# SEMESTER LEARNING PLAN


**ADVANCED MATHEMATICS COURSES**
**(23H01120204)**





**TEACHING TEAM**

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STUDI PROGRAM OF MATHEMATICS - S1
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
HASANUDDIN UNIVERSITY
MAKASSAR
2025

## 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: Understand the basic concepts of multivariable calculus, including vectors, vector calculus, several techniques and tools needed in mathematics. (CPL1)

CPMK-2: Have an underlying geometric intuition and visualization that will enable students to understand problems. (CPL1 dan CPL2)

CPMK-3: Understand how to use multivariable calculus concepts and several mathematical tools effectively to solve simple mathematics, science and engineering problems. (CPL2 dan CPL3)

## Sub-CLO

Sub CPMK-1: Students are able to understand well the objectives, uses of the course material and its relationship to other subjects, review students' initial competency regarding vectors.Students are able to explain concepts in vector-valued functions.Students are able to calculate and provide geometric interpretations of concepts in vector-valued functions.Students are able to apply vector-valued functions to physics problems. (CPMK-1)

Sub CPMK-2: Students are able to explain the integral concept of a function with a domain in the form of curves and curved surfaces.Students are able to calculate and interpret the integral form if the integration area is in the form of a curve and a curved surface.Students are able to make a connection between surface integrals and area areas. (CPMK-1)

Sub CPMK-3: Students are able to recognize simple problems that exist in everyday life and apply the concepts of vector functions and vector calculus to related problems. (CPMK-3)

Sub CPMK-4: Students are able to explain concepts and provide examples of convergent and divergent sequences and series.Students are able to carry out convergence tests on given sequences and series. (CPMK-1)

Sub CPMK-5: Students are able to apply basic integral calculus to improper integral forms.Students are able to understand the convergence test of improper integrals (CPMK-3)

Sub CPMK-6: Students are able to understand the form of sequences and series of real numbers and power series and dere functions (CPMK-3)

Sub CPMK-7: Students are able to recognize simple problems that exist in everyday life and apply the concepts of series, Gamma functions and Beta functions. (CPMK-1 dan CPMK-3)

Sub CPMK-8: Students understand in depth and are able to solve problems of Forier series, Forier integrals and apply Forier series and Forier integrals in everyday life. (CPMK-1)

# Learning Analytics

| Advanced Mathematics |
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| Students understand in depth and are able to solve problems of Forier series, Forier integrals and apply Forier series and Forier integrals in everyday life. (CPMK-1) |
|---|

↑

| Students are able to recognize simple problems that exist in everyday life and apply the concepts of series, Gamma functions and Beta functions. (CPMK-1 dan CPMK-3) |
|---|

↑

| Students are able to understand the form of sequences and series of real numbers and power series and dere functions (CPMK-3) |
|---|

↑

| Students are able to apply basic integral calculus to improper integral forms.Students are able to understand the convergence test of improper integrals (CPMK-3) |
|---|

↑

| Students are able to explain concepts and provide examples of convergent and divergent sequences and series.Students are able to carry out convergence tests on given sequences and series. (CPMK-1) |
|---|

↑

| Students are able to recognize simple problems that exist in everyday life and apply the concepts of vector functions and vector calculus to related problems. (CPMK-3) |
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↑

| Students are able to explain the integral concept of a function with a domain in the form of curves and curved surfaces.Students are able to calculate and interpret the integral form if the integration area is in the form of a curve and a curved surface.Students are able to make a connection between surface integrals and area areas. (CPMK-1) |
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| Students are able to understand well the objectives, uses of the course material and its relationship to other subjects, review students' initial competency regarding vectors.Students are able to explain concepts in vector-valued functions.Students are able to calculate and provide geometric interpretations of concepts in vector-valued functions.Students are able to apply vector-valued functions to physics problems. (CPMK-1) |
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| Have passed the course Basic Mathematics I and Basic Mathematics II |
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# HASANUDDIN UNIVERSITY
## FAKULTY OF MATHEMATICS AND NATURAL SCIENCES
### STUDY PROGRAM OF MATHEMATICS - S1
# SEMESTER LEARNING PLAN

| Course | | Code | Cource Group | Credits | SEMESTER | Compilation Date |
|---|---|---|---|---|---|---|
| Advanced Mathematics | | 23H01120204 | Analysis | 4 | 3 | 12 Agustus 2025 |

| AUTHORITY | | SLP Developer Lecturer | Coordinator | Head of Study Program |
|---|---|---|---|---|
| | | Jusmawati Massalesse, S.Si.,M.Si., Naimah Aris, S.Si.,M.Math., Dr. Muhammad Zakir, M.Si. | Naimah Aris, S.Si.,M.Math. | Dr. Firman, S.Si.,M.Si. |

| | | 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:** Understand the basic concepts of multivariable calculus, including vectors, vector calculus, several techniques and tools needed in mathematics. | |
| | | **CLO-2:** Have an underlying geometric intuition and visualization that will enable students to understand problems. | |
| | **SLO-2** | **CLO-2:** Have an underlying geometric intuition and visualization that will enable students to understand problems. | |
| | | **CLO-3:** Understand how to use multivariable calculus concepts and several mathematical tools effectively to solve simple mathematics, science and engineering problems. | |
| | **SLO-3** | **CLO-3:** Understand how to use multivariable calculus concepts and several mathematical tools effectively to solve simple mathematics, science and engineering problems. | |
| | **CLO ⇒ Sub-CLO** | | |
| **Learning Outcomes Course** | | **Sub-CLO-1:**Students are able to understand well the objectives, uses of the course material and its relationship to other subjects, review students' initial competency regarding vectors.Students are able to explain concepts in vector-valued functions.Students are able to calculate and provide geometric interpretations of concepts in vector-valued functions.Students are able to apply vector-valued functions to physics problems. | |
| | | **Sub-CLO-2:**Students are able to explain the integral concept of a function with a domain in the form of curves and curved surfaces.Students are able to calculate and interpret the integral form if the integration area is in the form of a curve and a curved surface.Students are able to make a connection between surface integrals and area areas. | |

| | CLO-1 | **Sub-CLO-4:**Students are able to explain concepts and provide examples of convergent and divergent sequences and series.Students are able to carry out convergence tests on given sequences and series. |
| --- | --- | --- |
| | | **Sub-CLO-7:**Students are able to recognize simple problems that exist in everyday life and apply the concepts of series, Gamma functions and Beta functions. |
| | | **Sub-CLO-8:**Students understand in depth and are able to solve problems of Forier series, Forier integrals and apply Forier series and Forier integrals in everyday life. |
| | CLO-3 | **Sub-CLO-3:**Students are able to recognize simple problems that exist in everyday life and apply the concepts of vector functions and vector calculus to related problems. |
| | | **Sub-CLO-5:**Students are able to apply basic integral calculus to improper integral forms.Students are able to understand the convergence test of improper integrals |
| | | **Sub-CLO-6:**Students are able to understand the form of sequences and series of real numbers and power series and dere functions |
| | | **Sub-CLO-7:**Students are able to recognize simple problems that exist in everyday life and apply the concepts of series, Gamma functions and Beta functions. |

**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 | | | | | |
| | | | | Quiz | Written Exam | Written Exam | | | |
| SLO-1 | CLO-1 | SUB-CLO-2 | | 15 | 10 | 0 | 25 | | |
| SLO-3 | CLO-3 | SUB-CLO-3 | | 15 | 10 | 0 | 25 | | |
| SLO-3 | CLO-3 | SUB-CLO-5 | | 15 | 0 | 10 | 25 | | |
| SLO-3 | CLO-3 | SUB-CLO-6 | | 15 | 0 | 10 | 25 | | |
| | | | | 60 | 20 | 20 | 100 | | |

| Course Description | The focus of this course is on vector functions, using calculus to analyze the geometry of curves and surfaces in three-dimensional space and some of the necessary mathematical techniques/tools. Topics that will be discussed are Parametric Functions, Vector Functions: Vector Functions and Space Curves, Derivatives and Integrals of Vector Functions, Arc Length and Curvature, and Motion in Space. Vector calculus: Vector fields, Line integrals, Green's theorem, Curl and divergence, Parametric surfaces and their areas, Surface integrals, Stokes' theorem. Convergent test of series, series and integration of Fourier, Gamma and Beta functions. |
| --- | --- |

| | Learning Materials/Subjects | |
|---|---|---|
| **Learning Materials/Subjects** | 1. Vector Functions: Parametric Functions, Vector Functions and Space Curves, Derivatives and Integrals of Vector Functions, Arc Length and Curvature, Motion in Space | |
| | 2. Calculus Vector: vectors fields, line integrals, The Fundamental Theorem for Line Integrals, Green's theorem, curl and divergence, Surface integrals, Stokes Theorem | |
| | 3. Line Integrals and Surface Integrals | |
| | 4. Sequence and Series | |
| | 5. Series and Fourier Integrals | |
| | 6. Gamma and Beta Functions | |

| | **Main References** |
|---|---|
| **Reference** | 1. James Stewart, Daniel Clegg, Saleem Watson, "Early Calculus Transcendentals " Ninth Edition, Thomson Brooks/Cole, 2021. |
| | 2. James Stewan, "Calculus Early Transcendentals, Sixth edition", Thomson Brooks/Cole, 2008. |
| | 3. George B Thomas, Advanced Calculus, Twelfth Edition", Addison Wesley, 2010. |
| | 4. Robert Wrede, Spiegel Murray, "Theory and Problems of Advanced Calculus", Schaum series, 1997. |
| | **Additional References** |
| | 1. MIT Multivariable Calculus Lecture: https://www.youtube.com/playlist?list=PL4C4C8A7D06566F38 |
| | 2. www.khanacademy.org |

| **Teaching Team** | Jusmawati Massalesse, S.Si.,M.Si., Naimah Aris, S.Si.,M.Math., Dr. Muhammad Zakir, M.Si. |
|---|---|
| **Course requirement** | Basic Mathematics I, Basic Mathematics II |

| 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 |

| 1-2 | Students are able to understand well the objectives, uses of the course material and its relationship to other subjects, review students' initial competency regarding vectors.Students are able to explain concepts in vector-valued functions.Students are able to calculate and provide geometric interpretations of concepts in vector-valued functions.Students are able to apply vector-valued functions to physics problems. (CPMK-1) | **Formative:**<br><br>Gagal diterjemahkan<br><br><br>**Sumative:**<br><br>Complete understanding of vector concepts, dot product, cross product, and line equations in a plane.<br><br>Complete understanding of concepts in vector functions.<br><br>Completeness in calculating and describe graphic curve parameter equation, limit, derivative, integral of vector-valued function, length curves, and curvature.<br><br>Completion in applying vector-valued functions in determining the speed and acceleration of an object. | **Formative Criteria:**<br><br>**Sumative Criteria:**<br><br>**Assessment Technique:**<br><br>Test | **Studying:**<br><br>Other methods<br><br>Lecture + discussion<br><br><br>90 minutes | | College contracts, RPS, CPMK, Permenristekdikti number 44 year 2015, KKNI documents, academic regulations Unhas.<br><br>Vectors: vector concepts, dot product, cross product, and equations of lines in a plane. Vector functions and space curve; Parametric equations, vector functions, space curves, velocity vectors, acceleration vectors, derivatives and integrals of vector functions; Curve length; Curvature; and Movement in curves. | 0 |

| 3-4 | Students are able to explain the integral concept of a function with a domain in the form of curves and curved surfaces.Students are able to calculate and interpret the integral form if the integration area is in the form of a curve and a curved surface.Students are able to make a connection between surface integrals and area areas. (CPMK-1) | **Formative:** Gagal diterjemahkan  **Sumative:** Completion in explaining the meaning of vector fields, gradient fields, line integrals  line integral of an object moving on a curve, curl and divergence, Green's theorem, surface integral and Stokes' theorem.  Completion in carrying out the integration process correctly for integral cases where the integration region is shaped arch or curved surface.  Completeness in connecting and calculating surface integrals through area. | **Formative Criteria:**  **Sumative Criteria:**  Quiz (15)  **Assessment Technique:**  Test and Non-Test | **Studying:**  Other methods  Lecture + question and answer discussion  90 minutes | | Vector Fields and Integral  Line  1. Line Integrals in Space, Vector Fields and Line Integrals  2. The line integral of the Field Vector,  3. Basic Theorem Line integral  Integral Surface:  1. Green's Theorem,  2. Integral Surface  3. Stokes' Theorem | 15 |
| 5-6 | Students are able to recognize simple problems that exist in everyday life and apply the concepts of vector functions and vector calculus to related problems. (CPMK-3) | **Formative:** Gagal diterjemahkan  **Sumative:** The accuracy of analyzing the solution to the given problem. | **Formative Criteria:**  **Sumative Criteria:**  Quiz (15)  **Assessment Technique:**  Test | **Studying:**  Other methods  Lecture + Question and answer discussion  90 minutes | | Solution of problems in everyday life using the concepts of vector functions and vector calculus. | 15 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | Students are able to understand well the objectives, uses of the course material and its relationship to other subjects, review students' initial competency regarding vectors.Students are able to explain concepts in vector-valued functions.Students are able to calculate and provide geometric interpretations of concepts in vector-valued functions.Students are able to apply vector-valued functions to physics problems. (CPMK-1) | **Formative:** Gagal diterjemahkan

**Sumative:** Gagal diterjemahkan | **Formative Criteria:**

**Sumative Criteria:**

**Assessment Technique:** Gagal diterjemahkan | **Studying:** Other methods

Lecture + Discussion + Questions and Answers

90 minutes | | 1. Vector valued functions

2. Solving vector-valued function problems

3. Geometrically interpreting vector-valued functions | 0 |
| 8 | Written Exam | | | | | | 20 |
| 9-11 | Students are able to explain concepts and provide examples of convergent and divergent sequences and series.Students are able to carry out convergence tests on given sequences and series. (CPMK-1) | **Formative:** Gagal diterjemahkan

**Sumative:**

1. Give correct examples of sequences and series

2. Clarity and accuracy of the test convergence carried out. | **Formative Criteria:**

**Sumative Criteria:**

**Assessment Technique:** Test | **Studying:** Other methods

Lecture + Question and Answer Discussion

90 minutes | | Sequences and Series: Sequences, Monotone Series, Convergence of Series, Series, Convergence Test of Series | 0 |

| 12 | Students are able to apply basic integral calculus to improper integral forms.Students are able to understand the convergence test of improper integrals (CPMK-3) | **Formative:**<br><br>Gagal diterjemahkan<br><br><br>**Sumative:**<br><br>Carry out the process of answering improper integrals with correct integral values. Carry out appropriate convergence tests for cases of improper integrals where the integral value cannot be determined using the usual method. | **Formative Criteria:**<br><br>**Sumative Criteria:**<br><br>Quiz (15)<br><br>**Assessment Technique:**<br><br>Test and Non-Test | **Studying:**<br><br>Other methods<br><br>Lecture + Question and answer discussion<br><br><br><br>90 minutes | | Assessment Form :<br><br>Media: Google Meet, WAG<br><br>TM: 2x4x50,<br><br>PT + BM: (2+2)x(4x60)<br><br>Media: Sikola,<br>Youtube Sikola (Module 12, 13, Task 4, and youtube link)<br><br>BM:  Pre-readings: Schaum, 2002 Chapter 12 and Module 12 - 13 and write a summary of the material they have read.<br><br>Lecture participants complete the assignment independently and submit it. at SIKOLA . | 15 |
| 13-14 | Students are able to understand the form of sequences and series of real numbers and power series and dere functions (CPMK-3) | **Formative:**<br><br>Gagal diterjemahkan<br><br><br><br>**Sumative:**<br><br>Completeness and integration of concepts in the steps to answer exam questions, Independence. | **Formative Criteria:**<br><br>**Sumative Criteria:**<br><br>Quiz (15) dinilai dengan rubrik 01<br><br>**Assessment Technique:**<br><br>Test | **Studying:**<br><br>Other methods<br><br>Lecture + Discussion + Questions and Answers<br><br><br><br>90 minutes | | Fourier Series, and Integral<br><br>Fourier: Periodic Functions, Fourier Series, Even Functions and Odd Functions, Series and Fourier Integral | 15 |
| 15 | Students are able to recognize simple problems that exist in everyday life and apply the concepts of series, Gamma functions and Beta functions. (CPMK-1, CPMK-3) | **Formative:**<br><br>Gagal diterjemahkan<br><br><br><br>**Sumative:**<br><br>The accuracy of analyzing the solution to a given problem | **Formative Criteria:**<br><br>**Sumative Criteria:**<br><br>**Assessment Technique:**<br><br>Test | **Studying:**<br><br>Other methods<br><br>Lecture + Discussion + Questions and Answers<br><br><br><br>90 minutes | | Solution of problems in everyday life using the concepts of series, Gamma function and Beta function, series and Fourier integral | 0 |

| 16 | Written Exam | | 20 |
|---|---|---|---|
| | | | 100 |

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

| SLO / CLO | CLO-1 | CLO-3 |
|---|---|---|
| CPL-1 (ILO 1) | Quiz (Weight 15%) | |
| CPL-2 (P2) | | Quiz (Weight 15%)<br>Quiz (Weight 15%)<br>Quiz (Weight 15%) |
| CPL-3 (KU1) | | Quiz (Weight 15%)<br>Quiz (Weight 15%)<br>Quiz (Weight 15%) |

**Evaluation Type and Assessment Weight**

| Type | Assessment Weight |
|---|---|
| Quiz | 60 |
| Written Exam | 20 |
| Written Exam | 20 |
| 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 | | | | | |
| | | | | Quiz | Written Exam | Written Exam | | | |
| SLO-1 | CLO-1 | SUB-CLO-2 | | 15 | 10 | 0 | 25 | | |
| SLO-3 | CLO-3 | SUB-CLO-3 | | 15 | 10 | 0 | 25 | | |
| SLO-3 | CLO-3 | SUB-CLO-5 | | 15 | 0 | 10 | 25 | | |
| SLO-3 | CLO-3 | SUB-CLO-6 | | 15 | 0 | 10 | 25 | | |
| | | | | 60 | 20 | 20 | 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 |