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

1. *Course number and name*

MAT82215 Abstract Algebra

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

3 sks / 4,53 ECTS

3. *Instructors and course coordinator*

1. Dr. Yanita

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

1. David S. D., Richard M. F., *Abstract Algebra,* 3rd eds, John Wiley & Sons, Inc. USA, 2004.
2. Charles, C. P., *A book of Abstract Algebra,* 2nd eds, Springer, USA. 2007.

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

3. Yotsanan, M. *Abstract Algebra: Group Theory, Ring and Field, Advanced Group Theory, Modules and Notherian Ring, Field Theory*, Danex Intercorpoation, Bangkok, 2015.
4. Joseph A. G, *Contemporery Abstract Algebra,* 9th eds, Cengange Learning, 2017.
5. W. K. Nicholson, *Introduction to Abstract Algebra*, John Wiley & Sons, Hoboken, New Jersey, 2012.

6. *Specific course information*

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

In this course, mathematical concepts will be discussed in the form of definitions and mathematical properties in the form of lemmas and theorems related to Abstract Algebra, which include group theory, ring theory, and polynomial rings.

B. Prerequisites or co-requisites

-

C. Indicate whether a required or elective course in the program

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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 (a combination of Teacher-Centered Learning and Student-Centered Learning)

7. Intended Learning Outcomes

ILO 2: Mastering mathematical concepts and applications (real analysis, advanced linear algebra, and statistics) in solving complex mathematical problems

PI-1 Able to explain mathematical concepts (Real Analysis, Advanced Linear Algebra, and Statistics).

PI-2 Able to identify complex mathematical problems.

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.

8. *Course Learning Outcomes*

1. Able to understand the properties and solve problems in group theory (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)

2. Able to understand the properties and solve problems in ring theory. (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)

3. Able to understand the properties and solve problems in polynomial rings (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)

9. *Brief list of topics to be covered*

This course discusses theories in algebra (linear algebra and abstract algebra). Students do simple research on one of the topics given in the study material.

10. *Learning and teaching methods*

Directed Learning, Teacher Center Learning

11. *Language of instruction*

Bahasa Indonesia and English

12. *Assessment methods and criteria*

Summative Assessment :
 1. Task/homework : 40%

Formative Assessment:
2. Mid-term exam : 30%
3. Final exam: 30%

SEMESTER STUDY PLAN

ABSTRACT ALGEBRA

(COMPULSORY COURSE)

DEPARTMENT OF MATHEMATICS AND DATA SCIENCE

FACULTY OF MATHEMATICS AND NATURAL SCIENCES

UNIVERSITAS ANDALAS

2024

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

Course Name	Course Code	URL *I-Learn*	Credits	Semester	Compilation Date
Abstract Algebra	MAT82215	https://sci.ilearn.unand.ac.id	3	2	May 14th, 2024

Person in Charge	Study Plan Creator	Head of Research Group	Head of Study Program
	Dr. Yanita	Prof. Dr. Admi Nazra	Prof. Dr. Ferra Yanuar

Intended Learning Outcomes (ILO) and Course Learning Outcomes (ILO)	Intended Learning Outcomes	
	ILO-2	Mastering mathematical concepts and applications (real analysis, advanced linear algebra, and statistics) in solving complex mathematical problems PI-1 Able to explain mathematical concepts (Real Analysis, Advanced Linear Algebra, and Statistics). PI-2 Able to identify complex mathematical problems.
	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.
	Course Learning Outcomes	
	1. Able to understand the properties and solve problems in group theory (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	
	2. Able to understand the properties and solve problems in ring theory. (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	
	3. Able to understand the properties and solve problems in polynomial rings (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	

Brief Description	In this course, mathematical concepts will be discussed in the form of definitions and mathematical properties in the form of lemmas and theorems related to Abstract Algebra, which include group theory, ring theory, and polynomial rings. The learning method in this course is face-to-face
Study Material	1. Group Theory (Definition and basic properties, cyclic groups, permutation groups, dihedral groups, direct product groups, subgroups, normal subgroups, factor groups, cosets and Langange's theorem, and group homomorphism) 2. Ring Theory (definition and basic properties, integral area, field, subring, ideal, ring factor, and ring homomorphism) 3. Ring polynomials
References	**Main** 1. David S. D., Richard M. F., *Abstract Algebra,* 3rd eds, John Wiley & Sons, Inc. USA, 2004. 2. Charles, C. P., *A book of Abstract Algebra,* 2nd eds, Springer, USA. 2007. **Additional** 3. Yotsanan, M. *Abstract Algebra: Group Theory, Ring and Field, Advanced Group Theory, Modules and Notherian Ring, Field Theory*, Danex Intercorpoation, Bangkok, 2015. 4. Joseph A. G, *Contemporery Abstract Algebra,* 9th eds, Cengange Learning, 2017. 5. W. K. Nicholson, *Introduction to Abstract Algebra*, John Wiley & Sons, Hoboken, New Jersey, 2012.
Learning Media	**Software :** • LMS Unand (http://fmipa.ilearn.unand.ac.id/) • Zoom meeting • Whatsapp
	Hardware : • Computer/Laptop • Smartphone
Team Teaching	Dr. Yanita
Required courses	-

Weekly Study Plan

Week / Meet (1)	Course Outcomes (2)	Indicator (3)	Assessment (4)	Activities/Forms of Learning [Estimated time]				Media (9)	Subject, references (10)	Weight (11)
				Synchronus*		Asynchronus**				
				Face to face Offline (5)	Face to face Online (6)	Individual (7)	Face to face Offline (5)			
1/1	CLO-1 Able to understand the properties and solve problems in group theory (**ILO**-2: PI-1, **ILO**-3: PI-1, PI-2, PI-3)	• Accuracy in proving a set accompanied by a binary operation is a group • Accuracy in proving the single element of identity in a group • Singularity in proving that the inverse element of an element in the group is singular • Accuracy in proving the law of cancellation • Accuracy in determining subgroups from a finite group	• Non test 1st Task : 4% • Mid-term : 5%	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes]	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes] (Specific conditions: The total number of blended learning meetings is 50% of the total number of meetings)	• Students read and study material from the main and additional references • Students work on assignments individually		• PPT • I learn (Specific condition: Zoom meeting, WA group, learning video)	• Tuition contract • SSP **Learning Material** • Definition and basic properties of group • Subgroup [1] : pp.16, 46 [2] : pp. 31, 41 [3] : pp. 5 – 7 [4] : pp. 42 – 65 [5] : pp. 76 – 85	**9%**

		Accuracy in proving that a subset of a group is a subgroup								
2/2	CLO-1 Able to understand the properties and solve problems in group theory (**ILO**-2: PI-1, **ILO**-3: PI-1, PI-2, PI-3)	• Accuracy in determining orders from a group • Accuracy in determining the order of an element in the group • Accuracy in determining the center and centralizer of a group • Accuracy in determining the normal subgroup	Non test: - Test : Mid-term : 5%	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes]	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes] (Specific conditions: The total number of blended learning meetings is 50% of the total number of meetings)	• Students read and study material from the main and additional references • Students work on assignments individually		• PPT • I learn (Specific condition: Zoom meeting, WA group, learning video)	• Order of group • Order of group element • Center and centralizer of group • Normal Subgroup [1]: pp.16, 46 [2]: pp. 31, 41 [3]: pp. 5 – 7 [4]: pp. 42 – 65 [5]: pp. 76 – 85	5%
3/3	CLO-1 Able to understand the properties and solve problems in group theory (**ILO**-2: PI-1,	• Accuracy in determining the coset of a finite group • Accuracy in determining group factors	• Non test 2nd Task : 4% • Test :	Teaching and discussion: - explanation of learning material - explanation of the task	Teaching and discussion: - explanation of learning material - explanation of the task	• Students read and study material from the main and		• PPT • I learn (Specific condition: Zoom meeting,	• Coset • Factor • Langrange's Theorem [4] hal 142	7%

	ILO-3: PI-1, PI-2, PI-3)	• Accuracy in proving Lagrange's Theorem	Mid-term : 3%	[1 × 3 × 50 minutes]	[1 × 3 × 50 minutes] (Specific conditions: The total number of blended learning meetings is 50% of the total number of meetings)	additional references • Students work on assignments individually		WA group, learning video)		
4/4	CLO-1 Able to understand the properties and solve problems in group theory (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	• Accuracy in determining whether a group is a cyclic group or not (taken as an example of a finite group and an infinite group) • Accuracy in determining the generator of a cyclic group • Accuracy in proving theorems regarding generators of cyclic groups • Accuracy in determining the elements of the	Non test: - Test : Mid-term : 5%	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes]	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes] (Specific conditions: The total number of blended learning meetings is 50% of the total number of meetings)	Students read and study material from the main and additional references		• PPT • I learn (Specific condition: Zoom meeting, WA group, learning video)	• Cyclic group • Properties of cyclic group • Dihedral group [4] hal 75 – 80	5%

		dihedral group with $n = 2,3,4$								
5/5	CLO-1 Able to understand the properties and solve problems in group theory (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	• Accuracy in determining permutation groups with permutations $n = \{1,2,3\}$ • Accuracy in determining the cycle of a permutation group • Accuracy in proving and using theorems related to permutation groups	• Non test 3rd Task : 2% • Test : Mid-term : 5%	Teaching and discussion: - explanation of learning material - explanation of the task [$1 \times 3 \times 50$ minutes]	Teaching and discussion: - explanation of learning material - explanation of the task [$1 \times 3 \times 50$ minutes] (Specific conditions: The total number of blended learning meetings is 50% of the total number of meetings)	• Students read and study material from the main and additional references • Students work on assignments individually		• PPT • I learn (Specific condition: Zoom meeting, WA group, learning video)	• Permutation group • Properties of permutation group [4] hal 93 – 104	**8%**
6/6	CLO-1 Able to understand the properties and solve problems in group theory (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	• Accuracy in determining the elements of the direct product group of two finite groups • Accuracy in proving theorems related to the order of elements in the direct product	• Non test 4th Task : 5% • Test : Mid-term : 3%	Teaching and discussion: - explanation of learning material - explanation of the task [$1 \times 3 \times 50$ minutes]	Teaching and discussion: - explanation of learning material - explanation of the task [$1 \times 3 \times 50$ minutes] (Specific conditions: The	• Students read and study material from the main and additional references • Students work on assignments individually		• PPT • I learn (Specific condition: Zoom meeting, WA group, learning video)	• Direct product group • Properties of direct product group (external direct product) [4] hal 156 – 160	**7%**

		• Accuracy in determining the criteria for cyclic and non-cyclic direct product groups			total number of blended learning meetings is 50% of the total number of meetings)					
7/7	CLO-1 Able to understand the properties and solve problems in group theory (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	• Accuracy in proving a function from one group to another group (can be the same group) is a group homomorphism • Accuracy in determining the kernel of a homomorphism • Accuracy in proving theorems related to homomorphism • Accuracy in proving the main theorem of homomorphism and its use	• Non test : 5th Task : 5% • Test : Mid-term : 4%	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes]	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes] (Specific conditions: The total number of blended learning meetings is 50% of the total number of meetings)	• Students read and study material from the main and additional references • Students work on assignments individually		• PPT • I learn (Specific condition: Zoom meeting, WA group, learning video)	• Group homomor-phism • Properties of group homomor-phisms • Fundament al Theorem of homo-morphisma group [4] pp. 194 – 201	**9%**
8	**MID-TERM EXAM**									
9	CLO-2 Able to understand the properties and	• The accuracy in proving a set with two binary	• Non Test : 6th Task : 4%	Teaching and discussion:	Teaching and discussion:	• Students read and study		• PPT • I learn	• Ring theory • Subring	**8%**

	solve problems in ring theory. (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	operations ′+′ and ′×′ is ring • Accuracy in proving the properties of rings	• Test : Final exam : 4%	- explanation of learning material - explanation of the task [1 × 3 × 50 minutes]	- explanation of learning material - explanation of the task [1 × 3 × 50 minutes] (Specific conditions: The total number of blended learning meetings is 50% of the total number of meetings)	material from the main and additional references • Students work on assignments individually		(Specific condition: Zoom meeting, WA group, learning video)		
10	CLO-2 Able to understand the properties and solve problems in ring theory. (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	• Accuracy in determining the zero divisor in a ring • Accuracy in proving whether a ring is an integral region or not • Accuracy in proving a ring is a field	• Non Test : 7th Task : 4% • Test : Final exam : 4%	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes]	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes] (Specific conditions: The total number of blended learning meetings is 50% of the total	• Students read and study material from the main and additional references • Students work on assignments individually		• PPT • I learn (Specific condition: Zoom meeting, WA group, learning video)	• Zero divisor • Integral domain • Field	**8%**

					number of meetings)					
11	CLO-2 Able to understand the properties and solve problems in ring theory. (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	• Accuracy in proving a subset of the ring is ideal • Accuracy in proving an ideal is a maximum ideal or prime ideal • Accuracy in determining the ideal in a ring and constructing a ring factor based on the selected ideal	• Non test 8th Task : 4% • Test : Final exam : 4%	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes]	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes] (Specific conditions: The total number of blended learning meetings is 50% of the total number of meetings)	• Students read and study material from the main and additional references • Students work on assignments individually		• PPT • I learn (Specific condition: Zoom meeting, WA group, learning video)	• Ideal • Maximal Ideal • Prime ideal • Relation between maximal/ prime and field/integ ral domain • Factor ring	**8%**
12	CLO-2 Able to understand the properties and solve problems in ring theory. (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	• Accuracy in proving a function from one ring to another ring is a ring homomor-phism • Accuracy in determining the kernel and image of a homomor-phism ring	Non test : Test : Final exam : 6%	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes]	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes] (Specific conditions: The	Students read and study material from the main and additional references		• PPT • I learn (Specific condition: Zoom meeting, WA group, learning video)	Ring homomorp hisms	**6%**

No	CLO							Media	Material	Weight
					total number of blended learning meetings is 50% of the total number of meetings)					
13	CLO-2 Able to understand the properties and solve problems in ring theory. (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	Accuracy in proving that properties of ring homomorphism	Non test : Test : Final exam : 6%	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes]	Teaching and discussion: - explanation of learning material - explanation of the task [1 × 3 × 50 minutes] (Specific conditions: The total number of blended learning meetings is 50% of the total number of meetings)	Students read and study material from the main and additional references		• PPT • I learn (Specific condition: Zoom meeting, WA group, learning video)	Properties of ring homomorphism	**6%**
14	CLO-3 Able to understand the properties and solve problems in polynomial rings (**ILO**-2: PI-1, PI-2;	• Accuracy in writing polynomials in a ring • Accuracy in using addition/subtraction and multiplication	• Non test 9th Task : 4% • Test : Final exam : 3%	Teaching and discussion: - explanation of learning material - explanation of the task	Teaching and discussion: - explanation of learning material - explanation of the task	• Students read and study material from the main and additional references		• PPT • I learn (Specific condition: Zoom meeting, WA group,	• Polyno-mial rings • Division algorithm for polyno-mials • Remainder theorem	**7%**

		operations in polynomial rings • Accuracy of using division algorithms in polynomial ring factorization		$[1 \times 3 \times 50$ minutes]	$[1 \times 3 \times 50$ minutes] (Specific conditions: The total number of blended learning meetings is 50% of the total number of meetings)	• Students work on assignments individually		learning video)	• Factoriza-tion theorem	
15	CLO-3 Able to understand the properties and solve problems in polynomial rings (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	Accuracy in testing reduced or irreducible polynomials of degree 2 and 3 in a polynomial ring	• Non test 10th Task : 4% • Test : Final exam : 3%	Teaching and discussion: - explanation of learning material - explanation of the task $[1 \times 3 \times 50$ minutes]	Teaching and discussion: - explanation of learning material - explanation of the task $[1 \times 3 \times 50$ minutes] (Specific conditions: The total number of blended learning meetings is 50% of the total number of meetings)	• Students read and study material from the main and additional references • Students work on assign-ments individu-ally		• PPT • I learn (Specific condition: Zoom meeting, WA group, learning video)	• Reduced and irreducible polyno-mials • Unique factorizati on on polyno-mial rings	7%
									Total	**100%**
16	**FINAL EXAM**									

1 credit = 50 minutes face-to-face meeting, 60 minutes structured study, 60 minutes independent study

Indicators, Criteria, and Assessment Weights

1. Assessment weight for each Assessment

NO	Assessment	Weight (%)
1	Mid-Term Exam	30
2	Final Exam	30
3	Task (Homework)	40
	TOTAL	**100**

2. Assessment weight for Intended Learning Outcome
   - CLO-1: 50%
   - CLO-2: 36%
   - CLO-3: 14%

Table Assesment Plan:

No.	CLO	Weight (%)			
		Task (%)	Mid-term (%)	Final exam (%)	Total (%)
1	Able to understand the properties and solve problems in group theory (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	1st Task : 4 2nd Task : 4 3rd Task : 2 4th Task : 5 5th Task : 5	30		50
2	Able to understand the properties and solve problems in ring theory. (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	6th Task : 4 7th Task : 4 8th Task : 4		24	36

3	Able to understand the properties and solve problems in polynomial rings (**ILO**-2: PI-1, PI-2; **ILO**-3: PI-1, PI-2, PI-3)	9th Task : 4 10th Task : 4		6	14
	Total	**40**	**30**	**30**	**100**

Matrix of CLO and ILO

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