	Universitas Negeri Surabaya Faculty of Engineering, Bachelor of Information Systems Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Linear and Matrix Algebra	5720103001	Compulsory Study Program Subjects	T=3	P=0	ECTS=4.77	1	February 26, 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

Program Objectives (PO)

PO - 1	Students can complete matrix operations
PO - 2	Students can solve 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
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. Elementary Linear Algebra.The SailorFoundation. 4. Matthews, K. R. 2013.ElementaryLinear Algebra.University of Queensland.
4. Sibaroni,Yuliant. 2002. Buku Ajar Aljabar Linear. STT Telkom

Supporters:

Supporting lecturer	Dr. Yuni Yamasari, S.Kom., M.Kom. Aries Dwi Indriyanti, S.Kom., M.Kom.

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 matrix concepts and be able to operate matrices	1.1. Explain the concept of a matrix 2.2. Explain the types of matrices 3.3. Able to complete matrix operations 4.4. Explain the properties of matrix operations	**Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises	Observe the power point about matrix material and explore the operations of the 3 X 50 matrix	**Material:** Matrix concept **References:** *Sibaroni, Yuliant. 2002. Textbook of Linear Algebra. STT Telkom*	4%
2	Determining the inverse of a matrix	1.1. Explain the meaning of matrix inverse 2.2. Explain the properties of inverse matrices 3.3. Find the inverse of a matrix of order 2x2 4.4. Find the inverse of a matrix of order nxn with a cofactor matrix 5.5. Find the inverse of a matrix of order nxn with elementary row transformation	**Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 6 X 50 exercises	Observe power points about inverse matrix material and ask questions about inverse matrix material through discussion of the results of observations 6 X 50	**Material:** Inverse matrix **Reader:** *Sibaroni, Yuliant. 2002. Textbook of Linear Algebra. STT Telkom*	4%
3	Determining the inverse of a matrix	1.1. Explain the meaning of matrix inverse 2.2. Explain the properties of inverse matrices 3.3. Find the inverse of a matrix of order 2x2 4.4. Find the inverse of a matrix of order nxn with a cofactor matrix 5.5. Find the inverse of a matrix of order nxn with elementary row transformation	**Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 6 X 50 exercises	Exploring matrix inverses and connecting matrix inverses with different orders - as well as analyzing different ways of determining the determinants of matrices that have different orders 6 X 50	**Material:** Inverse matrix **Reader:** *Sibaroni, Yuliant. 2002. Textbook of Linear Algebra. STT Telkom*	4%

4	Determining the determinant of a matrix	1. 1. Explain the meaning of determinant 2. 2. Determine the value of the determinant of a matrix of order 2x2 3. 3. determine the value of the determinant of the matrix of order 3x3 4. 4. explain the properties of determinants 5. 5. determine the value of the determinant of the nxn order matrix with the cofactor matrix 6. 6. determine the value of the determinant of a matrix of order nxn using elementary row transformation (TBE)	**Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 6 X 50 exercises	Observe the power point on matrix determinant material and explore the determinant of the 6 X 50 matrix	**Material:** Matrix determinants **References:** *Kolman, Bernard. 2004. Elementary Linear Algebra. NewJearsey: Prentice Hall*	4%
5	Determining the determinant of a matrix	1. 1. Explain the meaning of determinant 2. 2. Determine the value of the determinant of a matrix of order 2x2 3. 3. determine the value of the determinant of the matrix of order 3x3 4. 4. explain the properties of determinants 5. 5. determine the value of the determinant of the nxn order matrix with the cofactor matrix 6. 6. determine the value of the determinant of a matrix of order nxn using elementary row transformation (TBE)	**Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 6 X 50 exercises	Connecting the determinants of matrices with different orders and analyzing the differences in how to determine the determinants of matrices that have different orders and presenting them 6 X 50	**Material:** Matrix determinants **References:** *Kolman, Bernard. 2004. Elementary Linear Algebra. NewJearsey: Prentice Hall*	4%
6	Can determine the solution of SPL (System of Linear Equations)	1. 1. Explain the meaning of SPL 2. 2. Explain the types of SPL 3. 3. Explain the types of SPL settlement 4. 4. Determine the SPL solution with 2 equations and 2 variables 5. 5. Determine the SPL solution with n equations and n variables using the matrix method 6. 6. Determine the SPL solution with n equations and n variables using the Cramer method 7. 7. Determine the SPL solution with n equations and n variables using the TBE method	**Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises	Exploring SPL 3 X 50	**Material:** Systems of Linear Equations **References:** *Anton, Howard. 2010.Elementary Linear Algebra.John Wiley & Sons, Inc*	5%

7	Students can complete Homogeneous SPL and SPL where there are many equations with many variables	1.1. Determine the SPL solution where there are many equations for the number of variables 2.2. Determine the homogeneous SST solution	**Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises	Exploring Homogeneous SPL and SPL where the number of equations is 3 X 50 variables	**Material:** Systems of Linear Equations **References:** *Anton, Howard. 2010.Elementary Linear Algebra.John Wiley & Sons, Inc*	5%
8	Can determine the solution to SPL using Matlab and can use SPL for everyday problems	1.1. Able to operate Matlab 2.2. Determine the SPL solution using Matlab 3.3. Completing SPL with daily problem cases	**Form of Assessment** : Test	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises	Exploring SPL using Matlab 3 X 50	**Material:** Systems of Linear Equations **References:** *Anton, Howard. 2010.Elementary Linear Algebra.John Wiley & Sons, Inc*	20%
9	Students work on UTS questions	UTS	**Criteria:** UTS **Form of Assessment** : Participatory Activities	UTS 1 X 1	UTS 1 X 1	**Material:** UTS **Library:**	4%
10	Understand vector concepts and be able to operate vectors	1.1. Explain the meaning of vector 2.2. Explain how to represent vectors 3.3. Explain equivalent vectors, zero vectors and negative vectors 4.4. Complete vector operations - Addition of vectors - Subtraction of vectors - Multiplication of vectors with scalars 5.5. Explain the properties of vector operations. 6. Explain vector norms	**Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises	Observe the power point about vector material and ask questions about vector material through discussion of the results of observations 3 X 50	**Material:** equivalent vectors, zero vectors and negative vectors **Library:** *Elementary Linear Algebra. The SailorFoundation. 4. Matthews, KR 2013. ElementaryLinear Algebra. University of Queensland.*	4%
11	Able to operate vectors	1.1. Explain the vector dot product and cross product multiplication operations 2.2. Determine the angle between two vectors 3.3. Implement recursion in some cases	**Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises	Explore the 3 X 50 vector	**Material:** Vector **Library:** *Elementary Linear Algebra. The SailorFoundation. 4. Matthews, KR 2013. ElementaryLinear Algebra. University of Queensland.* **Material:** multiplication of vector dot product and cross product **Library:** *Elementary Linear Algebra. The SailorFoundation. 4. Matthews, KR 2013. ElementaryLinear Algebra. University of Queensland.*	4%

12	Determining the general vector space from a set of vectors	1.1. Explain real vector space 2.2. Explain subspace 3.3. Explain linear combinations 4.4. Building/stretching 5.5. Non-linear 6.6. base	**Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises	Presenting the results of the 3 X 50 vector material exercise	**Material:** general vector space from a set of vectors **Library:** *Elementary Linear Algebra.The SailorFoundation. 4. Matthews, KR 2013. ElementaryLinear Algebra. University of Queensland.*	4%
13	Students can use PGS to change non-orthonormal bases into orthonormal bases	1.1. Explain orthogonal sets and orthonormal sets 2.2. Explain the Gram Schmidt Process	**Form of Assessment** : Participatory Activities	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises	Observe power points about the Gram Schmidt Process material and ask questions about the Gram Schmidt Process material through discussion of the results of their observations 3 X 50	**Material:** Gram Schmidt Process **Library:** *Elementary Linear Algebra. The SailorFoundation. 4. Matthews, KR 2013. ElementaryLinear Algebra. University of Queensland.*	5%
14	Can determine Linear Transformation, Kernel and Range of a vector	1.1. Explain Linear transformation 2.2. Explain Kernel and range	**Form of Assessment** : Practical Assessment	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises	Explore Linear Transformation, Kernel and Range of a vector and analyze it 3 X 50	**Material:** Linear Transformation, Kernel and Range of a vector **Library:** *Elementary Linear Algebra.The SailorFoundation. 4. Matthews, KR 2013. ElementaryLinear Algebra. University of Queensland.*	4%
15	Can determine the eigenvalues and eigenvectors of a matrix	1.1. Explain eigenvalues 2.2. Explain eigenvectors 3.3. Determine the values and eigenvectors	**Form of Assessment** : Practical Assessment	Approach: Scientific Model: Cooperative Method: Discussion, Presentation and 3 X 50 exercises	Explore eigenvalues and eigenvectors and present the results of the exercise to determine 3 X 50 eigenvalues and vectors	**Material:** Determining the eigenvalues and eigenvectors of a matrix. **Library:** *Elementary Linear Algebra. The SailorFoundation. 4. Matthews, KR 2013. ElementaryLinear Algebra. University of Queensland.*	5%
16	Students work on UAS questions	UTS	**Criteria:** UTS **Form of Assessment** : Test	UAS 1 X 1	UAS 1 X 1	**Material:** UAS **Literature:**	20%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	51%
2.	Practical Assessment	9%
3.	Test	40%
		100%

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** abilities in the process and student learning outcomes are specific and measurable statements that identify the abilities 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.