	Module Description/Course Syllabi
	Study Programme: Magister of Mathematics Faculty of Mathematics and Natural Sciences Universitas Andalas

1. *Course number and name*

MAT82253 Topic in Combinatorics 2

2. *Credits and contact hours/Number of ECTS credits allocated*

3 SKS / 4.52 ECTS

3. *Instructors and course coordinator*

1. Dr. Lyra Yulianti, 2) Dr. Des Welyyanti

4. *Text book, title, author, and year*

1. Chartrand, G., Zhang, P., *Introduction to Graph Theory*, McGraw-Hill, New York, 1st ed, 2005
2. Chartrand, G., Zhang, P., *Chromatic Graph Theory*, CRC Press, Taylor and Francis Group, New York, 1st ed, 2009

5. *Recommended reading and other learning resources/tools*

Recent papers in metric dimension, partition dimension, and locating chromatic numbers

6. *Specific course information*

A. *Brief description of the content of the course (catalogue description)*

This course discusses about the metric dimension, partition dimension and locating chromatic number of a graph. This course also gives some newest results related to metric dimension, partition dimension and locating chromatic number.

B. *Prerequisites or co-requisites*

MAT82151 Combinatorial Theory
C. Indicate whether a required or elective course in the program
Elective
D. Level of course unit (according to EQF: first cycle Bachelor, second cycle Master)
Second Cycle Master
E. Year of study when the course unit is delivered (if applicable)
2nd Year
F. Semester when the course unit is delivered
Even Semester
G. Mode of delivery (face-to-face, distance learning)
Face to face

7. Intended Learning Outcomes

ILO-3
Comprehensive mastery of one several theories for development in the fields of analysis, algebra, applied mathematics, statistics, and combinatorial mathematics:
    a) Able to identify theories used in related mathematical problems.
    b) Able to apply theories for advancement in related fields (advanced theory).
Able to use advanced theory to solve related mathematical problems.

ILO-4
Mastering scientific techniques and developing them in solving research problems through multidisciplinary or interdisciplinary approaches:
    a) Able to apply mathematical techniques in research problem-solving.
    b) Able to analyze research problems.

c) Able to formulate theorems/models and prove their validity.
Able to use various mathematical software to solve complex mathematical problems.

ILO-5
Able to work and conduct research in the field of mathematics and related fields of science by developing the latest issues independently or collaboratively and communicating them academically:
a) Capable of formally and correctly proving mathematical statements.
b) Able to employ relevant techniques for conducting research.
Capable of communicating research findings in an academic manner.

ILO-6
a) Able to independently expand and deepen learning based on acquired knowledge.
b) Able to expand and deepen interdisciplinary competencies based on acquired knowledge.
Able to understand and apply the latest developments in mathematical theory.

8. *Course Learning Outcomes*

Have the understanding about the metric dimension of a graph and determine the metric dimension of a given graph.

Have the understanding about the partition dimension of a graph and determine the partition dimension of a given graph

Have the understanding about the locating chromatic number of a graph and determine the locating chromatic number of a given graph

9. *Brief list of topics to be covered*

1. Connectivity
2. Metric dimension of a graph
3. Partition dimension of a graph
4. Coloring in Graphs: Vertex, edge, and map colorings
1. Vertex-chromatic, edge-chromatic, and locating chromatic number of graphs

10. *Learning and teaching methods*

Project-Based Learning, Student Centre Learning

11. *Language of instruction*

Bahasa

12. Assessment methods and criteria

Summative Assessment:
 1. Mid-term exam: 30%
 2. Final exam: 30%
 3. Quiz: 20%
 4. Task: 20%

SEMESTER LEARNING PLAN
TOPIC IN COMBINATORICS MATHEMATICS 2
(REQUIRED COURSE)

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

SEMESTER STUDY PLAN (SSP) **MASTER OF MATHEMATICS PROGRAM** **FACULTY OF MATHEMATICS AND NATURAL SCIENCE** **UNIVERSITAS ANDALAS**					

RENCANA PEMBELAJARAN SEMESTER

Course Name	Code	Course URL *i-Learn*	Credits	Semester	DATE
TPOIC IN COMBINATORICS MATHEMATICS 2	**MAT82153**	https://sci.ilearn.unand.ac.id	3	2	February 24th , 2024

Person in Charge	Create by	Head of Research Group	Head of Master Program
	Dr. Des Welyyanti	Prof. Dr. Syafrizal Sy	Dr. Ferra Yanuar

Intended Learning Outcomes (ILO) and Course Learning Outcomes (CLO)	**Intended L earning Outcomes**	
	ILO-3	Comprehensive mastery of one or several theories for development in the fields of analysis, algebra, applied mathematics, statistics and combinatorial mathematics. PI-1 Able to identify theories used in related mathematical problems. PI-2 Able to apply theories for advancement in related fields (advanced theory). PI-3 Able to use advanced theory to solve related mathematical problems.
	ILO 4	Mastering scientific techniques and developing them in solving research problems through multidisciplinary or interdisciplinary approaches. PI-1 Able to apply mathematical techniques in research problem-solving. PI-2 Able to analyse research problems.

		PI-3 Able to formulate theorems/models and prove their validity.
		PI-4 Able to use various mathematical software to solve complex mathematical problems,
	ILO 5	Able to work and conduct research in the field of mathematics and related fields of science by developing the latest issues independently or collaboratively and communicating them academically. PI-1Capable of formally and correctly proving mathematical statements.
		PI-2 Able to employ relevant techniques for conducting research.
		PI-3 Capable of communicating research findings in an academic manner.
	Course Learning Outcomes	
	1. Have the understanding about the metric dimension of a graph and determine the metric dimension of a given graph.	
	2. Have the understanding about the partition dimension of a graph and determine the partition dimension of a given graph	
	3. Have the understanding about the locating chromatic number of a graph and determine the locating chromatic number of a given graph	
Brief description	This course discusses about the metric dimension, partition dimension and locating chromatic number of a graph. This course also gives some newest results related to metric dimension, partition dimension and locating chromatic number.	
Course Materials	1. Connectivity 2. Metric dimension of a graph 3. Partition dimension of a graph 4. Coloring in Graphs: Vertex, edge, and map colorings 1. Vertex-chromatic, edge-chromatic, and locating chromatic number of graphs	
References	**Main:**	
	1. Chartrand, G., Zhang, P., *Introduction to Graph Theory*, McGraw-Hill, New York, 1st ed, 2005 2. Chartrand, G., Zhang, P., *Chromatic Graph Theory*, CRC Press, Taylor and Francis Group, New York, 1st ed, 2009	

	Additional	
	1. Recent papers in metric dimension, partition dimension, and locating chromatic numbers.	
Learning Media	**Software :**	**Hardware :**
	- LMS Unand (http://fmipa.ilearn.unand.ac.id/) - Zoom meeting - Whatsapp	- Komputer/Laptop - Smartphone
Team Teaching	Dr.Des Welyyanti, Dr Lyra Yulianti	
Required courses	MAT82151 Combinatorial Theory	

Weekly Study Plan

Week / Meet (1)	Course Outcomes (2)	Indicator (3)	Assessment (4)	Activities/Forms of Learning [Time estimated]				Media (9)	Subject, references (10)	Weight (11)
				Synchronus*		Asynchronus**				
				Face to face Offline (5)	Face to face Online (6)	Individual (7)	Collaboration (8)			
1/1	Review some materials in Graph Theory and Discrete Mathematics	• Discipline in carrying out course contracts • Accurate understanding of related material	Activeness in lectures	Teaching and discussion: - Introduction to SSP - material explanation - task explanation - discussion and question-and-answer lecture material - brief explanation of the final project [1 x 3 x 50 minute]		Students read and study the learning materials individually [1 x 3 x 50 minute]	Students discuss in groups about lecture material [1 x 2 x 50 minutes]	• PPT • i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video	• Assessment Rules, SSP, Syllabus, Tuition Contract • Review of some definitions in graph theory	
2/2	**CLO-1** Have the understanding about the metric dimension of a graph and determine the metric dimension of a given graph	Accurate understanding of related material	Activeness in lectures	Teaching and discussion: - material explanation [1 x 2 x 50 minute]		Students read and study the learning materials individually [1 x 1 x 50 minute]	Students discuss in groups about lecture material [1 x 1 x 50 minutes]	• PPT • i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video	Definition of metric dimension, resolving set and basis Some previous results on metric dimension of graphs	
3/3	**CLO-1** Have the understanding about the metric dimension of a graph and determine the metric dimension of a given	Accurate understanding of related material	Activeness in lectures	Teaching and discussion: material explanation [1 x 2 x 50 minute]		Students read and study the learning materials individually [1 x 1 x 50 minute]	Students discuss in groups about lecture material [1 x 1 x 50 minutes]	• PPT • i-learn (LMS Unand) Specific condition: Zoom meeting, WA group,	Determine the metric dimension of given graphs	

Week	CLO / Learning Sub-outcome	Indicator	Assessment Form	Teaching and Learning Activities		Student Individual Learning	Student Group Learning	Media and Learning Resources	Learning Material	Weight
	graph							learning video		
4/4	**CLO-2** Have the understanding about the partition dimension of a graph and determine the partition dimension of a given graph	Accurate understanding of related material	Activeness in lectures	Teaching and discussion: material explanation [1 x 2 x 50 minute]		Students read and study the learning materials individually [1 x 1 x 50 minute]	Students discuss in groups about lecture material [1 x 1 x 50 minutes]	• PPT • i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video)	The partition dimension of a connected graph and the resolving partition of a given graph	
5/5	**CLO-2** Have the understanding about the partition dimension of a graph and determine the partition dimension of a given graph	Accurate understanding of related material	Activeness in lectures	Teaching and discussion: material explanation [1 x 2 x 50 minute]		Students read and study the learning materials individually [1 x 1 x 50 minute]	Students discuss in groups about lecture material [1 x 1 x 50 minutes]	• PPT • i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video)	Determine the partition dimension of given connected graphs	
6/6	**CLO-2** Have the understanding about the partition dimension of a graph and determine the partition dimension of a given graph	Accurate understanding of related material	Task 1	Teaching and discussion: material explanation [1 x 2 x 50 minute]		Students read and study the learning materials individually [1 x 1 x 50 minute]	Students discuss in groups about lecture material [1 x 1 x 50 minutes]	• PPT • i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video)	The partition dimension of a disconnected graph and the resolving partition of a given graph	10%
7/7	**CLO-2** Have the understanding about the partition dimension of a graph and determine the partition dimension of a given graph	• Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of task	Quiz 1	Teaching and discussion: • explanation of learning material • explanation of the task • explanation of the assessment [1 x 3 x 50 minutes]		• Students read and study learning materials • Students do assignments independently		• PPT • i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video)	Determine the partition dimension of given disconnected graphs	10 %
8 and 9	**MID-TERM EXAM**									

No	CLO									
10/10	**CLO-3** Have the understanding about the locating chromatic number of a graph and determine the locating chromatic number of a given graph	Accurate understanding of related material	Activeness in lectures	Teaching and discussion: material explanation [1 x 2 x 50 minute]		Students read and study the learning materials individually [1 x 1 x 50 minute]	Students discuss in groups about lecture material [1 x 1 x 50 minutes]	• PPT • i-learn (LMS Unand) • Specific condition: Zoom meeting, WA group, learning video)	Vertex coloring, locating chromatic number and color code	
11/11	**CLO-3** Have the understanding about the locating chromatic number of a graph and determine the locating chromatic number of a given graph	Accurate understanding of related material	Activeness in lectures		Teaching and discussion: explanation of learning material [1 x 3 x 50 minutes] (Specific conditions: The total number of blended learning meetings is 40 % of the total number of meetings)	Students read and study the learning materials individually [1 x 1 x 50 minute]	Students discuss in groups about lecture material [1 x 1 x 50 minutes]	• PPT • i-learn (LMS Unand) • Specific condition: Zoom meeting, WA group, learning video)	The locating chromatic number of some simple graphs	
12/12	**CLO-3** Have the understanding about the locating chromatic number of a graph and determine the locating chromatic number of a given graph	Accurate understanding of related material	Activeness in lectures		Teaching and discussion: explanation of learning material [1 x 3 x 50 minutes] Specific conditions: The total number of blended learning meetings is 40 % of the total number of meetings)	Students read and study the learning materials individually [1 x 1 x 50 minute]	Students discuss in groups about lecture material [1 x 1 x 50 minutes]	• PPT • i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video)	Some previous results on the characterizations of graphs with certain given locating chromatic number	
13/13	**CLO-3** Have the understanding about the locating chromatic number of a graph and determine the locating	Accurate understanding of related material	Activeness in lectures		Teaching and discussion: explanation of learning material [1 x 3 x 50 minutes]	Students read and study the learning materials individually [1 x 1 x 50 minute]	Students discuss in groups about lecture material [1 x 1 x 50 minutes]	• PPT • i-learn (LMS Unand) Specific condition:	The locating chromatic number of disconnected graphs	

Meeting	CLO / Learning outcome	Assessment criteria	Assessment form	Teaching method		Structured study	Independent study	Media	Material	Weight
	chromatic number of a given graph				(Specific conditions: The total number of blended learning meetings is 40 % of the total number of meetings)			Zoom meeting, WA group, learning video)		
14/14	**CLO-3** Have the understanding about the locating chromatic number of a graph and determine the locating chromatic number of a given graph.	Accurate understanding of related material	Activeness in lectures	Teaching and discussion: material explanation [1 x 2 x 50 minute]		Students read and study the learning materials individually [1 x 1 x 50 minute]	Students discuss in groups about lecture material [1 x 1 x 50 minutes]	• PPT • i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video)	Some previous results on the locating chromatic number of disconnected graphs	
15/15	**CLO-3** Have the understanding about the locating chromatic number of a graph and determine the locating chromatic number of a given graph	Accurate understanding of related material	Task 2	Teaching and discussion: material explanation [1 x 2 x 50 minute]		Students read and study the learning materials individually [1 x 1 x 50 minute]	Students discuss in groups about lecture material [1 x 1 x 50 minutes]	• PPT • i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video)	Determination of the locating chromatic number of homogeneous disconnected graphs	
16/16	**CLO-3** Have the understanding about the locating chromatic number of a graph and determine the locating chromatic number of a given graph.	• Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task execution Originality of task	Quiz 2	Teaching and discussion: • explanation of learning material • explanation of the task • explanation of the assessment [1 x 2 x 50 minutes]		• Students read and study learning materials • Students do assignments independently	Students discuss in groups about lecture material and assignment [1 x 1 x 50 minutes]	• PPT • i-learn (LMS Unand) • Specific condition: Zoom meeting, WA group, learning video)	Determination of the locating chromatic number of non-homogeneous disconnected graphs	10 %
17 s/d 18	**FINAL EXAMINATION**									**30 %**

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

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	30
2	Final Exam	30
3	Homework	20
4	Quiz	20
	TOTAL	**100**

2. Assessment weight for Intended Learning Outcome
   a) CLO-1: 25 %
   b) CLO-2. 25 %
   c) CLO-3: 50 %

Assessment Plan Table:

ASSESSMENT	Task		Quiz		Mid-term Exam	Final Exam	TOTAL
CLO	1	2	1	2			
CLO-1 Have the understanding about the metric dimension of a graph and determine the metric dimension of a given graph.	5%		5%		15%		25%
CLO-2 Have the understanding about the partition dimension of a graph and determine the partition dimension of a given graph	5%		5%		15%		25%
CLO-3 Have the understanding about the locating chromatic number of a graph and determine the locating		10%		10%		30%	50%

chromatic number of a given graph						
TOTAL BOBOT		**20%**	**20%**	**30%**	**30%**	**100%**

Matrix of CLO and ILO

CLO	ILO									
	4			**5**				**6**		
	PI			**PI**				**PI**		
	1	2	3	1	2	3	4	1	2	3
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓