SEMESTER STUDY PLAN
ANALYTICAL GEOMETRY
(COMPULSORY COURSE)
Case-Based Method

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

SEMESTER STUDY PLAN (SSP)
STUDY PROGRAM S 1 MATHEMATICS
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
UNIVERSITAS ANDALAS

Course Name	Course Code	*I-Learn* Course URL	Credits	Semester	Compilation Date
ANALYTICAL GEOMETRY	MAT62121	https://sci.ilearn.unand.ac.id	4	2	March 27, 2023

Person in Charge	Study Plan Creator	Head of Research Group	Head of the study program
	Efendi, M.Si Budi Rudianto, M.Si	Dr. Haripamyu	Dr. Arrival Rince Putri

Intended Learning Outcomes (ILO) and Performance Indicators (PI)	Intended Learning Outcomes	
	ILO-2	Possesses profound knowledge of the basic concepts of mathematics PI-1: An ability to explain the basic concepts of mathematics PI-2: An ability to give examples related to the basic concepts of mathematics PI-3: An ability to determine solutions of the simple problems using the basic concept of mathematics
	ILO-3	An ability to identify, explain and generalize simple mathematics problems PI-1: An ability to identify simple mathematical problems PI-2: An ability to explain simple mathematical problems PI-3: An ability to generalize 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 PI-2: An ability to illustrate simple mathematical problems based on appropriate basic mathematical concepts and techniques

		PI-3: An ability to solve simple mathematical problems using appropriate basic mathematical concepts and techniques
	ILO-5	An ability to formally and correctly prove a simple mathematical statement using facts and methods that have been studied PI-1: An ability to identify the formal structures and analogous forms in mathematics PI-2: An ability to use facts and apply methods in proving simple mathematical statements PI-3: An ability to present simple mathematical statements proof rigorously (sequentially and consistently) PI-4: An ability to conclude or interpret the results of the proving simple mathematical statement
	ILO-6	Have ability 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 PI-2: An ability to use data and technology and apply them to solve simple mathematical statements or other areas PI-3: An ability to process data using available technology in simple mathematical problems or other fields PI-4: An ability to conclude and interpret data processing results for simple mathematical problems or other fields PI-5: An ability to design an algorithm 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
	Course Learning Outcomes (CLO)	

	1. Students are able to advanced theoretical concepts, especially related to the definition and basic properties of conic sections, translation and rotation and determine the equations of conic sections in Cartesian coordinates and draw sketches. (CP-2: PI-1)
	2. Students are able to master the concept of curve parameterization and curvature of curves in a plane, equations in polar coordinates and calculus in polar coordinates. CP-2: PI-1)
	3. Students are able to generalize plane geometry problems into three-dimensional space geometry. CP-3: PI-1, PI-2)
	4. Students are able to identify and explain problems related to plane equations, distance, area, volume. (CP 4: PI-2, PI-3)
	5. Students are able to solve geometric problems on planes and space using mathematical software (CP-6: PI-1- PI-4)
	6. Students are able to communicate the results of their thoughts and work both orally and in writing. (CP-7: PI-2)
Brief description of Course	This course discusses analytical geometry of planes and space. Lectures start with an introduction to analytical geometry, conic section equations , translation, rotation, representation of parametric equations of curves on a plane. Towards the mid-semester evaluation, calculus topics in polar coordinates were discussed. After the mid-semester evaluation, we were introduced to Cartesian coordinates in three-dimensional space, vectors, dot products and cross products, vector-valued functions and curvilinear motion, lines and tangents in three-dimensional space, and surfaces in three-dimensional space. Towards the end of semester evaluation, an introduction to cylindrical and spherical coordinates is given. To complement students' skills and abilities in communicating mathematically and using mathematical software, towards the end of the semester they are given group collaboration assignments related to topics in analytical geometry.
Study Materials /Sub-Study Materials	1. Analytical geometry of the Cartesian plane 2. Cone Slice 3. Translation and rotation of axes 4. Representation of parametric equations of curves on a plane

<table>
<tr><td></td><td colspan="2">5. Polar coordinate system
6. Equation of curves in polar coordinates and their graphs
7. Cartesian coordinates in three-dimensional space
8. Vectors, dot products and cross products
9. Vector valued functions and curvilinear motion
10. Lines and tangents in three-dimensional space
11. Surfaces in three-dimensional space
12. Cylindrical and spherical coordinates</td></tr>
<tr><td>References</td><td colspan="2">Main :
1. Dale Varberg, Edwin Purcell and Steve Rigdon, Calculus , Pearson, 2007, 9 th ed.
Additional:
1. E. J. Herman, G. Strang, Calculus Vol.2 , Openstax, 2016, https://openstax.org/details/books/calculus-volume-2
2. JR Hass, CE Heil, and MD Weir, Thomas`Calculus, Pearson Education, 2018, 14th ed .</td></tr>
<tr><td>Learning Media</td><td>Software :
• LMS Unand (https://sci.ilearn.unand.ac.id)
• Zoom meetings
• WhatsApp</td><td>Device hard :
• Computer/Laptop
• Smartphones</td></tr>
<tr><td>Team Teaching</td><td colspan="2">1. Efendi, M.Si
2. Budi Rudianto, M.Si</td></tr>
<tr><td>Required courses</td><td colspan="2">Calculus 1</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>

I. Weekly Lecture Plan

Week / Meet (1)	Course Outcomes (2)	Indicators (3)	Assessment (4)	Activities/Forms of Learning [Time estimated]				Media (9)	Subject, references (10)	Weight (11)
				Synchronous *		Asynchronous **				
				Face to face Offline (5)	Face to face Online (6)	Individual (7)	Collaborative (10)			
1/1	CLO 1 Students are able to master theoretical concepts, especially related to the definition and basic properties of conic sections, translation and rotation and determine the equations of conic sections in Cartesian coordinates and draw sketches.	• Discipline in carrying out college contracts • Accurate understanding of related material	MIDTERM EXAM (2%)	• SL - Introduction to RPS - Studying : concept explanation, discussion and question and answer course material [1 x 2x 50] minutes		A.M Students look for references according to the RPS and study lecture material: Analytical geometry of planes and space [2 x 2 x 60] minutes		LMS (ilearn UNAND)	• Introduction to College (Assessment Rules, RPS, Syllabus, Tuition Contract) • A glance at the geometry of planes and space [1]	**3%**

2/2	CLO 1 Students are able to master theoretical concepts, especially related to the definition and basic properties of conic sections, translation and rotation and determine the equations of conic sections in Cartesian coordinates and draw sketches.	Accurate understanding of related material	MIDTERM EXAM (2%)	• SL Studying : concept explanation discussion and question and answer course material [1 x 2 x 50 minutes]		A.M Students look for references and study material equations of circles and ellipses [2 x 2 x 60 minutes]		LMS (Ilearn UNAND)	Conic Slices: Equations of circles and ellipses [1]	**3%**
2/3	CLO 1 Students are able to master theoretical concepts, especially related to the definition and basic properties of conic sections, translation and rotation and determine the equations of conic sections in Cartesian	Accurate understanding of related material	MIDTERM EXAM (2%)		• elementary school Studying : concept explanation discussion and question and answer course material [1 x 2 x 50 minutes]	A.M Students look for references and study material on parabolic equations [2 x 2 x 60 minutes]		LMS (ilearn UNAND) Google Meet	Parabola equation [1]	**3%**

	coordinates and draw sketches.									
3/4	CLO 1 Students are able to master theoretical concepts, especially related to the definition and basic properties of conic sections, translation and rotation and determine the equations of conic sections in Cartesian coordinates and draw sketches.	Accurate understanding of related material	MIDTERM EXAM (3%)	● SL Studying : concept explanation discussion and question and answer course material [1 x 2 x 50 minutes]		A.M Students look for references and study material using TDK II and the substitution method to calculate definite integrals [2 x 2 x 60 minutes]		LMS (ilearn UNAND)	Hyperbola equation [1]	**3%**
4/5	CLO 2 Students are able to master the concepts of curve parameterization and curvature of	Accurate understanding of related material	MIDTERM EXAM (3%)	● SL Studying : concept explanation discussion and question		● A.M Students look for references and study material on parametric		LMS (ilearn UNAND)	Parametric equations and curvature of curves [1]	**3%**

	curves in a plane, equations in polar coordinates and calculus in polar coordinates .			and answer course material [1 x 2 x 50 minutes]		equations and curvature of curves [2 x 2 x 60 minutes]				
4/6	CLO 1 Students are able to master theoretical concepts, especially related to the definition and basic properties of conic sections, translation and rotation and determine the equations of conic sections in Cartesian coordinates and draw sketches.	Accurate understanding of related material	MIDTERM EXAM (3%)		● elementary school Studying : concept explanation discussion and question and answer course material [1 x 2 x 50 minutes]	● A.M Students look for references and study translation material [2 x 2 x 60 minutes]		LMS (ilearn UNAND) Google meet	Translation [1]	**3%**

5/7	CLO 1 Students are able to master theoretical concepts, especially related to the definition and basic properties of conic sections, translation and rotation and determine the equations of conic sections in Cartesian coordinates and draw sketches.	Accurate understanding of related material	MIDTERM EXAM (3%)	SL Studying : concept explanation discussion and question and answer course material [1 x 2 x 50 minutes] Tutorials [1 x 2 x 50 minutes]		A.M Students look for references and study material rotation [2 x 2 x 60 minutes]		LMS (ilearn UNAND)	Rotation [1]	**3%**
6/8	CLO 2 Students are capable master the concept of curve parameterization and curve curvature in the plane, equations in polar coordinates and calculus in polar coordinates .	Accurate understanding of related material	MIDTERM EXAM (4%)	SL Studying : concept explanation discussion and question and answer course material [1 x 2 x 50 minutes]		A.M Students look for references and study polar coordinates material [2 x 2 x 60] minutes		LMS (ilearn UNAND)	Polar coordinates [1]	**3%**
6/9	CLO 2 Students are able to master the concept of curve	Accurate understanding of related material	MIDTERM EXAM (4%)		SL Studying : concept explanation	AK Students look for references and study		LMS (ilearn UNAND)	Area in polar coordinates [1]	**8%**

	parameterization and curvature of curves in a plane, equations in polar coordinates and calculus in polar coordinates.		Task (5%)		discussion and question and answer course material [1 x 2 x 50 minutes]	material on areas in polar coordinates [2 x 2 x 60] minutes		Google meet		
7/10	CLO 2 Students are able to master the concept of curve parameterization and curvature of curves in a plane, equations in polar coordinates and calculus in polar coordinates.	Accurate understanding of related material Accuracy in answering quiz questions	MIDTERM EXAM (4%) Quiz (5%)	SL Studying : concept explanation discussion and question and answer course material [1 x 2 x 50 minutes]		A.M Students look for references and study material on the length of curves and tangent lines in polar coordinates [2 x 2 x 60] minutes		LMS (ilearn UNAND)	Length of curve and tangent line in polar coordinates [1]	**8%**
	MIDTERM EXAM (30%)									
8/11	CLO 3 Students are able to generalize plane geometry problems to three-dimensional space geometry.	• Accuracy in explaining and understanding related material	FINAL EXAM (3%) Quiz (5%)	Studying : concept explanation discussion and question and answer course material		Students look for references and study material on Cartesian coordinates in dimensional space three		LMS (ilearn UNAND)	Cartesian coordinates in dimensional space three [1]	**8%**

				[1 x 2 x 50] minutes		[2 x 2 x 60 minutes]				
8/12	CLO 4 Students are able to identify and explain problems related to plane equations, distance, area, volume	• Accuracy in explaining and understanding related material	FINAL EXAM (3%)	Studying : concept explanation discussion and question and answer course material [1 x 2 x 50] minutes		Students look for references and study material on vectors and dot products [2 x 2 x 60 minutes]		LMS (ilearn UNAND)	Vectors and dot products and cross products [1]	**3%**
9/13	CLO 3 Students are able to generalize plane geometry problems to three-dimensional space geometry.	• Accuracy in explaining and understanding related material	FINAL EXAM (3%)	Studying : concept explanation discussion and question and answer course material [1 x 2 x 50] minutes		Students look for references and study material on vector-valued functions [2 x 2 x 60 minutes]		LMS (ilearn UNAND)	Vector valued functions [1]	**3%**
10/14	CLO 3 Students are able to generalize plane geometry problems to three-dimensional space geometry	• Accuracy in explaining and understanding related material • Accuracy in answering quiz questions	FINAL EXAM (3%) Quiz (5%)	Studying : concept explanation discussion and question and answer course material		Students look for references and study curvilinear motion [2 x 2 x 60 minutes]		LMS (ilearn UNAND)	Curvilinear motion [1]	**3%**

				[1 x 2 x 50] minutes						
10/15	CLO 4 Students are able to identify and explain problems related to plane equations, distance, area, volume	• Accuracy in explaining and understanding related material	FINAL EXAM (3%)			Students look for references and study the equations of lines in three-dimensional space [2 x 2 x 60 minutes]		LMS (ilearn UNAND)	Line equations in three-dimensional space [1]	**3%**
11/16	CLO 4 Students are able to identify and explain problems related to plane equations, distance, area, volume	• Accuracy in explaining and understanding related material	FINAL EXAM (3%)	Studying : concept explanation discussion and question and answer course material [1 x 2 x 50] minutes		Students look for references and study the equations of tangent lines in three-dimensional space . [2 x 2 x 60 minutes]		LMS (ilearn UNAND)	The equation of a tangent line in three-dimensional space [1]	**3%**
12/17	CLO 4 Students are able to identify and explain problems related to plane equations, distance, area, volume	• Accuracy in explaining and understanding related material	FINAL EXAM (4%)	Studying : concept explanation discussion and question and answer course material [1 x 2 x 50] minutes		Students look for references and study surface equations in three-dimensional space . [2 x 2 x 60 minutes]		LMS (ilearn UNAND)	Surface Equations in three-dimensional space [1]	**4%**

12/18	CLO 4 Students are able to identify and explain problems related to plane equations, distance, area, volume	• Accuracy in explaining and understanding related material	FINAL EXAM (4%)	Studying : concept explanation discussion and question and answer course material [1 x 2 x 50] minutes		Students look for references and study tube coordinates [2 x 2 x 60 minutes]		LMS (ilearn UNAND)	Tube coordinates [1]	**4%**
13/19	CLO 4 Students are able to identify and explain problems related to plane equations, distance, area, volume	• Accuracy in explaining and understanding related material • Accuracy in answering quiz questions	FINAL EXAM (4%) Quiz (5%)	Studying : concept explanation discussion and question and answer course material [1 x 2 x 50] minutes		Students look for references and study spherical coordinates [2 x 2 x 60 minutes]		LMS (ilearn UNAND)	Spherical coordinates [1]	**9 %**
14/20	CLO 5 Students are able to solve geometric problems on planes and space using mathematical software CLO 6 Students are able to communicate the results of their thoughts and work	• Skills in explaining in the form of presentations • Accuracy of answers in discussions • Skills in using mathematical software Accuracy in answering	Task (5 %) Presentation (5 %)	Discussion/Presentation: concept explanation discussion and question and answer course material [1 x 2 x 50 minutes]		• A.M Students look for references independently regarding analytical geometry topics and use mathematical software to solve them	• AK Students discuss in groups and make presentations in class [1 x 2 x 60 minutes]	LMS (ilearn UNAND)	Group discussion/presentation [1]	**10 %**

	both orally and in writing.	assignment questions Neatness in completing tasks • Originality of task results				[1 x 2 x 60 minutes]				
14/21	CLO 5 Students are able to solve geometric problems on planes and space using mathematical software CLO 6 Students are able to communicate the results of their thoughts and work both orally and in writing	• Skills in explaining in the form of presentations • Accuracy of answers in discussions • Skills in using mathematical software Accuracy in answering assignment questions Neatness in completing tasks • Originality of task results	Task (5 %) Presentation (5 %)	Discussion/Presentation: concept explanation discussion and question and answer course material [1 x 2 x 50 minutes]		• A.M Students look for references independently regarding analytical geometry topics and use mathematical software to solve them [1 x 2 x 60 minutes]	• AK Students discuss in groups and make presentations in class [1 x 2 x 60 minutes]	LMS (ilearn UNAND)	Group discussion/presentation [1]	**10 %**
	FINAL EXAM (30%)									

Indicators, Criteria and Assessment Weights

1. Assessment Weight for Each Form of Assessment

NO	Form of Assessment	WEIGHT (%)
1	**Mid-Term Exam**	30 %
2	**Final Exam**	30%
3	**Quizzes**	15 %
4	Presentation	10 %
5	Tasks (Presentations, reports)	15 %
TOTAL		**100 %**

2. Assessment weight for each course learning achievement

- CLO-1: 15 %
- CLO 2: 25%
- CLO 3: 20 %
- CLO 4: 20 %
- CLO 5: 10 %
- CLO 6: 10 %

II. Assessment Plan Table

CLOs	Form of assessment					
	Mid-Term Exam (%)	**Final Exam (%)**	**Quizzes (%)**	Presentation	**Homework** /Reports **(%)**	**Total weight**
1. Students are able to master theoretical concepts, especially related to the definition and basic properties of conic sections, translation and rotation and determine the equations of conic sections in Cartesian coordinates and draw sketches. (ILO-2: PI-1, PI-2, PI-3))	15%					15%
2. Students are able to master the concepts of curve parameterization and curvature of curves in a plane, equations in polar coordinates and calculus in polar coordinates. ILO-2: PI-1, PI-2, PI-3))	15%		5%		5%	25%
3. Students are able to generalize plane geometry problems into three-dimensional space geometry. ILO-3: PI-1, PI-2, PI-3))		15 %	5%			20%
4. Students are able to identify and explain problems related to plane equations, distance, area and volume. (ILO 4: PI-1, PI-2, PI-3)		15%	5%			20%
5. Students are able to solve geometric problems on planes and space using mathematical software. (ILO-6: PI-1- PI-4)				10%		10%

6. Students are able to communicate the results of their thoughts and work both orally and in writing. (ILO-7: PI-1, PI-2, PI-3)					10%	10%
Total Weight	30%	30%	15%	10%	15%	100%

Matrix of CLOs and ILOs

CLOs	**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				✓	✓	✓				✓	✓		✓	✓	✓	✓	✓	✓	✓				✓	✓									

7				✓	✓	✓							✓	✓	✓	✓	✓	✓	✓												

Task	Task Type	Recommended Questions (reference [1])
1	Student's task on basic understanding of analytical geometry, parabola, ellipse, hyperbola, translation, axes rotation	Problem set 10.1, Problem set 10.2 Problem set 10.3 No 1-5 for each problem
2	Student's task on basic understanding of parametric representation and polar coordinate	Problem set 10.4 Problem set 10.5 Problem set 10.6 Problem set 10.7 No 1-5 for each problem
3	Student's task on basic understanding of Geometry in space and vectors	Problem set 11.1, Problem set 11.2 Problem set 11.3 Problem set 11.4 No 1-5 for each problem
4	Student's task on basic understanding of vector valued function, lines and tangent line cylindrical, curvature and spherical coordinates	Problem set 11.5 Problem set 11.6 Problem set 11.7 Problem set 11.8 Problem set 11.9 No 1-5 for each problem