# SEMESTER LEARNING PLAN

**MATHEMATICAL LOGIC AND SETS COURSES**
**(23H01110203)**


**TEACHING TEAM**

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STUDI PROGRAM OF MATHEMATICS - S1
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
HASANUDDIN UNIVERSITY
MAKASSAR


2025

**STUDY PROGRAM OF MATEMATIKA - S1**
**FACULTY OF MATHEMATICS AND NATURAL SCIENCES**
**HASANUDDIN UNIVERSITY**

## Vision

The scientific vision is to become a study program with an international reputation in the development of mathematics based on the Indonesian maritime continent by 2030

## Vision Strategy

## Misson

To fulfill the above vision, the Undergraduate Mathematics Study Program has four missions, namely:

- Organizing innovative and effective mathematics learning to improve the quality and creativity of students in order to compete nationally and internationally.
- Improving a research culture that produces internationally reputable publications.
- Playing an active role in community service activities and collaborating with other academic institutions, government, business, media and society.
- Carry out governance in the Mathematics Study Program that is effective, efficient and transparent based on IT and ISO 9001:2015 standards to achieve the tridharma goals.

## Graduate Profiles

Gagal diterjemahkan

## PLO charged to courses

CPL-1 (ILO 1) - Students are able to demonstrate an advanced understanding of basic pure and simple applied mathematics.

CPL-2 (P2) - The students are able to identify objects, techniques, and theorems in fundamental mathematics, and making a connection for solving problems

CPL-3 (KU1) - The students are able to analyse a mathematical problem with logic, analytic, and systematic structure

## Course Learning Outcomes (CLO)

CPMK-1: Students have a relatively deep understanding in determining the truth value of a statement, including statements containing quantifiers, understand the laws of logic and several inference methods, understanding sets, relations in sets. (CPL1)

CPMK-2: Understand the process of proving a statement logically, analytically and systematically, proving set cardinal numbers and operations between cardinal numbers. (CPL3)

CPMK-3: Understand how to use the laws of logic, inference methods, proof methods for the development of mathematics and application to other scientific disciplines (CPL2)

## Sub-CLO

Sub CPMK-1: Students are able to explain and give examples of statements; able to determine the truth value of a compound statement (CPMK-1)

Sub CPMK-2: Able to prove the equivalence of two propositions using tautology and able to derive various conclusions using the laws of logic (CPMK-2)

Sub CPMK-3: Able to determine the truth value of quantified statements and able to state the form of refutation of quantified statements (CPMK-1)

Sub CPMK-4: Able to use quantified statements in Mathematical concepts, including: the concept of

functions and function limits (CPMK-3)

Sub CPMK-5: Able to explain and provide examples of various types of Evidence Methods and able to determine the type of evidence method that can be used for a case (CPMK-2 dan CPMK-3)

Sub CPMK-6: Know, explain and describe sets and the properties of sets (CPMK-1)

Sub CPMK-7: Know, explain and describe, and perform various set operations (CPMK-2)

Sub CPMK-8: Know, explain and describe relationships and the nature of relationships in sets (CPMK-1)

Sub CPMK-9: Know, explain and describe several operations between cardinal numbers (CPMK-2)

# Learning Analytics

Mathematical Logic and Sets

↑

Know, explain and describe several operations between cardinal numbers (CPMK-2)

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Know, explain and describe relationships and the nature of relationships in sets (CPMK-1)

↑

Know, explain and describe, and perform various set operations (CPMK-2)

↑

Know, explain and describe sets and the properties of sets (CPMK-1)

↑

Able to explain and provide examples of various types of Evidence Methods and able to determine the type of evidence method that can be used for a case (CPMK-3 dan CPMK-2)

↑

Able to use quantified statements in Mathematical concepts, including: the concept of functions and function limits (CPMK-3)

↑

Able to determine the truth value of quantified statements and able to state the form of refutation of quantified statements (CPMK-1)

↑

Able to prove the equivalence of two propositions using tautology and able to derive various conclusions using the laws of logic (CPMK-2)

↑

Students are able to explain and give examples of statements; able to determine the truth value of a compound statement (CPMK-1)

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Have passed the course Basic Mathematics I

# HASANUDDIN UNIVERSITY
## FAKULTY OF MATHEMATICS AND NATURAL SCIENCES
### STUDY PROGRAM OF MATHEMATICS - S1
# SEMESTER LEARNING PLAN

| Course | Code | Cource Group | Credits | SEMESTER | Compilation Date |
|---|---|---|---|---|---|
| Mathematical Logic and Sets | 23H01110203 | Algebra | 3 | 1 | 10 Agustus 2024 |

| AUTHORITY | SLP Developer Lecturer | Coordinator | Head of Study Program |
|---|---|---|---|
| | Prof. Dr. Amir Kamal Amir, M.Sc., Prof. Dr. Hasmawati, M.Si., Dr. Firman, S.Si.,M.Si. | Prof. Dr. Amir Kamal Amir, M.Sc. | Dr. Firman, S.Si.,M.Si. |

| | | |
|---|---|---|
| **Learning Outcomes Course** | **SLOs that are imposed on the course** | |
| | **SLO-1:** | Mahasiwa memiliki pemahaman yang relatif mendalam dalam matematika murni dan matematika terapan sederhana. |
| | **SLO-2:** | Mahasiswa mampu mengidentifikasi objek, teknik, dan sifat dalam matematika dasar, dan membuat koneksi untuk menyelesaikan masalah |
| | **SLO-3:** | Mahasiswa mampu menganalisis suatu masalah matematika dengan logika, analitik, dan struktur sistematis |
| | **SLO ⇒ Course Learning Outcomes** | |
| | After completing this course, it is expected: | |
| | **SLO-1** | **CLO-1:** Students have a relatively deep understanding in determining the truth value of a statement, including statements containing quantifiers, understand the laws of logic and several inference methods, understanding sets, relations in sets. |
| | **SLO-3** | **CLO-2:** Understand the process of proving a statement logically, analytically and systematically, proving set cardinal numbers and operations between cardinal numbers. |
| | **SLO-2** | **CLO-3:** Understand how to use the laws of logic, inference methods, proof methods for the development of mathematics and application to other scientific disciplines |
| | **CLO ⇒ Sub-CLO** | |
| | **CLO-1** | **Sub-CLO-1:**Students are able to explain and give examples of statements; able to determine the truth value of a compound statement |
| | | **Sub-CLO-3:**Able to determine the truth value of quantified statements and able to state the form of refutation of quantified statements |
| | | **Sub-CLO-6:**Know, explain and describe sets and the properties of sets |
| | | **Sub-CLO-8:**Know, explain and describe relationships and the nature of relationships in sets |
| | **CLO-2** | **Sub-CLO-2:**Able to prove the equivalence of two propositions using tautology and able to derive various conclusions using the laws of logic |
| | | **Sub-CLO-5:**Able to explain and provide examples of various types of Evidence Methods and able to determine the type of evidence method that can be used for a case |

| | | |
|---|---|---|
| | | **Sub-CLO-7:**Know, explain and describe, and perform various set operations |
| | | **Sub-CLO-9:**Know, explain and describe several operations between cardinal numbers |
| | **CLO-3** | **Sub-CLO-4:**Able to use quantified statements in Mathematical concepts, including: the concept of functions and function limits |
| | | **Sub-CLO-5:**Able to explain and provide examples of various types of Evidence Methods and able to determine the type of evidence method that can be used for a case |
| | **Correlation between SLOs/CLOs to Sub-CLOs** | |

| SLOs that are charged on the Course | CPMK | SUB CPMK | Form of Assessment* | | | | | | Weight | Value | Student Score |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Formative | Sumative | | | | | | | |
| | | | | Short Q&A | Independent Assignment | Case Studies | Written Exam | Written Exam | | | |
| SLO-1 | CLO-1 | SUB-CLO-1 | Discipline | 0 | 0 | 0 | 0 | 0 | 0 | | |
| SLO-3 | CLO-2 | SUB-CLO-2 | Punctuality | 0 | 10 | 0 | 2.04 | 0 | 12.04 | | |
| SLO-1 | CLO-1 | SUB-CLO-3 | | 0 | 10 | 0 | 2.04 | 0 | 12.04 | | |
| SLO-2 | CLO-3 | SUB-CLO-4 | independence | 0 | 0 | 10 | 2.04 | 0 | 12.04 | | |
| SLO-3 | CLO-2 | SUB-CLO-5 | Punctuality | 0 | 0 | 10 | 2.04 | 0 | 12.04 | | |
| SLO-1 | CLO-1 | SUB-CLO-6 | Punctuality | 4 | 0 | 0 | 0.82 | 0 | 4.82 | | |
| SLO-3 | CLO-2 | SUB-CLO-7 | | 0 | 5 | 0 | 1.02 | 0 | 6.02 | | |
| SLO-1 | CLO-1 | SUB-CLO-8 | | 4 | 0 | 0 | 0 | 1.67 | 5.67 | | |
| SLO- | CLO- | SUB-CLO-9 | Punctuality | 7 | 0 | 0 | 0 | 0 | 7 | | |
| SLO-3 | CLO-2 | SUB-CLO-9 | Punctuality | 0 | 0 | 20 | 0 | 8.33 | 28.33 | | |
| | | | | 15 | 25 | 40 | 10 | 10 | 100 | | |

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| **Course Description** | This course is designed to develop logical thinking and critical thinking skills. This course does not emphasize the use or mastery of formulas mathematics, but rather trains and strengthens the logical aspects of mathematics and knowledge of sets of students. It is hoped that students understand the importance of mathematical knowledge, not because Must be proficient with numbers and various quantitative formulas only. The material for this course includes: Sentence Statements, Truth Value of Sentences, Laws of Logic, several special forms of statements, valid and invalid arguments, quantified statements, the use of logic in several basic concepts of mathematics, methods of proving statements, basics of set theory, relations on sets, and set cardinal numbers. |

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| **Learning Materials/Subjects** | 1. Basics of logic (Basics of logic)<br>2. Quantified Statement (Quantor statement)<br>3. Use of Quantor Statements<br>4. Method of Evidence (method of evidence)<br>5. Basics of Set Theory<br>6. Relations in Sets<br>7. Set of cardinal numbers |
| **Reference** | **Main References** |
| | 1.A. Weinstein, Logic, Set, and Number, second Edition, Wosworth Publishing Company, California, 1976.<br>2. P.J. Hurley, A Concise Introduction to Logic, 3rd Edition, Wadsworth Pub, 1988.<br>3. A.K. Amir, Structure of Logical and Systematic Thinking. Depublish, 2018.<br>4. Charles C Pinter, "Set Theory", Dover Publication, Inc.2014<br>5. Seymour Lipschutz, "Set Theory and Related Topics" Schaum Outline Series, 1998 |
| | **Additional References** |
| | K.H. Rosen, Discrete Mathematics and Its Applications, 4th Edition, McGraw-Hill, 1995. |
| **Teaching Team** | Prof. Dr. Budi Nurwahyu, MS., Prof. Dr. Amir Kamal Amir, M.Sc., Prof. Dr. Hasmawati, M.Si., Dra. Nur Erawati, M.Si. |
| **Course requirement** | Basic Mathematics I |

| **Week** | **Sub CPMK (End-of-stage learning ability)** | **Penilaian (*Assesment*)** | | **Learning Forms and Methods [time estimate]** | | **Content** | **Weight of Assessment (%)** |
|---|---|---|---|---|---|---|---|
| | | **Indicator** | **Techniques & Criteria** | **Offline** | **Online** | | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Students are able to explain and give examples of statements; able to determine the truth value of a compound statement (CPMK-1) | **Formative:**<br>Students are able to show discipline.<br><br>**Sumative:**<br>The accuracy of the explanation with examples; determines truth value via truth table | **Formative Criteria:**<br>Discipline dinilai dengan rubrik 01<br><br>**Sumative Criteria:**<br>Short Q&A (0)<br>**Assessment Technique:**<br>Test and Non-Test | **Studying:**<br>Collaborative learning (Collaborative Learning)<br><br>TM:3x1x50 | | College Contract, Statement, simple and compound, truth value table | 0 |
| 2 | Able to prove the equivalence of two propositions using tautology and able to derive various conclusions using the laws of logic (CPMK-2) | **Formative:**<br>Students are able to show a disciplined and active attitude in learning<br><br>**Sumative:**<br>Accuracy of using tautology and laws of logic | **Formative Criteria:**<br>Punctuality dinilai dengan rubrik 01<br><br>**Sumative Criteria:**<br>Independent Assignment (10) dinilai dengan rubrik 01<br>**Assessment Technique:**<br>Test and Non-Test | **Studying:**<br>Collaborative learning (Collaborative Learning)<br>Gagal diterjemahkan<br><br>3x1x50 | | The laws of logic, Tautology, Contradiction, converse, Inverse, Contraposition | 10 |
| 3 | Able to determine the truth value of quantified statements and able to state the form of refutation of quantified statements (CPMK-1) | **Formative:**<br>Gagal diterjemahkan<br><br>**Sumative:**<br>Accuracy of use several inference methods. | **Formative Criteria:**<br>**Sumative Criteria:**<br>Independent Assignment (10) dinilai dengan rubrik 01<br>**Assessment Technique:**<br>Test and Non-Test | **Studying:**<br>Collaborative learning (Collaborative Learning)<br>Gagal diterjemahkan<br><br>3x1x50 | | Valid argument and invalid, Some inference method | 10 |

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|---|---|---|---|---|---|---|---|
| 4-5 | Able to use quantified statements in Mathematical concepts, including: the concept of functions and function limits (CPMK-3) | **Formative:**<br>Students are able to show a disciplined and active attitude in learning<br><br>**Sumative:**<br>Accuracy determines value truth and accuracy determine the shape disclaimer. | **Formative Criteria:**<br>independence dinilai dengan rubrik 01<br><br>**Sumative Criteria:**<br>Case Studies (10) dinilai dengan rubrik 01<br><br>**Assessment Technique:**<br>Gagal diterjemahkan | **Studying:**<br>Collaborative learning (Collaborative Learning)<br>Gagal diterjemahkan<br><br>3x1x50 | | General accountant, quantifier existential as well negation of statement have an office | 10 |
| 6-7 | Able to explain and provide examples of various types of Evidence Methods and able to determine the type of evidence method that can be used for a case (CPMK-3, CPMK-2) | **Formative:**<br>Students are able to show a disciplined and active attitude in learning<br><br>**Sumative:**<br>Accuracy of use statement has office on Mathematics concepts, | **Formative Criteria:**<br>Punctuality dinilai dengan rubrik 01<br><br>**Sumative Criteria:**<br>Case Studies (10) dinilai dengan rubrik 01<br><br>**Assessment Technique:**<br>Test and Non-Test | **Studying:**<br>Collaborative learning (Collaborative Learning)<br>Gagal diterjemahkan<br><br>2x1x50 | | Logic Concepts on Function | 10 |
| 8 | Written Exam | | | | | | 10 |
| 9 | Know, explain and describe sets and the properties of sets (CPMK-1) | **Formative:**<br>Gagal diterjemahkan<br><br>**Sumative:**<br>The accuracy and systematicity of the proof steps | **Formative Criteria:**<br>Punctuality dinilai dengan rubrik 01<br><br>**Sumative Criteria:**<br>Short Q&A (4) dinilai dengan rubrik 01<br><br>**Assessment Technique:**<br>Test and Non-Test | **Studying:**<br>Collaborative learning (Collaborative Learning)<br><br>-<br><br>2x2x50 | | Types of proof methods and their applications | 4 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10-11 | Know, explain and describe, and perform various set operations (CPMK-2) | **Formative:**<br>Gagal diterjemahkan<br>**Sumative:**<br>The accuracy and systematicity of the proof steps | **Formative Criteria:**<br>**Sumative Criteria:**<br>Independent Assignment (5)<br>**Assessment Technique:**<br>Gagal diterjemahkan | **Studying:**<br>Collaborative learning (Collaborative Learning)<br>-<br>2x2x50 | | Proof method using Mathematical Induction | 5 |
| 12-13 | Know, explain and describe relationships and the nature of relationships in sets (CPMK-1) | **Formative:**<br>Gagal diterjemahkan<br>**Sumative:**<br>Accuracy Explanation with examples Accuracy in solving problems related to conversion between canonical forms | **Formative Criteria:**<br>**Sumative Criteria:**<br>Short Q&A (4)<br>**Assessment Technique:**<br>Test and Non-Test | **Studying:**<br>Collaborative learning (Collaborative Learning)<br>-<br>2x1x50 | | Understanding and examples of Boolean algebra, Form Conversion, SOP and POS Canonical Form Functions, and conversion between canonical forms | 4 |
| 14 | Know, explain and describe cardinal numbers () | **Formative:**<br>Gagal diterjemahkan<br>**Sumative:**<br>Gagal diterjemahkan | **Formative Criteria:**<br>Punctuality dinilai dengan rubrik 01<br>**Sumative Criteria:**<br>Short Q&A (7) dinilai dengan rubrik 01<br>**Assessment Technique:**<br>Test and Non-Test | | | Gagal diterjemahkan | 7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 15 | Know, explain and describe several operations between cardinal numbers (CPMK-2) | **Formative:**<br>Gagal diterjemahkan<br><br>**Sumative:**<br>Gagal diterjemahkan | **Formative Criteria:**<br>Punctuality dinilai dengan rubrik 01<br><br>**Sumative Criteria:**<br>Case Studies (20) dinilai dengan rubrik 01<br><br>**Assessment Technique:**<br>Test and Non-Test | | | Gagal diterjemahkan | 20 |
| 16 | Written Exam | | | | | | 10 |
| | | | | | | | 100 |

**Matrix of SLO, CLO, and Assessment Method**

| SLO / CLO | CLO-1 | CLO-2 | CLO-3 |
|---|---|---|---|
| CPL-1 (ILO 1) | Short Q&A<br>Independent Assignment (Weight 10%)<br>Short Q&A (Weight 4%)<br>Short Q&A (Weight 4%) | | |
| CPL-2 (P2) | | | Case Studies (Weight 10%)<br>Case Studies (Weight 10%) |
| CPL-3 (KU1) | | Independent Assignment (Weight 10%)<br>Case Studies (Weight 10%)<br>Independent Assignment (Weight 5%)<br>Case Studies (Weight 20%) | |

### Evaluation Type and Assessment Weight

| Type | Assessment Weight |
|---|---|
| Short Q&A | 15 |
| Independent Assignment | 25 |
| Case Studies | 40 |
| Written Exam | 10 |
| Written Exam | 10 |
| Total | 100 |

**Assessment and Evaluation of Student Achievement of CLOs**

| SLOs that are charged on the Course | CLO | SUB CLO | Form of Assessment* | | | | | Weight | Value | Student Score |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Formative | Sumative | | | | | | |
| | | | | Short Q&A | Independent Assignment | Case Studies | Written Exam | Written Exam | | | |
| SLO-1 | CLO-1 | SUB-CLO-1 | Discipline | 0 | 0 | 0 | 0 | 0 | 0 | | |
| SLO-3 | CLO-2 | SUB-CLO-2 | Punctuality | 0 | 10 | 0 | 2.04 | 0 | 12.04 | | |
| SLO-1 | CLO-1 | SUB-CLO-3 | | 0 | 10 | 0 | 2.04 | 0 | 12.04 | | |
| SLO-2 | CLO-3 | SUB-CLO-4 | independence | 0 | 0 | 10 | 2.04 | 0 | 12.04 | | |
| SLO-3 | CLO-2 | SUB-CLO-5 | Punctuality | 0 | 0 | 10 | 2.04 | 0 | 12.04 | | |
| SLO-1 | CLO-1 | SUB-CLO-6 | Punctuality | 4 | 0 | 0 | 0.82 | 0 | 4.82 | | |
| SLO-3 | CLO-2 | SUB-CLO-7 | | 0 | 5 | 0 | 1.02 | 0 | 6.02 | | |
| SLO-1 | CLO-1 | SUB-CLO-8 | | 4 | 0 | 0 | 0 | 1.67 | 5.67 | | |
| SLO- | CLO- | SUB-CLO-9 | Punctuality | 7 | 0 | 0 | 0 | 0 | 7 | | |
| SLO-3 | CLO-2 | SUB-CLO-9 | Punctuality | 0 | 0 | 20 | 0 | 8.33 | 28.33 | | |
| | | | | 15 | 25 | 40 | 10 | 10 | 100 | | |

**Lampiran Rubrik 01 | ASSESMENT TERTULIS**

| Kriteria Penilaian | Bobot/Skor Penilaian | | | | |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1/0 |
| Konsep/ metode yang digunakan | Penjelasan konsep /metode (*) sangat lengkap dan akurat | Penjelasan konsep/metode (*) cukup jelas tetapi beberapa informasi tidak dituliskan secara lengkap. | Penjelasan konsep/metode (*) kurang jelas dan banyak informasi yang tidak dituliskan | Penjelasan yang dituliskan hampir tidak berkaitan dengan konsep/ metode (*) | Tidak memberikan konsep yang dibutuhkan |
| Sistematika penulisan/ pembuktian | Sistematika penulisan/ pembuktian sangat jelas dan terstruktur | Sistematika penulisan/ pembuktian cukup jelas namun ada langkah yang hilang | Sistematika penulisan/ pembuktian kurang jelas | Sistematika penulisan/ pembuktian tidak jelas | Jawaban tidak benar/ tidak ada |
| Interpretasi geometri/ kualitatif/ kuantitatif. | Interpretasi geometri/ kualitatif/ kuantitaBtif (*) tepat dan lengkap | Interpretasi geometri/ kualitatif/ kuantitatif (*) cukup lengkap/ tepat | Interpretasi geometri/ kualitatif/ kuantitatif (*) kurang lengkap/ tepat | Interpretasi geometri/ kualitatif/ kuantitatif(*) tidak lengkap/ tepat | Interpretasi geometri/ kualitatif/kuantitatif(*) tidak benar |
| Perhitungan/kesimpulan | Perhitungan/ kesimpulan sangat akurat/tepat dan disertai alasan yang mendasarinya | Perhitungan/ kesimpulan cukup akurat/tepat dan disertai alasan yang mendasarinya | Kesimpulan cukup tepat, namun tidak disertai alasan yang jelas | Perhitungan/ kesimpulan kurang akurat/tepat dan tidak disertai alasan yang mendasarinya | Perhitungan/kesimpulan salah |