SEMESTER LEARNING PLAN

BASIC MATHEMATICS II COURSES
(23H01110303)

TEACHING TEAM

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

Course Learning Outcomes (CLO)

CPMK-1: Students are able to use many variable calculus concepts (functions, limits, derivatives, integrals, matrices and linear equation systems) to solve problems in mathematics, science, and technology (CPL1)

CPMK-2: Students are able to apply functions, derivatives, integrals and matrix operations to solve problems in related fields. (CPL3)

Sub-CLO

Sub CPMK-1: Students are able to describe the systematic steps in determining the domains and ranges of many variable functions, as well as on the representation of the function of two or three variables algebra, numerical and graphics (CPMK-1)

Sub CPMK-2: Students are able to prove the existence of limits and continuity in the function of two or more variables, both algebra and graphically (CPMK-1)

Sub CPMK-3: Students are able to find partial derivatives of one or higher order or higher order, directed derivatives, and total derivatives, both through the application of chain rules, compound functional rules, and relevant derivative theorems. (CPMK-1)

Sub CPMK-4: Students are able to demonstrate the application of the partial derivative of one or higher order to the maximum-minimum problem with or without obstacles, as well as on the problem of approximation through the Taylor formula. (CPMK-2)

Sub CPMK-5: Students are able to determine the results of the integration of double and double three, both

through the exchange of integration sequences or through coordinate transformation, including their use in the calculation of the area of integration, average value, volume, moment and mass center. (CPMK-2)

Sub CPMK-6: Students are able to use matrix properties, addition and matrix multiplication operations, as well as elementary line operations on determining the determinant and inverse matrix. (CPMK-1)

Sub CPMK-7: Students are able to apply the determinant, inverse and elementary line operations in the completion of the system of linear equations (CPMK-2)

Sub CPMK-8: Students are able to apply differential equations appropriately based on the characteristics of PD to get an accurate settlement. (CPMK-2)

Learning Analytics

Basic Mathematics II

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Students are able to apply differential equations appropriately based on the characteristics of PD to get an accurate settlement. (CPMK-2)

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Students are able to apply the determinant, inverse and elementary line operations in the completion of the system of linear equations (CPMK-2)

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Students are able to use matrix properties, addition and matrix multiplication operations, as well as elementary line operations on determining the determinant and inverse matrix. (CPMK-1)

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Students are able to determine the results of the integration of double and double three, both through the exchange of integration sequences or through coordinate transformation, including their use in the calculation of the area of integration, average value, volume, moment and mass center. (CPMK-2)

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Students are able to demonstrate the application of the partial derivative of one or higher order to the maximum-minimum problem with or without obstacles, as well as on the problem of approximation through the Taylor formula. (CPMK-2)

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Students are able to find partial derivatives of one or higher order or higher order, directed derivatives, and total derivatives, both through the application of chain rules, compound functional rules, and relevant derivative theorems. (CPMK-1)

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Students are able to prove the existence of limits and continuity in the function of two or more variables, both algebra and graphically (CPMK-1)

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Students are able to describe the systematic steps in determining the domains and ranges of many variable functions, as well as on the representation of the function of two or three variables algebra, numerical and graphics (CPMK-1)

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
Basic Mathematics II	23H01110303	Basic Science	3	2	1 Januari 2025

AUTHORITY	SLP Developer Lecturer	Coordinator	Head of Study Program
	Jusmawati Massalesse, S.Si.,M.Si., Edy Saputra Rusdy , S.Si., M.Si.	Jusmawati Massalesse, S.Si.,M.Si.	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-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 are able to use many variable calculus concepts (functions, limits, derivatives, integrals, matrices and linear equation systems) to solve problems in mathematics, science, and technology
	SLO-3	**CLO-2:** Students are able to apply functions, derivatives, integrals and matrix operations to solve problems in related fields.
	CLO ⇒ Sub-CLO	
	CLO-1	**Sub-CLO-1:**Students are able to describe the systematic steps in determining the domains and ranges of many variable functions, as well as on the representation of the function of two or three variables algebra, numerical and graphics
		Sub-CLO-2: Students are able to prove the existence of limits and continuity in the function of two or more variables, both algebra and graphically
		Sub-CLO-3: Students are able to find partial derivatives of one or higher order or higher order, directed derivatives, and total derivatives, both through the application of chain rules, compound functional rules, and relevant derivative theorems.
		Sub-CLO-6: Students are able to use matrix properties, addition and matrix multiplication operations, as well as elementary line operations on determining the determinant and inverse matrix.
	CLO-2	**Sub-CLO-4:**Students are able to demonstrate the application of the partial derivative of one or higher order to the maximum-minimum problem with or without obstacles, as well as on the problem of approximation through the Taylor formula.
		Sub-CLO-5: Students are able to determine the results of the integration of double and double three, both through the exchange of integration sequences or through coordinate transformation, including their use in the calculation of the area of integration, average value, volume, moment and mass center.
		Sub-CLO-7: Students are able to apply the determinant, inverse and elementary line operations in the completion of the system of linear equations

	Sub-CLO-8: Students are able to apply differential equations appropriately based on the characteristics of PD to get an accurate settlement.

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					
				Case Studies	Written Exam	Written Exam			
SLO-1	CLO-1	SUB-CLO-1	solve problems to find the domain and range of a function of two or more variables then draw a graph of the function of two or more variables	6	4	0	10		
SLO-1	CLO-1	SUB-CLO-2	Proving the existence of a limit through the limit and continuity of the function of two variables at a point from the definition rule.	8	5.33	0	13.33		
SLO-1	CLO-1	SUB-CLO-3	Solving partial derivatives, directed derivatives, and values of partial derivatives or directed derivatives, partial derivatives of explicit or implicit functions using chain rules,	8	5.33	0	13.33		
SLO-3	CLO-2	SUB-CLO-4	Find the maximum or minimum value of any multi-variable function with or without several constraint functions	8	5.33	0	13.33		
SLO-3	CLO-2	SUB-CLO-5	Determining integral boundaries and drawing the integration area, coordinate transformation, interpretation of integral results, determining the area of the integration area, average value and volume	10	0	6.67	16.67		
SLO-1	CLO-1	SUB-CLO-6	Determine the determinant and inverse matrix with several methods, get the SP solution	3	0	2	5		
SLO-3	CLO-2	SUB-CLO-7	Determine the solution of the differential equation with several methods.	7	0	4.67	11.67		
SLO-3	CLO-2	SUB-CLO-8		10	0	6.67	16.67		
				60	20	20	100		

Course Description	In this course, the concepts of multivariable calculus and elementary linear algebra are studied. Students will learn about Function two or more variables, limits and continuity of functions of many variables, partial derivatives and directed derivatives, extreme values of functions of many variables, Double integrals, differential equations, matrix theory, determinants and inverse matrices, systems of linear equations, and differential equations first order. The learning methods used are lectures, discussions and case methods which are expected to achieve achievements Learning this Course

Learning Materials/Subjects	1. Functions of Two or More Variables 2. Limits and Continuity 3. Partial Derivatives and Directional Derivatives; Taylor's Plinom 4. Extreme Values of Functions of Two or More Variables. 5. Double Integral and Triple Integral 6. Introduction to Matrix Theory 7. Systems of Linear Equations 8. Differential Equations
Reference	**Main References**
	1. Dale Varberg, Edwin Purcell, and Steve Rigdon, “Calculus”, ninth edition, Pearson, 2006. 2. George B. Thomas, Jr. “Thomas Calculus early transcendentals”, twelfth editions. 3. James Stewart, “Calculus Early Transcendentals”, sixth edition, Thomson Brooks/Cole, 2008 4. Howard Anton, Chris Rorres, “Elementary Linear Algebra, Applications version”, eleventh edition, Wiley, 2013. 5. Mathematics Lecturer Team, "Basic Mathematics", 2024
	Additional References
	www.khanacademy.org
Teaching Team	
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 describe the systematic steps in determining the domains and ranges of many variable functions, as well as on the representation of the function of two or three variables algebra, numerical and graphics (CPMK-1)	**Formative:** Gagal diterjemahkan **Sumative:** - Accuracy in determining the domain and range and giving examples of functions of two or more variables. - Accuracy in interpreting the equation of a function of two variables or three variables and drawing a sketch of a function of two or more variables	**Formative Criteria:** solve problems to find the domain and range of a function of two or more variables then draw a graph of the function of two or more variables **Sumative Criteria:** Case Studies (6) **Assessment Technique:** Non Test	**Studying:** Cooperative learning (Cooperative learning) 2x3x50	**Studying:** Self-Directed Learning PT Do Assignment I and submit it to SIKOLA 1x3x60	Lecture Contract Real Number System Functions of Two or More Variables. Definition of functions of two or more variables, domain and range. Graphs of functions of two variables and functions of three variables [Book 1, Ch 12 and 13; Book 2, Ch 11; Book 4, Chapter 1]	6

2-3	Students are able to prove the existence of limits and continuity in the function of two or more variables, both algebra and graphically (CPMK-1)	**Formative:** Gagal diterjemahkan **Sumative:** -Accuracy of steps and writing in the proof of existence limit on function twomodifier with one or more defining rules. -Clarity of description of continuity verification function of two variables at a point. -Accuracy in describing graphs of continuous, discontinuous functions.	**Formative Criteria:** Proving the existence of a limit through the limit and continuity of the function of two variables at a point from the definition rule. **Sumative Criteria:** Case Studies (8) **Assessment Technique:** Test and Non-Test	**Studying:** Cooperative learning (Cooperative learning) KM: Access and read Module 1 on the SIKOLA page or other relevant references and create a resume from the reading material. 2x3x60	**Studying:** Self-Directed Learning KM: Access and read Module 1 on the SIKOLA page or other relevant references and create a resume from the reading material. 2x3x60	Limits and Continuity Interpretation, Limits and Continuity Functions of two variables [Book 1, Ch 12 and 13; Book 2, Ch 11; Book 4, Chapter 1]	8

4-5	Students are able to find partial derivatives of one or higher order or higher order, directed derivatives, and total derivatives, both through the application of chain rules, compound functional rules, and relevant derivative theorems. (CPMK-1)	**Formative:** Gagal diterjemahkan **Sumative:** -Accuracy in determining partial derivatives and directed derivatives of functions of two or more variables -Directed derivative interpretation accuracy -Precisely uses the properties of the chain rule, implicit function rule, and total derivative to obtain derivatives of functions of two or more variables -The accuracy of finding the derivatives obtained and the Taylor Series expression is at least up to order 2 for any multivariable function	**Formative Criteria:** Solving partial derivatives, directed derivatives, and values of partial derivatives or directed derivatives, partial derivatives of explicit or implicit functions using chain rules, **Sumative Criteria:** Case Studies (8) **Assessment Technique:** Test and Non-Test	**Studying:** Cooperative learning (Cooperative learning) 1x2x50	**Studying:** Self-Directed Learning Doing Assignment II 1x3x60	Partial Derivatives and Directional Derivatives Definition and geometric interpretation of partial derivatives, High order derivatives. Definition of directed derivative, geometric interpretation. (Differentiality: Optional) Function chain rule of two variables relative to one variable, Function chain rule of three variables relative to one variable, Function chain rule of two variables relative to two variables, Implicit Function Derivative, Total Derivative. [Book 2, Ch 12, Book 4, Chapter 2] Taylor Series Taylor Series for functions of two variables or more [Book 2, Ch 9] [Book 2, Ch 12, Book 4, Chapter 3]	8

6-7	Students are able to demonstrate the application of the partial derivative of one or higher order to the maximum-minimum problem with or without obstacles, as well as on the problem of approximation through the Taylor formula. (CPMK-2)	**Formative:** Gagal diterjemahkan **Sumative:** - Precision in determining the type of extreme, both relative extreme and extreme global. - Precision in using the Lagrange method to determine the extreme values of functions with two and three constraints.	**Formative Criteria:** Find the maximum or minimum value of any multi-variable function with or without several constraint functions **Sumative Criteria:** Case Studies (8) **Assessment Technique:** Test and Non-Test	**Studying:** Cooperative learning (Cooperative learning) 3x2x50 **Studying:** Project Based Learning (Project-based Learning), Problem-Based Learning (Problem-based Learning) 3x1x50 **Studying:** Project-Based Learning (Project-based Learning) PT: Conducting self-reflection by reviewing partial derivative material and noting important points, including one's strengths and weaknesses regarding the material 2x3x60	**Studying:** Self-Directed Learning PT: Work on Assignment III and submit it to SIKOLA 2x3x60 **Studying:** Self-Directed Learning KM Study derivative material (Module 6) from SIKOLA class, main references or other relevant references) and write a summary of the material studied BM: 3x3x60	- Extreme Values and Multipliers Lagrange. - Two-variable Taylor formula [Book 2, Ch 12, Book 4, Chapter 2]	8
8	WRITTEN EXAMINATION						20

9-10	Students are able to determine the results of the integration of double and double three, both through the exchange of integration sequences or through coordinate transformation, including their use in the calculation of the area of integration, average value, volume, moment and mass center. (CPMK-2)	**Formative:** Gagal diterjemahkan **Sumative:** -The accuracy of the integration results. Accuracy in determining integral boundaries and drawing integration areas -The accuracy of the integration results. Accuracy in determining triples by changing the order of integration and coordinate transformation -Accuracy of integration results and interpretation of integral results	**Formative Criteria:** Determining integral boundaries and drawing the integration area, coordinate transformation, interpretation of integral results, determining the area of the integration area, average value and volume **Sumative Criteria:** Case Studies (10) **Assessment Technique:** Test and Non-Test	**Studying:** Cooperative learning (Cooperative learning) 3x2x50 **Studying:** Case Study (Case Study) 3x1x50 **Studying:** Problem-Based Learning (Problem-based Learning) 2x3x60	**Studying:** Project-Based Learning (Project-based Learning) Do Assignment V and submit it to SIKOLA 1x3x60 **Studying:** Cooperative learning (Cooperative learning) KM Study derivative material and its applications (Module 7& 8) from SIKOLA class, main references or other relevant references) and write a summary of the material studied BM: 3x3x60	Double Integrals Double Integrals, change the order of integrals, transform Cartesian coordinates to polar coordinates. Triple Integral, transformation of Cartesian coordinates to cylindrical coordinates and spherical coordinates Applications of double integrals [Book 2, Ch 13; Book 4, Chapter 4]	10

11	Students are able to use matrix properties, addition and matrix multiplication operations, as well as elementary line operations on determining the determinant and inverse matrix. (CPMK-1)	**Formative:** Gagal diterjemahkan **Sumative:** -The accuracy of the basic matrix operation steps used. -Precision in obtaining the determinant value Accuracy in obtaining the inverse matrix. -Precision in steps to get the solution SPL	**Formative Criteria:** Determine the determinant and inverse matrix with several methods, get the SP solution **Sumative Criteria:** Case Studies (3) **Assessment Technique:** Non Test	**Studying:** Cooperative learning (Cooperative learning) 2x2x50 **Studying:** Project-Based Learning (Project-based Learning) 2x1x50 **Studying:** Cooperative learning (Cooperative learning) 1x3x60	**Studying:** Self-Directed Learning PT: Work on Assignment VI and submit it to SIKOLA 1x3x60 **Studying:** Self-Directed Learning KM Study integral material (Module 9&10) from SIKOLA class, main references or other relevant references) and write a summary of the material studied BM: 2x3x60	Matrix and Operations Basic • Matrix • Determinants and • Matrix Inverse. [Book 3, Ch 2, Book 4, Ch 6]	3

12-13	Students are able to apply the determinant, inverse and elementary line operations in the completion of the system of linear equations (CPMK-2)	**Formative:** Gagal diterjemahkan **Sumative:** -The accuracy of the steps to solve the differential equation in a separable, homogeneous, or exact -Exact step of solving the differential equation in a way can be separated, homogeneous, or exact.	**Formative Criteria:** Determine the solution of the differential equation with several methods. **Sumative Criteria:** Case Studies (7) **Assessment Technique:** Test and Non-Test	**Studying:** Cooperative learning (Cooperative learning) 1x2x50 **Studying:** Problem-Based Learning (Problem-based Learning) 1x1x50 **Studying:** Project-Based Learning (Project-based Learning) PT: Doing self-reflection with youreview the Differential Equations, note down important points, including one's own strengths and weaknesses regarding the material, and work on several practice questions taken from relevant sources. 1x3x60	**Studying:** Self-Directed Learning KM Study material matrix, inverse and dereminant (Module 13) from SIKOLA class, main reference or other relevant reference) and write a summary of the material studied BM: 1x3x60	**Linear Equation Systems** 1. **Determinant and Inverse Methods** 2. **Gauss and Gauss Jordan Methods** **[Book 3, Ch 2, Book 4, Chapter 6]**	7

14-15	Students are able to apply differential equations appropriately based on the characteristics of PD to get an accurate settlement. (CPMK-2)	**Formative:** Gagal diterjemahkan **Sumative:** -Precision of steps to solve differential equations in a separable, homogeneous, or exact way -Accuracy of steps in solving non-exact differential equations, linear PD and Bernoulli.	**Formative Criteria:** **Sumative Criteria:** Case Studies (10) **Assessment Technique:** Test and Non-Test			**First Degree First Order Differential Equation** - Variable Differential Equations can be separated. - Differential Equations Homogeneous - Exact Differential Equations - Non Exact Differential Equations - Linear and Bernoulli differential equations [5] p 157-195 https://www.sciencedirect.com/journal/journal-of-differential-equations	10
16	WRITTEN EXAMINATION						20
							100

Matrix of SLO, CLO, and Assessment Method

SLO / CLO	CLO-1	CLO-2
CPL-1 (ILO 1)	Case Studies (Weight 6%) Case Studies (Weight 8%) Case Studies (Weight 8%) Case Studies (Weight 3%)	
CPL-3 (KU1)		Case Studies (Weight 8%) Case Studies (Weight 10%) Case Studies (Weight 7%) Case Studies (Weight 10%)

Evaluation Type and Assessment Weight

Type	Assessment Weight
Case Studies	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					
				Case Studies	Written Exam	Written Exam			
SLO-1	CLO-1	SUB-CLO-1	solve problems to find the domain and range of a function of two or more variables then draw a graph of the function of two or more variables	6	4	0	10		
SLO-1	CLO-1	SUB-CLO-2	Proving the existence of a limit through the limit and continuity of the function of two variables at a point from the definition rule.	8	5.33	0	13.33		
SLO-1	CLO-1	SUB-CLO-3	Solving partial derivatives, directed derivatives, and values of partial derivatives or directed derivatives, partial derivatives of explicit or implicit functions using chain rules,	8	5.33	0	13.33		
SLO-3	CLO-2	SUB-CLO-4	Find the maximum or minimum value of any multi-variable function with or without several constraint functions	8	5.33	0	13.33		
SLO-3	CLO-2	SUB-CLO-5	Determining integral boundaries and drawing the integration area, coordinate transformation, interpretation of integral results, determining the area of the integration area, average value and volume	10	0	6.67	16.67		
SLO-1	CLO-1	SUB-CLO-6	Determine the determinant and inverse matrix with several methods, get the SP solution	3	0	2	5		
SLO-3	CLO-2	SUB-CLO-7	Determine the solution of the differential equation with several methods.	7	0	4.67	11.67		
SLO-3	CLO-2	SUB-CLO-8		10	0	6.67	16.67		
				60	20	20	100		