Determining eigenvalues and vectors	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises			5%
16	Can determine the eigenvalues and eigenvectors of a matrix	1. Explaining eigenvalues 2. Explaining eigenvectors 3. Determining eigenvalues and vectors	**Criteria:** Cognitive Values, Character Values, and Psychomotor Values **Form of Assessment** : Project Results Assessment / Product Assessment	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises			15%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	30%
2.	Project Results Assessment / Product Assessment	45%
		75%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.