SEMESTER STUDY PLAN
COMPLEX ANALYSIS
(ELECTIVE 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
Complex Analysis	MAT81221	https://sci.ilearn.unand.ac.id	3	4	13 May 2024

Person In Charge	Study Plan Creator	Head of Research Group	Head of Study Program
	Dr. Shelvi Ekariani	Dr. Haripamyu	Prof. Dr. Ferra Yanuar

Intended Learning Outcomes (ILO) and Performance Indicator (PI)	Intended Learning Outcomes	
	ILO-2	Mastering mathematical concepts and applications (real analysis, advanced linear algebra, and statistics) in solving complex mathematical problems. PI-1: An ability to explain mathematical concepts (Real Analysis, Advanced Linear Algebra, and Statistics). PI-2: An ability to identify complex mathematical problems. PI-3: An ability to solve complex mathematical problems.
	ILO-3	Comprehensive mastery of one or several theories for development in analysis, algebra, applied mathematics, statistics, and combinatorial mathematics. PI-1: An ability to identify theories used in related mathematical problems. PI-2: An ability to apply theories for advancement in related fields (advanced theory). PI-3: An ability to use advanced theory to solve related mathematical problems.
	ILO-6	Able to be actively involved in lifelong learning and sustainability. PI-1: An ability to independently expand and deepen learning based on acquired knowledge. PI-2: An ability to expand and deepen interdisciplinary competencies based on acquired knowledge. PI-3: An ability to understand and apply the latest developments in mathematical theory.

<table>
<tr><td></td><td colspan="2">Course Learning Outcomes</td></tr>
<tr><td></td><td>1</td><td>An ability to master theoretical concepts especially related to Complex number systems. (ILO-2: PI-1, PI-2, PI-3)</td></tr>
<tr><td></td><td>2</td><td>An ability to develop mathematical thinking, starting from procedural understanding to broad comprehension including exploration, logical reasoning, generalization, abstraction, and formal proof about contour integrals. (ILO-3: PI-1, PI-2, PI-3)</td></tr>
<tr><td></td><td>3</td><td>An ability to reconstructing, modifying, analyzing/structurally thinking about Cauchy integrals and their applications. (ILO-3: PI-1, PI-2, PI-3)</td></tr>
<tr><td></td><td>4</td><td>An ability to master theoretical concepts especially related to Meromorphic functions and residues, as well as Holomorphic functions. (ILO-2: PI-1, PI-2, PI-3)</td></tr>
<tr><td></td><td>5</td><td>An ability to prove a complex mathematical statement using appropriate facts and methods. (ILO-6: PI 1 – 3)</td></tr>
<tr><td>Brief Description</td><td colspan="2">This course provides experience for students to know about complex number systems, contour integral, Cauchy integrals and their application, Meromorphic functions and residues, as well as Holomorphic function.</td></tr>
<tr><td>Course Materials</td><td colspan="2">1. Complex number systems
2. Contour integrals
3. Cauchy integrals and their applications
4. Meromorphic functions and residues
5. Holomorphic functions</td></tr>
<tr><td>References</td><td colspan="2">Main:
1. R. E. Greene & S. G. Krantz. (2006). Function Theory of One Complex Variable. 3rd edition. AMS, USA
Additional:
2. J. B. Conway. (1978). Functions of One Complex Variable I. 2nd edition. Springer</td></tr>
<tr><td>Learning Media</td><td>Software:</td><td>Hardware:</td></tr>
</table>

	● LMS Unand (http://fmipa.ilearn.unand.ac.id/) ● Zoom meeting ● Whatsapp	● Computer/Laptop ● Smartphone
Team Teaching	1. Dr. Shelvi Ekariani 2. Dr. Haripamyu	
Assessment	Homework, Quizzes, Mid-Term exam, Final exam	
Required courses	Advanced Real Analysis	
Academic Norms	https://akademik.unand.ac.id/images/2022-03-30%20Peraturan%20Rektor%20Nomor%207%20Tahun%202022%20Penyelenggaraan%20Pendidikan-khusus%20Bab%20II.pdf	

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	CLO-1 Ability to master theoretical concepts especially related to Complex number systems. (**ILO-2**: PI-1, PI-2, PI-3)	• Discipline in carrying out the course contract. • Accuracy in understanding related material.	Non test Test Mid-Term exam: 5% Quizzes 1: 3%	Teaching and discussion: - Explanation of Semester Learning Plan - explanation of learning material - explanation of the task - explanation of the assessment [*1 × 3 × 50* minutes]	Teaching and discussion: - Explanation of Semester Learning Plan - explanation of learning material - explanation of the task - explanation of the assessment [*1 × 3 × 50* minutes] (Specific conditions: The total number of blended	Students read and study learning materials related to real number systems and their properties [*1 × 3 × 120* minutes]		• PPT • I learn (LMS Unand) • (Specific condition : Zoom meeting, WA group, learning video)	• Course Introduction • Definition of complex numbers, • properties of complex numbers, • triangle inequality • Cauchy-Schwarz inequality References: Main Reference 1.	8%

					learning meetings is 40% of the total number of meetings)					
2	CLO-1 Ability to master theoretical concepts especially related to Complex number systems. (**ILO-2**: PI-1, PI-2, PI-3)	• Accuracy in understanding related material • Accuracy in answering assignment questions • Neatness in completing assignments • Originality of assignment results	Non test Test Mid-Term exam: 5% Quizzes 1: 2%	Lectures and discussions [*1 × 3 × 50* minutes]		Students read and study materials from the main reference and others. [*1 × 3 × 120* minutes]		• PPT • I learn (LMS Unand) • (Specific condition: Zoom meeting, WA group, learning video)	• Holomorphic function, • Cauchy-Riemann equations, • harmonic function • antiderivative of a holomorphic function Reference: Main Reference 1.	7%
3	CLO-2 Ability to develop mathematical thinking, starting from procedural understanding	• Accuracy in understanding related material • Accuracy in answering	Non test: Homework 1: 3% Test Mid-Term exam: 5%	Lectures and discussions [*1 × 3 × 50* minutes]		Students read and study materials from the main reference and others.		• PPT • I learn (LMS Unand) • (Specific condition: Zoom meeting,	• Contour integrals • Derivative • antiderivative, • conformal mapping	8%

	to broad comprehension including exploration, logical reasoning, generalization, abstraction, and formal proof about contour integrals. (**ILO-3**: PI-1, PI-2, PI-3)	assignment questions ● Neatness in completing assignments ● Originality of assignment results				[*1 × 3 × 120* minutes]		WA group, learning video)	Reference: Main Reference 1.	
4	CLO-2 Ability to develop mathematical thinking, starting from procedural understanding to broad comprehension including exploration, logical reasoning, generalization, abstraction, and formal proof about contour integrals.	● Accuracy in understanding related material ● Accuracy in answering assignment questions ● Neatness in completing assignments ● Originality of assignment results	Non test : Homework : 2% Test: Mid-Term exam: 15%	Lectures and discussions [*1 × 3 × 50* minutes]		Students read and study materials from the main reference and others [*1 × 3 × 120* minutes]		● PPT ● I learn (LMS Unand) ● (Specific condition : Zoom meeting, WA group, learning video	● Cauchy's integral theorem, ● Green's theorem Reference: Main Reference 1.	17%

	(**ILO-3**: PI-1, PI-2, PI-3 CLO-5 Ability to prove a complex mathematical statement using appropriate facts and methods. (**ILO-6**: PI 1 – 3)									
5	CLO-3 Ability to reconstruct, modifying, analyzing/structurally thinking about Cauchy integrals and their applications. (**ILO-3**: PI-1, PI-2, PI-3)	• Accuracy in understanding related material • Accuracy in answering assignment questions • Neatness in completing assignments • Originality of assignment results	Non test: Test Mid-Term exam: 3% Quizzes 1: 3%	Lectures and discussions [$1 \times 3 \times 50$ minutes]		Students read and study materials from the main reference and others [$1 \times 3 \times 120$ minutes]		• PPT • I learn (LMS Unand) • (Specific condition : Zoom meeting, WA group, learning video)	• Derivative of a holomorphic function, • Morera's theorem Reference: Main Reference 1.	6%
6-7	CLO-3 Ability to reconstruct,	• Accuracy in understanding	Non test: Test	Lectures and discussions		Students read and study materials from		• PPT	• Taylor series,	4%

	modifying, analyzing/structurally thinking about Cauchy integrals and their applications. (**ILO-3**: PI-1, PI-2, PI-3)	related material ● Accuracy in answering assignment questions ● Neatness in completing assignments ● Originality of assignment results	Mid-Term exam: 2% Quizzes 1: 2%	[$2 \times 3 \times 50$ minutes]		the main reference and others [$2 \times 3 \times 120$ minutes]		● I learn (LMS Unand) ● (Specific condition: Zoom meeting, WA group, learning video)	● convergence of Taylor series ● Power series of holomorphic functions, ● Liouville's theorem, ● uniform limit of holomorphic functions Reference: Main Reference 1.	
8	**MID-TERM EXAM**									
9	CLO-3 Ability to reconstruct, modifying, analyzing/structurally thinking about Cauchy integrals and their applications. (**ILO-3**: PI-1, PI-2, PI-3)	● Accuracy in understanding related material ● Accuracy in answering assignment questions ● Neatness in completing assignments ● Originality of assignment results	Non test : Test Final exam: 15%	Lectures and discussions [$1 \times 3 \times 50$ minutes]		Students read and study materials from the main reference and others [$1 \times 3 \times 120$ minutes]		● PPT ● I learn (LMS Unand) ● (Specific condition: Zoom meeting, WA group, learning video)	● Singular points, ● Riemann's Removable Singularities theorem, ● expansion around singular points Reference: Main Reference 1.	**15%**

10-12	CLO-4 Ability to master theoretical concepts especially related to Meromorphic functions and residues, as well as Holomorphic functions. (**ILO-2**: PI-1, PI-2, PI-3) CLO-5 Ability to prove a complex mathematical statement using appropriate facts and methods. (**ILO-6**: PI 1 – 3)	• Accuracy in understanding related material • Accuracy in answering assignment questions • Neatness in completing assignments • Originality of assignment results	Non test: Homework 2: 3% Test Final exam: 10% Quizzes 2: 5%	Lectures and discussions [$3 \times 3 \times 50$ minutes]		Students read and study materials from the main reference and others [$3 \times 3 \times 120$ minutes]		• PPT • I learn (LMS Unand) • (Specific condition: Zoom meeting, WA group, learning video)	• Cauchy's Integral Formula for Annulus, • existence of Laurent series, • example of Laurent series • Residue theorem, • definition of simply connected holomorphic • Examples of definite integral calculations	**18%**
13-15	CLO-4 Ability to master theoretical concepts especially	• Accuracy in understanding related material	Non test: Homework : 2% Test	Lectures and discussions [$2 \times 3 \times 50$ minutes]		Students read and study materials from the main reference and others		• PPT • I learn (LMS Unand) • (Specific condition	• Infinite singularities • several definitions of singularities of	**17%**

	related to Meromorphic functions and residues, as well as Holomorphic functions. (**ILO-2**: PI-1, PI-2, PI-3) CLO-5 Ability to prove a complex mathematical statement using appropriate facts and methods. (**ILO-6**: PI 1 – 3)	• Accuracy in answering assignment questions • Neatness in completing assignments • Originality of assignment results	Final exam: 10% Quizzes 2: 5%			[2 × 3 × 120 minutes]		: Zoom meeting, WA group, learning video)	holomorphic functions • Definition of poles and zeroes • Open Mapping Theorem	
									Total Weight	100%
16	**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	35
2	Final Exam	35
3	Homework	10
4	Quizzes	20
TOTAL		**100**

2. Assessment weight for Intended Learning Outcome
   - CLO-1: 15 %
   - CLO-2: 15 %

- CLO-3: 25 %
- CLO-4: 15 %
- CLO-5: 30 %

Assessment Plan Table:

No.	CLO	Assessment				Weight (%)
		Homework (%)	Quizzes (%)	Mid-Term Exam (%)	Final Exam (%)	
1	Ability to master theoretical concepts especially related to Complex number systems. (**ILO-2**: PI-1, PI-2, PI-3)		Quizzes 1: 5	10		15
2	Ability to develop mathematical thinking, starting from procedural understanding to broad comprehension	Homework 1: 5		10		15

	including exploration, logical reasoning, generalization, abstraction, and formal proof about contour integrals. (**ILO-3**: PI-1, PI-2, PI-3)					
3	Ability to reconstruct, modifying, analyzing/structurally thinking about Cauchy integrals and their applications. (**ILO-3**: PI-1, PI-2, PI-3)		Quizzes 1: 5	5	15	25
4	Ability to master theoretical concepts especially related to Meromorphic functions and residues, as well as Holomorphic functions. (**ILO-2**: PI-1, PI-2, PI-3)		Quizzes 2: 5		10	15
5	Ability to prove a complex mathematical statement using appropriate facts and	Homework 2: 5	Quizzes 2: 5	10	10	30

	methods. (**ILO-6**: PI-1 – 3)					
Total		**10**	**20**	**35**	**35**	**100**

Matrix of CLO and ILO

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