SEMESTER STUDY PLAN

INTRODUCTION TO DIFFERENTIAL GEOMETRY

(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
Introduction to Differential Geometry	**62221**	https://sci.ilearn.unand.ac.id	3	4	…May 2024

Person In Charge	Study Plan Creator	Head of Research Group	Head of Study Program
	Dr. Haripamyu	Dr. Haripamyu	Dr. Noverina Alfiany

	Intended Learning Outcomes	
Intended Learning Outcomes (ILO) and Performance Indicator (PI)	**ILO-4**	An ability to use concept and fundamental technique 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 formally and correctly proves a simple mathematical statements using facts and methods that have been studied. PI-1: An ability to identify formal structures and analogous forms in mathematics PI-2: An ability to use facts and apply methods to prove simple mathematical statements PI-3: An ability to present simple mathematical statement proof rigorously (sequentially and conscientious)
	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 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
	Course Learning Outcomes	
	1	Students are able to identify basic concepts and problems related to the geometry of curves and surfaces, especially curvatures in planes and space (**ILO-4**: PI-1, PI-2)
	2	Students are able to prove the properties that apply to curves and surfaces. (**ILO-5**: PI-1, PI-2, PI-3)
	3	Students are able to solve problems related to curves and surfaces (**ILO-4**: PI-3)
	4	Students are able to present research reports and produce significant output. (**ILO-7**: PI-1, PI-2, PI-3)
	5	Students are able to work in teams (**ILO-8**: PI-1, PI-2, PI-3)
Brief Description	Differential Geometry is the science that studies the geometry of curves and surfaces, which are generally called curves, using calculus techniques. Therefore, knowledge of Calculus (including partial differentiation), Vectors and Elementary Linear Algebra (including matrices and determinants) is a necessary prerequisite for studying this science. The main tools for understanding and analyzing these curved objects are lines and planes (tangents) and the way they change along the curve. In this course students learn about curves in planes and space, curvature of plane curves and space curves, global properties of curves, surfaces in three dimensions, examples of surfaces. Project Based Learning (PjBL) is a learning method that uses projects/activities as a medium. Students carry out exploration, assessment, interpretation, synthesis and information to produce various forms of learning outcomes.	

<table>
<tr><td>Course Materials</td><td colspan="2">1. Curves in the plane and in space
2. How much does a curve curve?
3. Global properties of curves
4. Surfaces in three dimensions</td></tr>
<tr><td>References</td><td colspan="2">Main:
[1] Elementary Differential Geometry, Andrew Pressley, second edition, Springer, 2012

Additional:
[2] Pengenalan Geometri Diferensial, Iwan Pranoto, penerbit ITB, 2004
[3] Journals and other relevant references.</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. Dr. Haripamyu</td></tr>
<tr><td>Assessment</td><td colspan="2">Homework, Quizzes, Mid-Term exam, Final exam</td></tr>
<tr><td>Required courses</td><td colspan="2">Elementary Linear Algebra, Calculus 3</td></tr>
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Weekly Study Plan

Week / Meet (1)	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)			
1-3	CLO-1 Students are able to identify basic concepts and problems related to the geometry of curves and surfaces, especially curvatures in planes and space (**ILO-4**: PI-1, PI-2)	• Accuracy in stating the definitions and basic geometric properties of curves and surfaces, especially curvature in planes and space,	Non test : Test Kuis 1: 1% UTS: 5%	Teaching and discussion: - Explanation of Semester Learning Plan - explanation of learning material - explanation of the task - explanation of the assessment [$3 \times 3 \times 50$ minutes]		• Students read and study learning materials • Students do assignments independently [$3 \times 3 \times 120$ minutes] -		• PPT • I learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	• Tuition Contract • SSP Definition and basic geometric properties of curves in planes and space, curvature, curves in planes and space	6%
4-5	CLO-2 Students are able to prove the properties that apply to curves and surfaces. (**ILO-**	• Accuracy in using the basic properties that have been studied in solving	Non test : Tugas 1 (1,5%) Test Kuis 1: 1% UTS: 2%	Teaching and discussion: - explanation of learning material		• Students read and study learning materials		• PPT • I learn	Global properties of curves	4,5%

	5: PI-1, PI-2, PI-3)	curve problems		- explanation of the assessment [2 × 3 × 50 minutes]		• Students do assignments independently [2 × 3 × 120 minutes]				
6-7	CLO-2 Students are able to prove the properties that apply to curves and surfaces. (**ILO-5**: PI-1, PI-2, PI-3)	• Accuracy in applying the basic properties that have been learned in solving surface problems • Accuracy in using data literacy and technology in solving problems related to curves and surfaces	Non test : Tugas 2 (1,5%) Test Kuis 1: 1% UTS: 3% •	Teaching and discussion: - explanation of learning material - - explanation of the assessment [2 × 3 × 50 minutes]		• Students read and study learning materials • Students do assignments independently [2 × 3 × 60 minutes]	Students discuss in groups about determine the solution of linear equations system (non homogen and homogen) [2 × 3 × 60 minutes]	• PPT • I learn (Specific condition: Zoom meeting, WA group, learning video))	Surfaces in three dimensions	5,5%
8	**MID-TERM EXAM**									

9-10	CLO-1 Students are able to identify basic concepts and problems related to the geometry of curves and surfaces, especially curvatures in planes and space (**ILO-4**: PI-1, PI-2) CLO-5 Students are able to work in teams (**ILO-8**: PI-1, PI-2, PI-3)	• Accuracy in the identification of the problem and basic concept	Progress report (10%)	Review and discuss the progress of project assignments [*2 × 3 × 50* minutes]		- Students read and study learning materials - Students do assignments independently [*2 × 3 × 60* minutes]	Students discuss in groups about lecture material and project work to be carried out *2 × 3 × 60* minutes]	• PPT • I learn	• Identification and formulation of project problems, • Identify method selection, • Determining the project schedule • [1], [2]	**1%**
11-12	CLO-2 Students are able to prove the properties that apply to curves and surfaces. (**ILO-5**: PI-1, PI-2, PI-3) CLO-5 Students are able to work in teams (**ILO-8**: PI-1, PI-2, PI-3)	• Accuracy in applying and comparing the properties that apply to Euclidean geometry in the hyperbolic plane in the given problem	Progress report (15%)	Review and discuss the progress of project assignments [*2 × 3 × 50* minutes]		- Students identify and formulate the characteristics of the given case study - [2x3x 60 minutes]	- Students discuss in groups to formulate problems in the case studies given [2x3x 60 minutes]	• PPT • I learn	• Project task progress • [1], [2]	**4,5%**

13-14	CLO-3 Students are able to solve problems related to curves and surfaces (**ILO-4**: PI-3) CLO-5 Students are able to work in teams (**ILO-8**: PI-1, PI-2, PI-3)	• Accuracy in applying the characteristics and solving the given problems	Progress report (20%)	Review and discuss the progress of project assignments [$2 \times 3 \times 50$ minutes]		Students solve given problems using applicable concepts and properties [2x3x 60 minutes]	Students discuss in groups to solve the problems given [2x3x 60 minutes]	• PPT • I learn	• Evaluation of the results of project tasks • [1], [2]	**4,5%**
15	CLO-4 Students are able to present research reports and produce significant output. (**ILO-7**: PI-1, PI-2, PI-3)	• Accuracy in verbally communicating project tasks	Project Report Presentation (15%)	Project Report Presentation		• Students improve project reports based on feedback • [1x3x 60 minutes]	Students discuss in groups to determine the project report [1x3x 60 minutes]	• PPT • I learn •	• Project report presentation	

16	CLO-3 Students are able to solve problems related to curves and surfaces (**ILO-4**: PI-3) CLO-5 Students are able to work in teams (**ILO-8**: PI-1, PI-2, PI-3)	• Accuracy in communicating project tasks in writing • Accuracy in applying the characteristics and solving the given problems	Project Report	**Project Report Collection**
			Total Weight	100%
	FINAL EXAM			

1 credit = 50 minutes face-to-face meeting, 60 minutes structured study, 60 minutes independent study
Each meeting duration is 3 credits = 3×50 minutes

Indicators, Criteria, and Assessment Weights

1. Assessment weight for each Assessment

NO	Assessment	Weight (%)
1	Mid-Term Exam	20
2	Progress Report	20
3	Homework	10
4	Presentation	

5	Final Project	50
TOTAL		**100**

2. Assessment weight for Intended Learning Outcome
   - CLO-1: 16 %
   - CLO-2: 20 %
   - CLO-3: 20 %
   - CLO- 4: 20 %
   - CLO-5: 20 %

Assessment Plan Table:

No.	CLO	Assessment					Weight (%)
		Homework (%)	**Progress Report (%)**	**Mid-Term Exam (%)**	**Presentation**	**Final Report (%)**	
1	CLO-1 Students are able to identify basic concepts and problems related to the geometry of	5	5	10			20

	curves and surfaces, especially curvatures in planes and space (**ILO-4**: PI-1, PI-2)						
2	CLO-2 Students are able to prove the properties that apply to curves and surfaces. (**ILO-5**: PI-1, PI-2, PI-3)		10	5			15
3	CLO-3 Students are able to solve problems related to curves and surfaces (**ILO-4**: PI-3)		15	5		5	25
4	CLO-4 Students are able to present research reports and produce significant output. (**ILO-7**: PI-1, PI-2, PI-3)				15		15
5	CLO-5 Students are able to work in teams		15		3	10	25

	(**ILO-8**: PI-1, PI-2, PI-3)						
Total		**5**	**45**	**20**	**15**	**15**	**100**

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																									✓	✓	✓					

Steps for Carrying Out Project Assignments

1. Identifying and formulating the problem of curvature of curves and surfaces of objects in case studies
2. Identifying project task requirements
3. Selection of methods, models and data that are relevant to the problem of curve curvature and object surfaces
4. 4. Preparation of project task work schedules
5. 5. Implementation of project tasks
6. 6. Monitoring and evaluating the implementation of project assignments by lecturers, including the obstacles and challenges faced
7. 7. Reports and final results of project tasks
8. 8. Presentation of the report/final results of the design project
9. 9. Final analysis and evaluation of project tasks

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