

SEMESTER LEARNING PLAN

**GRAPH THEORY COURSES
(23H01120403)**



TEACHING TEAM

Prof. Dr. Hasmawati, M.Si.
196412311990032007

Prof. Dr. Nurdin, S.Si., M.Si.
197008072000031002

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

Mission

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-9 (S2) - The students are able to adapt and develop self-abilities, both in mathematics and other relevant areas of science in their professional lives

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

CPL-5 (KK1) - The students are able to construct mathematical modelling with relatively new ideas and present the results orally and in writing

CPL-7 (KK3) - The students are able to demonstrate mathematical skills which include interpretation, connecting problems, solving problems, and communicating individually or teamwork

Course Learning Outcomes (CLO)

CPMK-1: Students master the basic concepts of graphs and several operations in graphs and can construct a graph through operations ()

CPMK-2: Students can enumerate tree graphs using matrix cofactors and then determine the center and center of gravity ()

CPMK-3: Students are able to develop basic knowledge of graph theory to understand graph coloring, Location coloring and Fuzzy coloring ()

CPMK-4: Students can determine the decomposition and factoring of a graph ()

CPMK-5: Students can determine the connectivity of points and edges of a connected graph ()

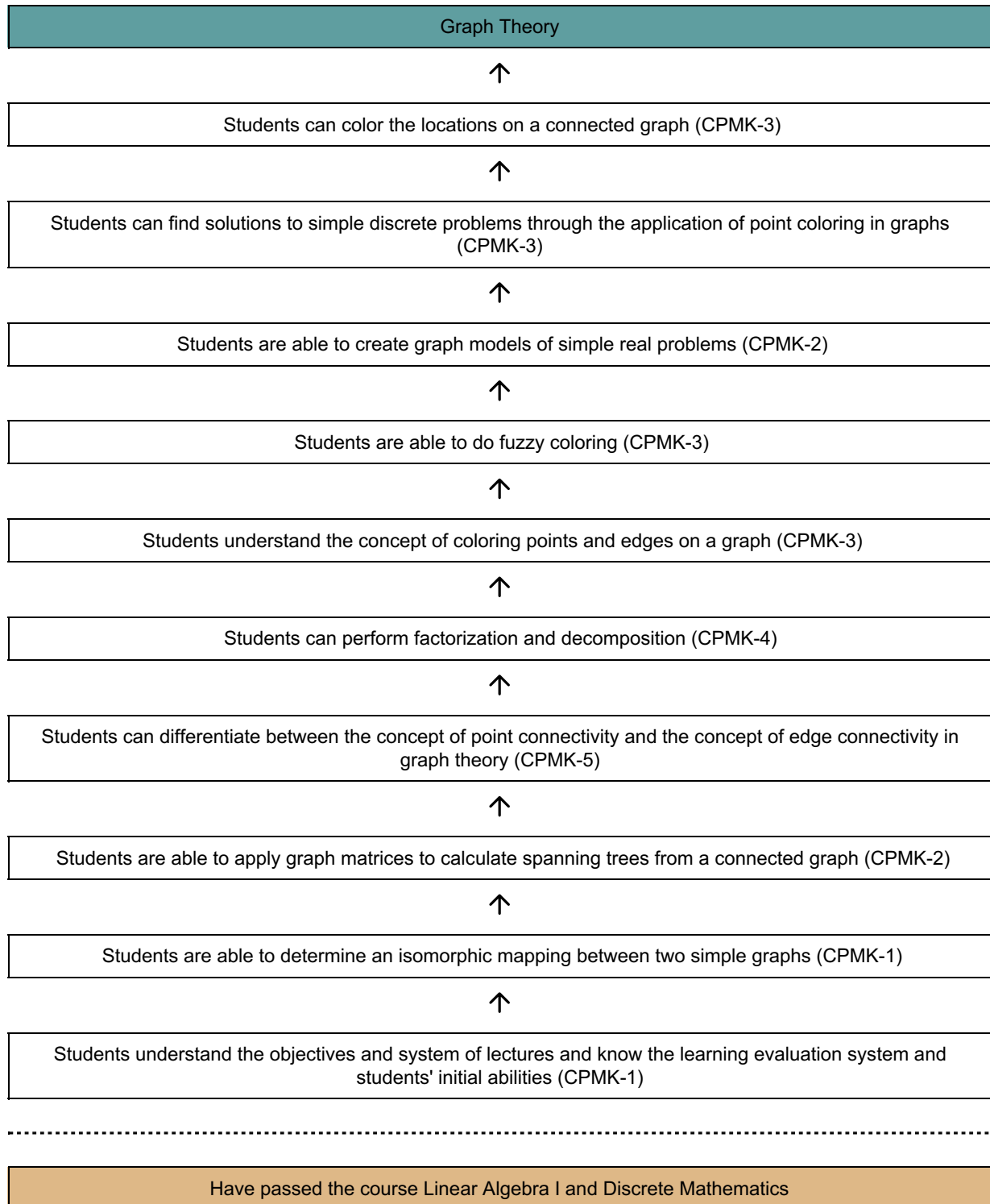
Sub-CLO

Sub CPMK-1: Students understand the objectives and system of lectures and know the learning evaluation system and students' initial abilities ()

Sub CPMK-2: Students are able to determine an isomorphic mapping between two simple graphs ()

- Sub CPMK-3: Students are able to apply graph matrices to calculate spanning trees from a connected graph ()
- Sub CPMK-4: Students can differentiate between the concept of point connectivity and the concept of edge connectivity in graph theory ()
- Sub CPMK-5: Students can perform factorization and decomposition ()
- Sub CPMK-6: Students understand the concept of coloring points and edges on a graph ()
- Sub CPMK-7: Students are able to do fuzzy coloring ()
- Sub CPMK-8: Students are able to create graph models of simple real problems ()
- Sub CPMK-9: Students can find solutions to simple discrete problems through the application of point coloring in graphs ()
- Sub CPMK-11: Students can color the locations on a connected graph ()

Learning Analytics





HASANUDDIN UNIVERSITY

FAKULTY OF MATHEMATICS AND NATURAL SCIENCES

STUDY PROGRAM OF MATHEMATICS - S1

SEMESTER LEARNING PLAN

Course		Code	Course Group	Credits	SEMESTER	Compilation Date
Graph Theory		23H01120403	Mathematical Combinatorics	3	3	13 Agustus 2025
AUTHORITY		SLP Developer Lecturer	Coordinator		Head of Study Program	
		Prof. Dr. Hasmawati, M.Si., Prof. Dr. Nurdin, S.Si., M.Si.	Prof. Dr. Hasmawati, M.Si.		Dr. Firman, S.Si.,M.Si.	
Learning Outcomes Course	SLOs that are imposed on the course					
	SLO-9:	Mahasiswa dapat beradaptasi dan mengembangkan kemampuan diri, baik dalam matematika dan bidang ilmu lain yang relevan dalam kehidupan profesional mereka, dengan budaya belajar sepanjang hayat				
	SLO-3:	Mahasiswa mampu menganalisis suatu masalah matematika dengan logika, analitik, dan struktur sistematis				
	SLO-5:	Mahasiswa dapat membangun pemodelan matematika dengan ideide yang relatif baru dan mempresentasikan hasil dengan jelas secara lisan dan tertulis				
	SLO-7:	Mahasiswa dapat menunjukkan keterampilan matematika termasuk menghubungkan masalah, menyelesaikan masalah, interpretasi, dan berkomunikasi secara individu atau dengan kerja tim				
	SLO ⇒ Course Learning Outcomes					
	After completing this course, it is expected:					
	CLO ⇒ Sub-CLO					
	CLO-1	Sub-CLO-1:Students understand the objectives and system of lectures and know the learning evaluation system and students' initial abilities				
		Sub-CLO-2:Students are able to determine an isomorphic mapping between two simple graphs				
	CLO-2	Sub-CLO-3:Students are able to apply graph matrices to calculate spanning trees from a connected graph				
		Sub-CLO-8:Students are able to create graph models of simple real problems				
	CLO-5	Sub-CLO-4:Students can differentiate between the concept of point connectivity and the concept of edge connectivity in graph theory				
	CLO-4	Sub-CLO-5:Students can perform factorization and decomposition				
	CLO-3	Sub-CLO-6:Students understand the concept of coloring points and edges on a graph				
		Sub-CLO-7:Students are able to do fuzzy coloring				

			Sub-CLO-9:Students can find solutions to simple discrete problems through the application of point coloring in graphs								
			Sub-CLO-11:Students can color the locations on a connected graph								
			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							
				Group task	Presentation	Independent Assignment	Project Report	Written Exam			
SLO-	CLO-1	SUB-CLO-2	Active and able to work together in groups.	10	0	0	0	0	10		
SLO-	CLO-2	SUB-CLO-3	Good grammar and writing correct definitions of operations in graphs, appropriate examples and various references.	0	0	10	0	0	10		
SLO-	CLO-4	SUB-CLO-5	Good grammar and correct writing of several definitions and notations in graphs, appropriate in factoring and decomposing a graph and various references.	0	0	0	20	0	20		
SLO-	CLO-2	SUB-CLO-8	Accurate in making garf modeling.	0	0	0	0	10	10		
SLO-	CLO-3	SUB-CLO-9	Good proposal structure, good and correct writing, consistent, meets good Indonesian language rules, various references.	0	0	0	20	0	20		
SLO-	CLO-3	SUB-CLO-10	Performance, neatness and clarity in delivery.	0	15	0	0	0	15		
SLO-	CLO-3	SUB-CLO-11	Accuracy in determining fuzzy chromatic number and location chromatic number.	0	0	0	15	0	15		
				10	15	10	55	10	100		
Course Description		Eye focus This lecture is on isomorphism, matrices in graphs, and the use of matrices graph to perform enumeration. Also learn the meaning and characteristics Euler graphs, Hamilton graphs, planar graphs, and directed graphs. In this course Students also learn about connectedness graphs, matching, factorization, vertex graph coloring, edge graph coloring, fuzzy coloring, and numbers local chromatic.									
Learning Materials/Subjects		Gagal diterjemahkan									
Reference		Main References									
		Gagal diterjemahkan									
		Additional References									

	Articles related to graph theory.						
Teaching Team	Prof. Dr. Hasmawati, M.Si., Prof. Dr. Nurdin, S.Si., M.Si.						
Course requirement	Linear Algebra I, Discrete Mathematics						
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 understand the objectives and system of lectures and know the learning evaluation system and students' initial abilities (CPMK-1)	Formative: student's ability to carry out commitment Sumative: Student accuracy in answering short question	Formative Criteria: right answer Sumative Criteria: Assessment Technique: Non Test	Studying: Other methods lecture about the lecture and assessment system 1x50 Studying: Other methods reminds material that has been studied in Discrete Mathematics which must be remembered and mastered as a basis for learning graph theory 1x50		Cons Lectures and delivery syllabus	0

2-3	Students are able to determine an isomorphic mapping between two simple graphs (CPMK-1)	Formative: activeness in discussion Sumative: Group Assignment: Ex.1: Form new graph through an operation (add, multiply, corona, amalgamation, comb or shackles; 2,3,4,5,6: Calculate the number of spanning trees of the new graph obtained by group 1.	Formative Criteria: Active and able to work together in groups. dinilai dengan rubrik 03 Sumative Criteria: Group task (10) dinilai dengan rubrik 01 Assessment Technique: Test and Non-Test	Studying: Collaborative learning (Collaborative Learning) Gagal diterjemahkan None		Isomorphism, matrix of a graph	10
3-4	Students are able to apply graph matrices to calculate spanning trees from a connected graph (CPMK-2)	Formative: on time Sumative: independent assignment: Ex.1: Form new graph through an operation (add, multiply, corona, amalgamation, comb or shackles; 2,3,4,5,6: Calculate the number of spanning trees of the new graph obtained by group 1.	Formative Criteria: Good grammar and writing correct definitions of operations in graphs, appropriate examples and various references. dinilai dengan rubrik 01 Sumative Criteria: Independent Assignment (10) Assessment Technique: Non Test	Studying: Group discussion (Small Group Discussion) Each group consists of 2 or 3 people 2x50	Studying: Self-Directed Learning via class group WA 1x50	tree matrix theorem and Cayley's theorem	10
5	Students can differentiate between the concept of point connectivity and the concept of edge connectivity in graph theory (CPMK-5)	Formative: craft Sumative: Calculating the connectivity of points and edges	Formative Criteria: Sumative Criteria: Assessment Technique: Test	Other Forms: Case Study (Case Study) constructing graphs 2x50		graph connectivity	0

6-7	Students can perform factorization and decomposition (CPMK-4)	Formative: activeness and ethics Sumative: choose any connected graft, then factor it and then make a decomposition	Formative Criteria: Good grammar and correct writing of several definitions and notations in graphs, appropriate in factoring and decomposing a graph and various references. dinilai dengan rubrik 03 Sumative Criteria: Project Report (20) dinilai dengan rubrik 01 Assessment Technique: Gagal diterjemahkan	Response and Tutorial: Collaborative learning (Collaborative Learning) 2x50		factorization and decomposition	20
8	Students are able to create graph models of simple real problems (CPMK-2)	Formative: order Sumative: determine a real, everyday problem and then create a graph model	Formative Criteria: Accurate in making garf modeling. dinilai dengan rubrik 01 Sumative Criteria: Written Exam (10) dinilai dengan rubrik 01 Assessment Technique: Gagal diterjemahkan	Other Forms: Self-Directed Learning UTS 2x50		Modeling in graph theory	10
9	Students are able to do fuzzy coloring (CPMK-3)	Formative: activity in the group Sumative: constructing a fuzzy graph then determining the fuzzy chromatic number	Formative Criteria: Sumative Criteria: Assessment Technique: Non Test	Response and Tutorial: Group discussion (Small Group Discussion) 4 or 5 people per group 2x2x50		fuzzy chromatic number	0

10-11	Students can color the locations on a connected graph (CPMK-3)	Formative: politeness Sumative: stain the location and determine the chromatic number of the location	Formative Criteria: Accuracy in determining fuzzy chromatic number and location chromatic number. dinilai dengan rubrik 01 Sumative Criteria: Project Report (15) dinilai dengan rubrik 01 Assessment Technique: Test and Non-Test	Studying: Case Study (Case Study) 2x2x50		location chromatic number	15
13-14	Students can find solutions to simple discrete problems through the application of point coloring in graphs (CPMK-3)	Formative: activeness Sumative: search for simple real problems through applying graph coloring	Formative Criteria: Good proposal structure, good and correct writing, consistent, meets good Indonesian language rules, various references. dinilai dengan rubrik 03 Sumative Criteria: Project Report (20) dinilai dengan rubrik 03 Assessment Technique: Test and Non-Test	Research, Design, or Development: Case Study (Case Study) 2x2x50		dot coloring application	20

15-16	Students can find solutions to simple discrete problems by applying edge coloring in graphs ()	Formative: Accuracy in collecting papers Sumative: paper structure, EYD, correct substance	Formative Criteria: Performance, neatness and clarity in delivery. dinilai dengan rubrik 02 Sumative Criteria: Presentation (15) dinilai dengan rubrik 02 Assessment Technique: Non Test	Other Forms: Group discussion (Small Group Discussion) 2x2x50		how to model a problem into a graph, how to present and how to write a paper	15
							100

Matrix of SLO, CLO, and Assessment Method

SLO / CLO	CLO-1	CLO-2	CLO-3	CLO-4	CLO-5
CPL-3 (KU1)					
CPL-5 (KK1)					
CPL-7 (KK3)					
CPL-9 (S2)					

Evaluation Type and Assessment Weight

Type	Assessment Weight
Group task	10
Presentation	15
Independent Assignment	10
Project Report	55
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							
				Group task	Presentation	Independent Assignment	Project Report	Written Exam			
SLO-	CLO-1	SUB-CLO-2	Active and able to work together in groups.	10	0	0	0	0	10		
SLO-	CLO-2	SUB-CLO-3	Good grammar and writing correct definitions of operations in graphs, appropriate examples and various references.	0	0	10	0	0	10		
SLO-	CLO-4	SUB-CLO-5	Good grammar and correct writing of several definitions and notations in graphs, appropriate in factoring and decomposing a graph and various references.	0	0	0	20	0	20		
SLO-	CLO-2	SUB-CLO-8	Accurate in making garf modeling.	0	0	0	0	10	10		
SLO-	CLO-3	SUB-CLO-9	Good proposal structure, good and correct writing, consistent, meets good Indonesian language rules, various references.	0	0	0	20	0	20		
SLO-	CLO-3	SUB-CLO-10	Performance, neatness and clarity in delivery.	0	15	0	0	0	15		
SLO-	CLO-3	SUB-CLO-11	Accuracy in determining fuzzy chromatic number and location chromatic number.	0	0	0	15	0	15		
				10	15	10	55	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/ kuantitatif (*) 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

Lampiran Rubrik 02 | ASSESMENT PRESENTASI

Kriteria Penilaian	Bobot/Skor Penilaian				
	5	4	3	2	1
Penguasaan Materi	Mahasiswa sangat menguasai materi	Mahasiswa menguasai materi	Mahasiswa cukup menguasai materi	Mahasiswa kurang menguasai materi	Mahasiswa tidak menguasai materi
Sistematika Penyajian	Mahasiswa menyajikan materi presentasi dengan sangat sistematis	Mahasiswa menyajikan materi presentasi dengan sistematis	Mahasiswa menyajikan materi presentasi dengan cukup sistematis	Mahasiswa menyajikan materi presentasi dengan kurang sistematis	Mahasiswa menyajikan materi presentasi dengan tidak sistematis
Suara dan Ekspresi	Mahasiswa menjelaskan dengan suara yang sangat jelas, volume yang sangat sesuai, pengucapan istilah sangat tepat	Mahasiswa menjelaskan dengan suara yang jelas, volume yang sesuai, pengucapan istilah tepat	Mahasiswa menjelaskan dengan suara yang cukup jelas, volume yang cukup sesuai, pengucapan istilah cukup tepat	Mahasiswa menjelaskan dengan suara yang kurang jelas, volume yang kurang sesuai, pengucapan istilah kurang tepat	Mahasiswa menjelaskan dengan suara yang tidak jelas, volume yang tidak sesuai, pengucapan istilah tidak tepat
Kepercayaan Diri	Mahasiswa berbicara dengan sangat semangat, menularkan semangat dan antusiasme pada pendengar, eye contact ke semua peserta (audience)	Mahasiswa berbicara dengan semangat, menularkan semangat dan antusiasme pada pendengar, eye contact ke semua peserta (audience)	Mahasiswa berbicara dengan cukup semangat, cukup menularkan semangat dan antusiasme pada pendengar, eye contact ke semua peserta (audience)	Mahasiswa berbicara dengan kurang semangat, kurang menularkan semangat dan antusiasme pada pendengar, eye contact yang kurang ke semua peserta (audience)	Mahasiswa berbicara dengan tidak semangat, tidak dapat menularkan semangat dan antusiasme pada pendengar, tidak ada eye contact ke semua peserta (audience)
Kemampuan menjawab pertanyaan	Mahasiswa mampu menjawab semua pertanyaan dengan sangat mendalam (lebih dari yang dibutuhkan), dan sangat tajam	Mahasiswa mampu menjawab semua pertanyaan dengan tepat, mendalam (lebih dari yang dibutuhkan), dan tajam	Mahasiswa mampu menjawab semua pertanyaan dengan cukup tepat, cukup mendalam, dan cukup tajam	Mahasiswa mampu menjawab semua pertanyaan dengan kurang tepat, kurang mendalam, dan kurang tajam	Mahasiswa mampu menjawab semua pertanyaan dengan tidak tepat, tidak mendalam, dan tidak tajam
Kepemimpinan presentasi kelompok)	Mahasiswa sangat mampu menginisiasi, menggerakkan, mengarahkan, mengorganisir jalannya presentasi	Mahasiswa mampu menginisiasi, menggerakkan, mengarahkan, mengorganisir jalannya presentasi	Mahasiswa cukup mampu menginisiasi, menggerakkan, mengarahkan, mengorganisir jalannya presentasi	Mahasiswa kurang mampu menginisiasi, menggerakkan, mengarahkan, mengorganisir jalannya presentasi	Mahasiswa tidak mampu menginisiasi, menggerakkan, mengarahkan, mengorganisir jalannya presentasi

Lampiran Rubrik 03 | ASSESMENT MAKALAH

Kriteria Penilaian	Bobot/Skor Penilaian				
	5	4	3	2	1
Sistematika dan kelengkapan penulisan	Mahasiswa menyusun laporan dengan sistematika yang sangat sesuai dengan format yang diberikan dan sangat lengkap	Mahasiswa menyusun laporan dengan sistematika yang sesuai dengan format yang diberikan dan lengkap	Mahasiswa menyusun laporan dengan sistematika yang cukup sesuai dengan format yang diberikan dan cukup lengkap	Mahasiswa menyusun laporan dengan sistematika yang kurang sesuai dengan format yang diberikan dan kurang lengkap	Mahasiswa menyusun laporan dengan sistematika yang tidak sesuai dengan format yang diberikan dan tidak lengkap
Kebenaran konsep ide yang dipaparkan	Mahasiswa menyusun makalah dengan konsep/ide yang dipaparkan dengan sangat tepat (sesuai dengan teori)	Mahasiswa menyusun makalah dengan konsep/ide yang dipaparkan dengan tepat	Mahasiswa menyusun makalah dengan konsep/ide yang dipaparkan dengan cukup tepat	Mahasiswa menyusun makalah dengan konsep/ide yang dipaparkan dengan kurang tepat	Mahasiswa menyusun makalah dengan konsep/ide yang dipaparkan dengan tidak tepat
Interpretasi metode dengan permasalahan yang dikaji	Mahasiswa sangat mampu mengidentifikasi relevansi metode dengan permasalahan yang dikaji	Mahasiswa mampu mengidentifikasi relevansi metode dengan permasalahan yang dikaji	Mahasiswa cukup mampu mengidentifikasi relevansi metode dengan permasalahan yang dikaji	Mahasiswa kurang mampu mengidentifikasi relevansi metode dengan permasalahan yang dikaji	Mahasiswa tidak mampu mengidentifikasi relevansi metode dengan permasalahan yang dikaji
Validitas Referensi – VR	Mahasiswa menggunakan referensi yang sangat up to date dan sangat relevan	Mahasiswa menggunakan referensi yang up to date dan relevan	Mahasiswa menggunakan referensi yang cukup up to date dan cukup relevan	Mahasiswa menggunakan referensi yang kurang up to date dan kurang relevan	Mahasiswa menggunakan referensi yang tidak up to date dan tidak relevan
Ketepatan waktu	Mahasiswa mengumpulkan makalah tepat waktu atau sebelum batas waktu yang ditentukan.	Mahasiswa mengumpulkan makalah lewat 1 hari dari batas waktu yang ditentukan.	Mahasiswa mengumpulkan makalah lewat 2 hari dari batas waktu yang ditentukan.	Mahasiswa mengumpulkan makalah lewat 3 hari dari batas waktu yang ditentukan.	Mahasiswa mengumpulkan makalah lewat 4 hari atau lebih dari batas waktu yang ditentukan.