SEMESTER STUDY PLAN COMBINATORICS (ELECTIVE COURSE)



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-I	Credits	Semester	Compilation Date						
COMBINA	TORICS		MAT62232	https://sci.ilea .id/	<u>rn.unand.ac</u>	3	4	12 May 2024					
			Study Pla	n Creator	Head of R	esearch Group	Head of	Study Program					
Person In	Charge		Dr. Lyra Dr. Des V Narwe	Yulianti, Velyyanti, n, M.Si	Prof. S	yafrizal Sy	Dr. No	verina Alfiany					
	Intend	ed Learning	Outcomes										
Intended Learning	ILO-2	Possesses p	profound knowle	dge of the basic o	concept math	ematics							
Outcomes (ILO) and		PI-1: An a	bility to explain b	oasic mathematic	al concepts								
Performance		PI-2: An a	bility to provide o	examples that are	e relevant to b	oasic mathematica	al concepts						
Indicator (PI)		PI-3: An ability to determine solutions to simple problems using basic mathematical concepts											
	ILO-3	An ability	ability to identify, explain and generalize simple mathematical problems										
		PI-1: An al	'I-1: An ability to identify simple mathematical problems										
		PI-2: An al	oility to explain si	imple mathemati	cal problems								
		PI-3: An al	oility to generaliz	e simple mathem	atical problem	ms							
	ILO-4	An ability	to use concept	and fundamenta	l technique c	of mathematics in	n solving sin	nple mathematical					
		PI-1: An math	ability to choose ematical problen	appropriate bas	ic mathemati	ical concepts and	l techniques	in solving simple					
		PI-2: An conce	n ability to illustrate simple mathematical problems based on appropriate basic mathematincepts and techniques										
	PI-3: An ability to solve simple mathematical problems using appropriate basic mathematical co and techniques												

IL	LO-5	An ability formally and correctly proves a simple mathematical statement 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)
		PI-4: An ability to conclude or interpret result of the proving simple mathematical statement
IL	L O-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
Co	ourse l	Learning Outcomes
	1	Have the understanding about the binomial and multinomial coefficients and their properties
	2	Have the understanding about three basic concepts in Combinatorics: Pigeonhole Principle, Parity, and
	-	Inclusion-Exclusion Principle.
	3	Have the understanding about Latin Square and its properties
	4	Have the understanding about Recurrence Relation and its properties
	5	Have the understanding about Marriage Theorem and its connection to matching and tournament
	6	Have the understanding trees and their properties
	7	Have the understanding about <i>Eulerian circuit</i> and <i>Hamiltonian cycle</i> in a graph.
	Q	Have the understanding about vertex coloring, edge coloring, and map coloring in a graph, and determine
	0	the vertex-chromatic and edge-chromatic numbers of a graph.

Brief Description	This course gives some concepts in	Combinatorics: Binomial and Multinomial Coefficients, Three basic principles
	in Combinatorics, Latin Square, Rev	iew of Recurrence Relation, Marriage Theorem, Trees, Euler and Hamiltonian
	Theorem, and Coloring in graphs.	This course is implemented using the PjBL learning method which allows
	students to apply the material they l	nave obtained in lectures to daily problems.
Course Materials	1. Binomial and Multinomial Co	pefficients
	2. Three Basic Concepts in Com	binatorics
	3. Latin Square	
	4. Recurrence Relation	
	5. Marriage Theorem	
	6. Trees	
	7. Eulerian Circuit and Hamilto	nian Cycle
	8. Coloring in Graphs: Vertex, e	dge and map colorings
References	Main:	
	V. Bryant, Aspect of Combinatorics: A	Wide-ranging introduction, Cambridge Univ. Press, Great Britain, 1995
	Additional:	
	K.H. Rosen, Discrete Mathematics at	nd Applications, McGraw-Hill, New York, 7th Edition, 2012
	Erickson, M. Pearls of Discrete Mathematical Science Content of Co	natics, CRC Press, Taylor, and Francis Group, 2010
Learning Media	Software:	Hardware:
	• LMS Unand	• Computer/Laptop
	(<u>http://fmipa.ilearn.unand.ac.id/</u>)	• Smartphone
	• Zoom meeting	
	• Whatsapp	
Team Teaching	1. Dr. Lyra Yulianti	
	2. Dr. Des Welyyanti	
	3. Narwen, M.Si	
Assessment	Homework, Quizzes, Mid-Term exa	m, Final exam
Required courses	MAT61111 Introduction to Mathema	atics. MAT62131 Discrete Mathematics

Weekly Study Plan

Week/ Meet	Course	Indicator	Assessment	Synchro	nous*	Asynchro	nous**		Subject,	Weight
(1)	Outcomes (2)	(3)	(4)	Face to face Offline (5)	Face to face Online (6)	Individual (7)	Collaboration (8)	Media (9)	references (10)	(11)
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 60 minute]	Students discuss in groups about lecture material [1 x 3 x 60 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 and discrete mathematics 	
2/2	CLO-1 Have the understanding about the binomial and multinomial coefficients and their properties	Accurate understanding of related material	Activeness in lectures	Teaching and discussion: - material explanation [1 x 3 x 50 minutes]		Students read and study the learning materials individually [1 x 3 x 60 minutes]	Students discuss in groups about lecture material [1 x 3 x 60 minutes]	 PPT i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video 	Definition of binomial and multinomial coefficients and their properties	

3/3	CLO-2 Have the understanding about three basic concepts in Combinatorics: Pigeonhole Principle, Parity, and Inclusion- Exclusion Principle.	Accurate understanding of related material	Activeness in lectures	Teaching and discussion: material explanation [1 x 3 x 50 minutes]	Student study tł materia individu [1 x 3 x	ts read and he learning ls ually 60 minutes]	Students discuss in groups about lecture material [1 x 3 x 60 minutes]	 PPT i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video 	Three basic theorems in Combinatorics: (1) Pigeonhole Principle, (2) Parity	
4/4	CLO-2 Have the understanding about three basic concepts in Combinatorics: Pigeonhole Principle, Parity, and Inclusion- Exclusion Principle.	Accurate understanding of related material	Activeness in lectures	Teaching and discussion: material explanation [1 x 3 x 50 minutes]	Student study tł materia individu [1 x 3 x	ts read and he learning ls ually 60 minutes]	Students discuss in groups about lecture material [1 x 3 x 60 minutes]	 PPT i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video) 	Three basic theorems in Combinatorics: (3) inclusion/exclusi on principle	
5/5	CLO-3 Have the understanding about Latin Square and its properties	Accurate understanding of related material	Activeness in lectures	Teaching and discussion: material explanation [1 x 3 x 50 minutes]	Student study tł materia individu [1 x 3 x	ts read and he learning ls ually : 60 minutes]	Students discuss in groups about lecture material [1 x 3 x 60 minutes]	 PPT i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video) 	Definition of Latin Square and its properties	
6/6	CLO-4 Have the understanding about Recurrence Relation and its properties	Accurate understanding of related material	Task 1	Teaching and discussion: material explanation [1 x 3 x 50 minutes]	Student study tł materia individu [1 x 3 x	ts read and he learning ls ually : 60 minutes]	Students discuss in groups about lecture material [1 x 3 x 60 minutes]	 PPT i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video) 	Recurrence Relation, the construction and solution of recurrence relation	10%
7/7	Review	 Accurate understanding of related material 	Quiz 1	Teaching and discussion: • explanation of learning material	• Stud and learnir	ents read study ng materials		• PPT • i-learn (LMS Unand) Specific	Review	10 %

		 Accuracy in answering assignment questions Neatness of task execution Originality of task 		 explanation of the task explanation of the assessment [1 x 3 x 50 minutes] 		• Students do assignments independently [1 x 3 x 120 minutes]		condition: Zoom meeting, WA group, learning video)		
8 and 9			,		MID-TERM	EXAM				
10/10	CLO-5 Have the understanding about Marriage Theorem and its connection to matching and tournament	Accurate understanding of related material	Activeness in lectures	Teaching and discussion: material explanation [1 x 3 x 50 minutes]		Students read and study the learning materials individually [1 x 3 x 60 minutes]	Students discuss in groups about lecture material [1 x 3 x 60 minutes]	 PPT i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video) 	Definition of Marriage Theorem Matching and tournament	
11/11	CLO-6: Have the understanding trees and their properties	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 3 x 60 minutes]	Students discuss in groups about lecture material [1 x 3 x 60 minutes]	 PPT i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video) 	Definition of trees Some properties of trees	
12/12	CLO-7 Have the understanding about <i>Eulerian</i> <i>circuit</i> and	Accurate understanding of related material	Activeness in lectures		Teaching and discussion: explanation of learning material [1 x 3 x	Students read and study the learning materials individually [1 x 3 x 60 minutes]	Students discuss in groups about lecture material [1 x 3 x 60	• PPT • i-learn (LMS Unand) Specific	Eulerian circuit and Eulerian trail	

	Hamiltonian cycle in				50 minutes]		minutes]	condition: Zoom		
	a graph.				Specific			meeting, WA		
	01				conditions: The			group, learning		
					total number of			video)		
					blended			/		
					learning					
					meetings is 40					
					% of the total					
					number of					
					meetings)					
13/13	CLO-7:	Accurate	Activeness		Teaching and	Students read and	Students	- DDT	Hamiltonian	
,	Have the	understanding of	in lectures		discussion:	study the learning	discuss in	• PP1	Path and	
	understanding	related material			explanation of	materials	groups about	• i-learn (LMS	Hamiltonian	
	about Eulerian				learning	individually	lecture material	Unand) Specific	Cycle	
	circuit and				material [1 x 3 x	[1 x 3 x 60 minutes]	[1 x 3 x 60	condition: Zoom	5	
	Hamiltonian cycle in				50 minutes]		minutes]	meeting, WA		
	a graph.				(Specific		-	group, learning		
	с .				conditions: The			video)		
					total number of					
					blended					
					learning					
					meetings is 40					
					% of the total					
					number of					
					meetings)					
14/14	CLO-8:	Accurate	Activeness	Teaching and		Students read and	Students	• PPT	Some theorems	
	Have the	understanding of	in lectures	discussion:		study the learning	discuss in		in vertex coloring	
	understanding	related material		material explanation		materials	groups about	• i-learn (LMS	and vertex-	
	about vertex			[1 x 3 x 50 minutes]		individually	lecture material	Unand) Specific	chromatic	
	coloring, edge					[1 x 3 x 60 minutes]	[1 x 3 x 60	condition: Zoom	number	
	coloring, and map						minutes]	meeting, WA		
	coloring in a graph,							group, learning		
	and determine the							video)		
	vertex-chromatic									
	and edge-chromatic									
	numbers of a graph.									
15/15	CLO-8:	Accurate	Task 2	Teaching and		Students read and	Students	• PPT	Some theorems	
	Have the	understanding of		discussion:		study the learning	discuss in		in edge coloring	
	understanding	related material		material explanation		materials	groups about	• 1-learn (LMS	and edge-	
	about vertex			[1 x 3 x 50 minutes]		individually	lecture material	Unand)		

	coloring, edge coloring, and map coloring in a graph, and determine the vertex-chromatic and edge-chromatic numbers of a graph.				[1 x 3 x 60 minutes]	[1 x 3 x 60 minutes]	Specific condition: Zoom meeting, WA group, learning video)	chromatic number	
16/16	CLO-8: Have the understanding about vertex coloring, edge coloring, and map coloring in a graph, and determine the vertex-chromatic and edge-chromatic numbers of a 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 3 x 50 minutes] 	 Students read and study learning materials Students do assignments independently [1 x 3 x 60 minutes] 	Students discuss in groups about lecture material and assignment [1 x 3 x 60 minutes]	 PPT i-learn (LMS Unand) Specific condition: Zoom meeting, WA group, learning video) 	Some theorems in map coloring Review materials	10 %
17 s/d 18	FINAL EXAMINAT	ION		1					30 %

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: 10 %
 - b) CLO-2. 10 %
 - c) CLO-3: 10 %
 - d) CLO-4: 10 %
 - e) CLO-5: 10 %
 - f) CLO-6: 15 %
 - g) CLO-7: 15 %
 - h) CLO-8: 20 %

Assessment Plan Table:

ASSESSMENT	Ta	ısk	Qı	ıiz	Mid-term	Final Exam	TOTAL
CLO	1	2	1	2	Exam		
CLO-1	2.5 %				7.5 %		10 %
Have the understanding about the binomial and multinomial							
coefficients and their properties							
CLO-2	2.5 %		5 %		7.5 %		15 %
Have the understanding about three basic concepts in							
Combinatorics: Pigeonhole Principle, Parity, and Inclusion-							
Exclusion Principle.							
CLO-3	2.5 %				7.5 %		10 %
Have the understanding about Latin Square and its properties							
CLO-4	2.5 %		5 %		7.5 %		15 %
Have the understanding about Recurrence Relation and its							
properties							
CLO-5		2.5 %				7.5 %	10 %
Have the understanding about Marriage Theorem and its							
connection to matching and tournament							
CLO-6		2.5 %				7.5 %	10 %
Have the understanding trees and their properties							

CLO-7	2.5 %	5 %		7.5 %	15 %
Have the understanding about <i>Eulerian circuit</i> and <i>Hamiltonian</i>					
<i>cycle</i> in a graph.					
CLO-8	2.5 %	5 %		7.5 %	15 %
Have the understanding about vertex coloring, edge coloring,					
and map coloring in a graph, and determine the vertex-					
chromatic and edge-chromatic numbers of a graph.					
TOTAL BOBOT	20%	20%	30%	30%	100%

Matrix of CLO and ILO

																II	0.															
CLO.		1			2			3			4			Ę	5				6				7			5	8			ļ	9	
		PI			PI			PI			PI			F	PI				PI				PI			ŀ	PI			F	'n	
	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										\checkmark	~	~																				
2										~	~	~																				
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4																	~	~	~	~	~											
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