SEMESTER STUDY PLAN
ADVANCED REAL ANALYSIS
(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
Advanced Real Analysis	MAT81121	https://sci.ilearn.unand.ac.id	3	1	12 May 2024

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

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 the fields of 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
	Course Learning Outcomes	
	1	Ability to explain the concept of the rational number system, its definition, and their properties (**ILO-2**: PI-1, PI-2, PI-3, **ILO-3**: PI-1, PI-2, PI-3)

<table>
<tr><td rowspan="5"></td><td>2</td><td>Ability to use the concept of the rational number system in constructing the real number system and its properties. (ILO-2: PI-1, PI-2, PI-3, ILO-3: PI-1, PI-2, PI-3)</td></tr>
<tr><td>3</td><td>Ability to generalize the concepts and properties of sets in real numbers. (ILO-2: PI-1, PI-2, PI-3, ILO-3: PI-1, PI-2, PI-3)</td></tr>
<tr><td>4</td><td>Ability to explain the concept of continuity of a function and identify the properties of continuity for a real-valued function. (ILO-2: PI-1, PI-2, PI-3, ILO-3: PI-1, PI-2, PI-3)</td></tr>
<tr><td>5</td><td>Ability to explain the concept of differential and integral calculus, identify the properties of derivatives and integral, and their relation to continuity. (ILO-2: PI-1, PI-2, PI-3, ILO-3: PI-1, PI-2, PI-3)</td></tr>
<tr><td>6</td><td>Students can reason intuitively and analytically and can express the results of their reasoning in writing, systematically and rigorously. (ILO-3: PI-1, PI-2, PI-3)</td></tr>
<tr><td>Brief Description</td><td colspan="2">This course begins by discussing how to construct a real number system through knowledge of the rational number system. Next, study the functions of one real-valued fruit related to continuity, derivatives, and integrals and sequences of functions.</td></tr>
<tr><td>Course Materials</td><td colspan="2">1. Real number system
2. Continuous function
3. Differential calculus
4. Integral calculus</td></tr>
<tr><td>References</td><td colspan="2">Main:
R. S. Strichartz. (2000). The Way of Analysis. Revised edition. Jones and Bartlett Publishers Inc., United States.
Additional:
R. G. Bartle and D. R. Sherbert. (2010). Introduction to Real Analysis, 4th edition, Wiley, New Jersey.</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
2. Dr. Shelvi Ekariani</td></tr>
</table>

Assessment	Homework, Quizzes, Mid-Term exam, Final exam
Required courses	-
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)			
1,2	CLO-1: Students are able to explain the concept of a rational number system and identify applicable properties. (**ILO-2, ILO-3**)	● Discipline in carrying out college contracts ● Accuracy in understanding related material	Participation (2.5%) Midterm exam (10%) Independent Assignment (2.5%)	Teaching and discussion: - Explanation of Semester Learning Plan - Discussion about the material course [$2 \times 3 \times 50$] minutes		● Students read the references and learn the definition of the derivative function. ● Students find the references, learn the course material on the relationship between derivatives		● I learn (LMS Unand)	● Introduction to Lectures (Assessment Rules, Semester Study Plan, Syllabus, Tuition Contract) ● Quantor Logic ● The set of infinite numbers ● Proof	15%

						and continuity functions, and prove the properties of derivatives. [2 x 3 x 120] minutes			● Rational number system	
3-5	CLO-2: Students are able to use the concept of a rational number system along with applicable properties in constructing real number systems and their properties. (**ILO-2**, **ILO-3**) CLO-6: Students are able to reason intuitively and analytically and are able to express the results of their reasoning in writing, systematically	● Accuracy in understanding related material ● Accuracy in answering task questions ● Neatness of task work ● Originality of the results of the task	Midterm exam (7%+3%) Quiz (5%+5%)	Teaching and discussion: - Explanation of the material concepts. - Discussion about the material course. [$3 \times 3 \times 50$ menit]		Students read the references and learn the materials. [$3 \times 3 \times 60$ menit]	Students do the group discussion. [$3 \times 3 \times 60$ menit]	LMS (ilearn UNAND)	Construction of the real number system: ● Cauchy's sequence ● Real number system as an ordered field	20%

	and rigorously. (**ILO-3)**									
6-7	CLO-3: Students are able to generalize the concepts and properties of sets in real numbers (**ILO-2**, **ILO-3**) CLO-6: Students are able to reason intuitively and analytically and are able to express the results of their reasoning in writing, systematically and rigorously. (**ILO-3)**	● Accuracy in understanding related material ● Accuracy in answering task questions ● Neatness of task work ● Originality of the results of the task	Midterm exam (7%+3%) Participation (2.5%) Assignment (2.5%)	Teaching and discussion: - Explanation of the material concepts. - Discussion about the material course. [$2 \times 3 \times 50$ menit]		Students read the references and learn the materials. [$2 \times 3 \times 60$ menit]	Students do the group discussion. [$2 \times 3 \times 60$ menit]	LMS (ilearn UNAND)	Limit and completeness Topology on the real number line	15%
8	**MID-TERM EXAM**									
9-10	CLO-4 Students are able to explain the concept of continuity of functions and identify the properties of continuity for	● Accuracy in understanding related material ● Accuracy in answering task questions ● Neatness of task work	Final exam (7%+3%) Participation (2.5%) Assignment (2.5%)	Teaching and discussion: - Explanation of the material concepts. - Discussion about the		Students read the references and learn the materials. [$2 \times 3 \times 60$ menit]	Students do the group discussion. [$2 \times 3 \times 60$ menit]	LMS (ilearn UNAND)	Continuous Function	**15%**

	the function of one real-value variable. (**ILO-2**, ILO-3) CLO-6: Students are able to reason intuitively and analytically and are able to express the results of their reasoning in writing, systematically and rigorously. (**ILO-3)**	• Originality of the results of the task		material course. [$2 \times 3 \times 50$ menit]						
11-13	CLO-5: Students are able to explain the concept of differential calculus and identify the properties of derivatives and their relation to continuity. (**ILO-2**, ILO-3) CLO-6: Students are able to reason intuitively and	• Accuracy in explaining and understanding related material • Accuracy in answering quiz questions	Final exam (7%+3%) Quiz (5%)	Teaching and discussion: - Explanation of the material concepts. - Discussion about the material course. [3× 3×50 menit]		Students read the references and learn the materials. [$3 \times 3 \times 60$ menit] -	Students do the group discussion. [$3 \times 3 \times 60$ menit]	• LMS (ilearn UNAND) • Zoom	Differential Calculus	**15%**

	analytically and are able to express the results of their reasoning in writing, systematically and rigorously. (**ILO-3)**									
14-15	CLO-5: Students are able to explain the concept of integral calculus and identify integral properties. (**ILO-2**, ILO-3) CLO-6: Students are able to reason intuitively and analytically and are able to express the results of their reasoning in writing, systematically and rigorously. (**ILO-3)**	• Accuracy in understanding related material • Accuracy in answering task questions • Neatness of task work • Originality of the results of the task	Final exam (7%+3%) Participation (2.5%) Assignment (2.5%)	Teaching and discussion: - Explanation of the material concepts. - Discussion about the material course. [$2 \times 3 \times 50$ menit]		Students read the references and learn the materials. [$2 \times 3 \times 60$ menit]	Students do the group discussion. [$2 \times 3 \times 60$ menit]	LMS (ilearn UNAND)	Integral Calculus	**15%**
16	**FINAL EXAM**									
Total Weight										100%

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

Indicators, Criteria, and Assessment Weights

1. Assessment weight for each Assessment

NO	Assessment	Weight (%)
1	Mid-Term Exam	30
2	Final Exam	30
3	Assignment	10
4	Quiz	20
5	Participation	10
TOTAL		**100**

2. Assessment weight for Intended Learning Outcome
   - CLO-1: 15 %
   - CLO-2: 12 %
   - CLO-3: 12 %
   - CLO-4: 12 %
   - CLO-5: 12 %
   - CLO-6: 12%

Assessment Plan Table:

No.	CLO	Assessment					Weight (%)
		Mid-Term Exam (%)	Final Exam (%)	Quizzes (%)	Participation (%)	Assignment (%)	
1	Students are able to explain the concept of a rational number system and identify applicable properties (**ILO-2**: PI-1, PI-2, PI-3, **ILO-3**: PI-1, PI-2, PI-3).	10%			2.5%	2.5%	15%
2	Students are able to use the concept of a rational number system along with applicable properties in constructing real number systems and their properties (**ILO-2**: PI-1, PI-2, PI-3, **ILO-3**: PI-1, PI-2, PI-3).	7%		5%			12%
3	Students are able to generalize the concept and nature of sets in real numbers (**ILO-2**: PI-1, PI-2, PI-3; **ILO-3**: PI-1, PI-2, PI-3).	7%			2.5%	2.5%	12%
4	Students are able to explain the concept of continuity of functions and identify the properties of continuity for the function of one real-value variable (**ILO-2**: PI-1, PI-2, PI-3; **ILO-3**: PI-1, PI-2,PI-3).		7%		2.5%	2.5%	12%

5	Students are able to explain the concepts of differential calculus and integral calculus, identify the properties of derivatives and their relation to continuity (**ILO-2**: PI-1, PI-2, PI-3, **ILO-3**: PI-1, PI-2, PI-3).		7%	5 %			12%
6	Students are able to reason intuitively and analytically and are able to express the results of their reasoning in writing, systematically and rigorously (**ILO-3**: PI-1, PI-2, PI-3).	6%	9%	10%			25 %
	Total	30%	30%	20%	10%	10%	100%

Information:

TK: Group ask

Matrix of CLO and ILO

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