SEMESTER STUDY PLAN
APPLICATION OF LINEAR ALGEBRA I
(ELECTIVE COURSE)
(Project Based Learning Method)

DEPARTMENT OF MATHEMATICS AND DATA SCIENCE
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
UNIVERSITAS ANDALAS
2024

SEMESTER STUDY PLAN (SSP)
BACHELOR PROGRAM OF MATHEMATICS
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
UNIVERSITAS ANDALAS

Course Name	Course Code	URL *I-Learn*	Credits	Semester	Compilation Date
Application of Linear Algebra 1	MAT61212	https://sci.ilearn.unand.ac.id	3	3	May 2024

Person In Charge	Study Plan Creator	Head of Research Group	Head of Study Program
	Monika Rianti Helmi, M.Si	Nova Noliza Bakar, M.Si	Dr. Noverina Alfiany

Intended Learning Outcomes (ILO) and Performance Indicator (PI)		Intended Learning Outcomes
	ILO-3	An ability to identify, explain, and generalize simple mathematical PI-1: An ability to identify simple mathematical problems PI-2: An ability to explain simple mathematical problems
	ILO-4	An ability to use concepts and fundamental techniques of mathematics in solving simple mathematical problems PI-1: An ability to choose appropriate basic mathematical concepts and techniques in solving simple mathematical problems
	ILO-6	Have ability to data literacy and technology and can apply them in solving simple mathematical problems or other relevant fields PI-1: An ability to identify the right data and technology to solve simple mathematical problems or other fields
	ILO-7	An ability to communicate effectively especially in the area of mathematics in with diverse communities PI-1: An ability to convey ideas or study results orally, especially in the field of mathematics PI-2: An ability to present ideas or study results in writing, especially in the field of mathematics PI-3: An ability to respond to feedback given
	ILO-8	An ability to work in a team PI-1: An ability to actively participate in a team with full responsibility

		PI-2: An ability to respond well to any feedback within the team PI-3: An ability to complete tasks according to the set schedule PI-4: An ability to adapt in a team
	Course Learning Outcomes	
	1	Students are able to identify real problems related to the system of linear equations, matrices, determinants and vectors in 2-space and 3-space (**ILO-3**: PI-1, PI-2);
	2	Students are able to choose methods, data, data collection techniques, and basic techniques to solve problems related to the system of linear equations, matrices, determinants and vectors in 2-space and 3-space (**ILO-6**: PI-1)
	3	Students are able to use the concepts of the system of linear equations, matrices, determinants and vectors in 2-space and 3-space to solve real problems (**ILO-4**: PI-1);
	4	Students are able to analyze and evaluate research results (**ILO-6**: PI-1)
	5	Students are able to communicate the results of their research orally and in writing according to scientific principles. (**ILO-7** : PI-1, PI-2, PI-3);
	6	Students are able to work in teams (**ILO-8**)
Brief Description	This course will provide and discuss several applications of basic linear algebra theories, namely: systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space. Some applications related to the concepts of linear algebra and matrices include problems network analysis, forest management, input-output leontief, assignment problems, game theory and cryptography.	

<table>
<tr><td>Course Materials</td><td colspan="2">Applications of :
1. systems of linear equations
2. matrices
3. determinants
4. vectors in 2-space and 3-space
such as : network analysis, forest management, input-output leontief, assignment problems, game theory and cryptography.</td></tr>
<tr><td>References</td><td colspan="2">Main:
1. H. Anton & C. Rorres (2014). Elementary Linear Algebra. 11th edition. Wiley, USA
https://www.pdfdrive.com/elementary-linear-algebra-applications-version-11th-edition-e40154216.html
Additional:
2. Related articles or publications</td></tr>
<tr><td>Learning Media</td><td>Software:
● LMS Unand (http://fmipa.ilearn.unand.ac.id/)
● Zoom meeting
● Whatsapp</td><td>Hardware:
● Computer/Laptop
● Smartphone</td></tr>
<tr><td>Team Teaching</td><td colspan="2">1. Monika Rianti Helmi, M.Si
2. Dr. Yanita
3. Dr. Noverina Alfiany</td></tr>
<tr><td>Assessment</td><td colspan="2">Proposal, Project and Presentations</td></tr>
<tr><td>Required courses</td><td colspan="2">-Elementary Linear Algebra, Calculus 1, Calculus 2</td></tr>
<tr><td>Academic Norms</td><td colspan="2">https://akademik.unand.ac.id/images/2022-03-30%20Peraturan%20Rektor%20Nomor%207%20Tahun%202022%20Penyelenggaraan%20Pendidikan-khusus%20Bab%20II.pdf</td></tr>
</table>

Weekly Study Plan

Week	Course Outcomes (2)	Indicator (3)	Assessment (4)	Activities/Forms of Learning [Time estimated]					Subject, references (10)	Weight (11)
				Synchronous*		Asynchronous**		Media (9)		
				Face to face Offline (5)	Face to face Online (6)	Individual (7)	Collaboration (8)			
1-4	CLO-1 Students are able to identify real problems related to the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space (ILO-3: PI-1, PI-2);	• Accuracy in identifying problems related to to the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space • Accuracy in formulating problems related to to the systems of linear equations,	Project progress 5%	Teaching and discussion: Explanation of study plan and explanation of tasks Review and discussion of identification of problems and constraints of design project tasks		Students identify problems and seek information on observations of the surrounding environment about related problems related to to the systems of linear	Students discuss in group about identifying problems in the surrounding environment related to to the systems of linear equations, matrices, determinants, and vectors in	• PPT • I learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	• Study plan and contract • Problem Identification • Identify the need for proposed solutions to problems [1] and [2]	5%

		matrices, determinants, and vectors in 2-space and 3-space		[4 × 3 × 50 minutes]		equations, matrices, determinants, and vectors in 2-space and 3-space [4 × 3 × 60 minutes]	2-space and 3-space [4 × 3 × 60 minutes]			
5-7	CLO-2 Students are able to choose methods, data, data collection techniques, and basic techniques to solve problems related to to the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space (ILO-6: PI-1)	Accuracy in choosing methods, data, data collection techniques, data presentation techniques, and basic techniques for solving related problems related to to the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space	Project progress 5%	Students collect data, present data and determine basic techniques to solve problems related to to the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space Time allocation [3 x 3 x 60 minutes]		Students discuss in teams to determine problems and proposed solutions Time allocation [3 x 3 x 120 minutes]		• PPT • I learn •(Kondisi tertentu: Zoom meeting, WA group, video pembelajaran)	Review of to systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space References [1] and [2]	5%
8	CLO-1 Students are able to identify real problems related to to the systems of linear	• Accuracy in identifying problems related to to the systems of linear equations,	Research proposal report 5%	Students present research proposals, students discuss in groups, and provide		- Students look for references and learn about the	Students discuss in groups and ask for references for research	• PPT • I learn	- Research Proposal Report - Presentation of progress reports	5%

	equations, matrices, determinants, and vectors in 2-space and 3-space (ILO-3: PI-1, PI-2);	matrices, determinants, and vectors in 2-space and 3-space • Accuracy in formulating problems related to to the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space		suggestions and comments to the group that presents their research proposals Time allocation [1 x 3 x 50 minutes]		course material - Students do the assigned assignments Time allocation [1 x 3 x 60 minutes]	proposal improvements based on suggestions and input from other groups Time allocation [1 x 3 x 60 minutes]		(Introduction and Data) References [1] and [2]	
	CLO-2 Students are able to choose methods, data, data collection techniques, and basic techniques to solve problems related to the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space (ILO-6: PI-1)	• Accuracy in choosing methods, data, data collection techniques, data presentation techniques, and basic techniques for solving problems related to the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space	Research proposal and presentations 5%							5%
	CLO-5 Students are able to communicate the results of their research orally	Accuracy in communicating the result analysis orally (presentation) and in	Research proposal and presentation 5%							5

	and in writing according to scientific principles. (ILO-7 : PI-1, PI-2, PI-3)	the form of scientific articles								
9-10	CLO-3 Students are able to use the concepts of systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space (ILO-4: PI-1);	Accuracy in using related theoretical concepts related to the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space Accuracy in interpreting calculation results using concepts related to vector spaces, inner product spaces, eigenvalues and vectors, and linear formations	Research report 10%	Review and discussion of the use of concepts related to the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space to solve real problems [2 x 3 x 50 minutes]		Students find references and learn about the concepts related to the topic of the project Time allocation [2 x 3 x 60 minutes]	-Students discuss in groups about using the concepts of the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space to solve real problems Time allocation [2 x 3 x 60 minutes]	Ilearn	concepts of the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space to solve real problems	10%
11-12	CLO-4 Students are able to analyze and evaluate research results (ILO-6: PI-1)	Accuracy in analyzing and evaluating design results	Progress report 10%	Discussion of analysis and evaluation of the final results of the study [2 x 3 x 50 minutes]		Students conduct research final results evaluation activities based on the results of team discussions [2 x 3 x 60 minutes]	Students work in teams to evaluate research results [2 x 3 x 60 minutes]	Ilearn	Stages and Review of the final results of the study	10%
	CLO-6 Students are able to work in teams (ILO-8)	The ability of students to work in teams	Progress report 5%							5%

13-15	CPLO-5 Students are able to communicate the results of their research orally and in writing according to scientific principles. (ILO-7 : PI-1, PI-2, PI-3)	Accuracy in communicating the result analysis orally (presentation) and in the form of scientific articles	Research report 10%	Kuliah dan diskusi - Penjelasan materi kuliah - penjelasan tugas [3 x 3 x 50 minutes]		Presentation project Time allocation [3 x 3 x 60 minutes]	Students refine reports based on feedback Time allocation [3 x 3 x 60 minutes]	Ilearn, zoom	Presentation project	10%
	CLO-6 Students are able to analyze and evaluate research results (ILO-6: PI-1)	The ability of students to work in teams	Research report and presentation 10%							10%
16	CLO-3 Students are able to use the concepts of systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space to solve real problems (ILO-4: PI-1);	Accuracy in using theoretical concepts related to the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space Accuracy in interpreting calculation results using concepts to the systems of linear equations, matrices, determinants, and vectors in 2-space and 3-space	Final report 10%	Project Presentation Time allocation [3 x 3 x 50 minutes]		Students refine reports based on feedback Time allocation [3 x 3 x 60 minutes]	Students discuss report improvements based on feedback Time allocation [3 x 3 x 60 minutes]	Ilearn	Project Report Poster Article	10%

	CLO-4 Students are able to analyze and evaluate research results (ILO-6: PI-1)	Accuracy in analyzing and evaluating design results	Final report 5%							5%
	CLO-5 Students are able to communicate the results of their research orally and in writing according to scientific principles. (ILO-7 : PI-1, PI-2, PI-3)	Accuracy in communicating analysis results orally (presentation) and in the form of scientific articles	Final report 5%							5%
	CLO-6 Students are able to work in teams (ILO-8)	The ability of students to work in teams	Final report 5%							5%

1 credit = 50 minutes face-to-face meeting, 60 minutes structured study, 60 minutes independent study
Each meeting duration is 2 credits = 2×50 minutes

Indicators, Criteria, and Assessment Weights

1. Assessment weight for each Assessment

NO	Assessment	Weight (%)
1	Proposal (progress and report)	20
2	Presentation	20
3	Project (progress, report, article and poster)	60
TOTAL		**100**

2. Assessment weight for Intended Learning Outcome
   - CLO-1: 10 %
   - CLO-2: 10 %
   - CLO-3: 20 %
   - CLO- 4: 20 %
   - CLO-5: 20 %
   - CLO-6: 20%

Assessment Plan Table:

No.	CLO	Assesment			Weigth (%)
		Proposal (progress and report)	Project (progress, report, article and poster)	Presentation	
1	Students are able to identify real problems related to vector spaces, inner yield spaces, values and eigenvectors, and linear formations (ILO-3: PI-1, PI-2)	10%			10,0%
2	Students are able to choose methods, data, data collection techniques, and basic techniques to solve problems related to vector spaces, deep yield spaces, values and eigenvectors, and linear formations (ILO-6: PI-1)	10%			10,0%
3	Students are able to use the concepts of vector space, inner product space, value and eigenvector, and linear transformation to solve real problems (ILO-4: PI-1)		20,0%		20%
4	Students are able to analyze and evaluate research results (ILO-6: PI-1)		20,0%		20%
5	Students are able to communicate the results of their research orally and in writing according to scientific principles. (ILO-7 : PI-1, PI-2, PI-3);		15,0%	10%	20%
6	Students are able to work in teams (ILOP-8)	5%	5%	10,0%	20%
	Total	5,0%	60,0%	20,0%	**100,0 %**

Information:
TK: Group ask

Matrix of CLO and ILO

CLO	ILO																															
	1			**2**			**3**			**4**			**5**				**6**					**7**			**8**				**9**			
	PI			**PI**			**PI**			**PI**			**PI**				**PI**					**PI**			**PI**				**PI**			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	1	2	3	4	5	1	2	3	1	2	3	4	1	2	3	4
1							✓	✓																								
2																	✓															
3										✓																						
4																	✓															
5																						✓	✓	✓								
6																									✓	✓	✓	✓				