

SEMESTER LEARNING PLAN

**COMPLEX FUNCTIONS COURSES
(23H01130303)**



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

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-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 of the concept of complex variable functions. (CPL1)

CPMK-2: Students are able to identify objects and master the techniques for proving complex variable function theorems. (CPL2)

CPMK-3: able to reconstruct, modify, analyze the basics of complex function theory and other fields and be able to assess accuracy, interpret and communicate both orally and in writing. (CPL1)

Sub-CLO

Sub CPMK-1: Students master the basic concepts of operations on complex numbers, writing complex numbers in polar coordinates, and determining the roots of complex numbers. (CPMK-1 dan CPMK-2)

Sub CPMK-2: Students understand complex number operations, functions and limits of complex functions. (CPMK-1 dan CPMK-2)

Sub CPMK-3: Students are able to recognize complex functions, limits of complex functions and continuity of complex functions. (CPMK-1 dan CPMK-2)

Sub CPMK-4: Students are able to identify differentiated functions (CPMK-1, CPMK-2 dan CPMK-3)

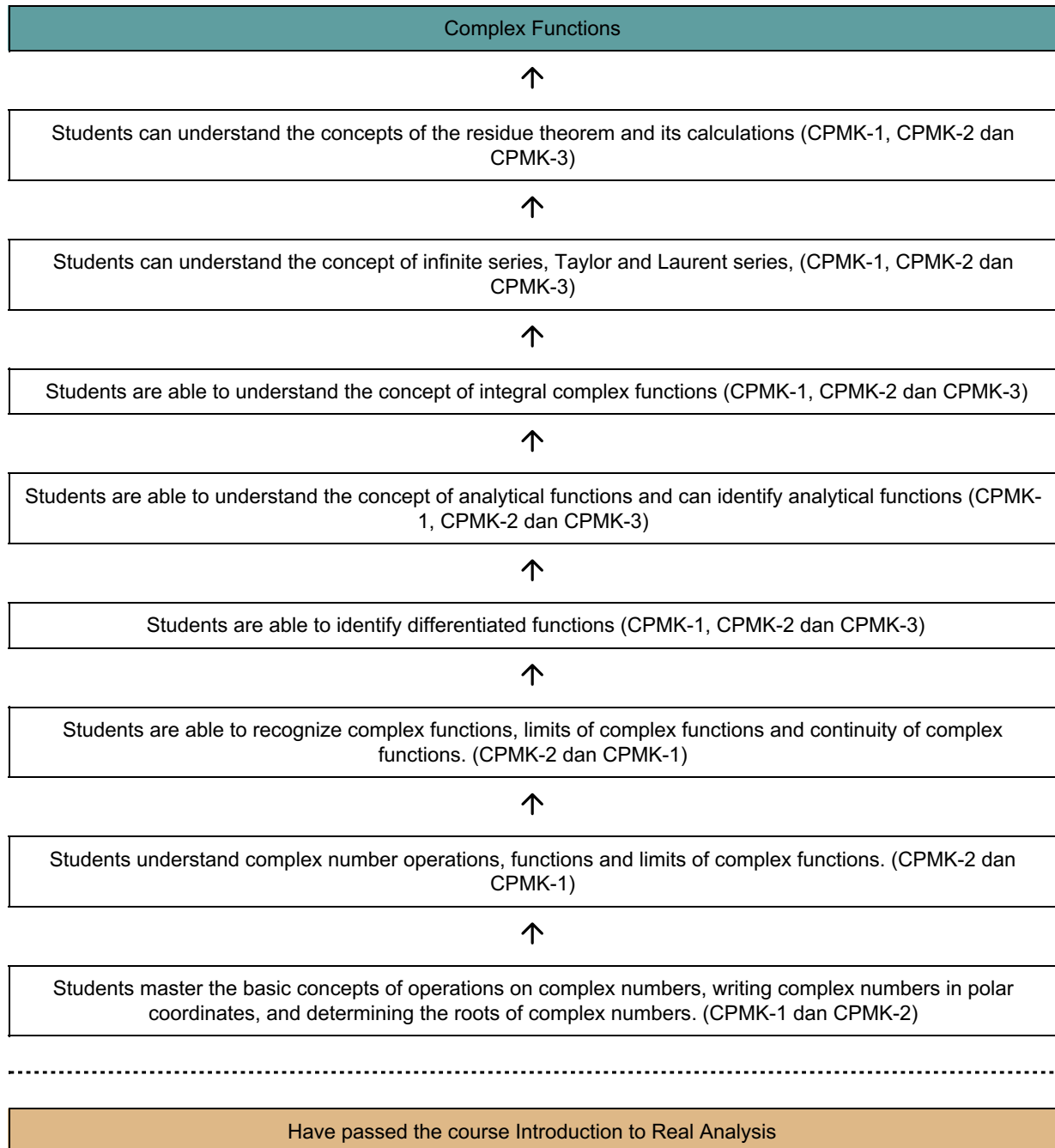
Sub CPMK-5: Students are able to understand the concept of analytical functions and can identify analytical functions (CPMK-1, CPMK-2 dan CPMK-3)

Sub CPMK-6: Students are able to understand the concept of integral complex functions (CPMK-1, CPMK-2 dan CPMK-3)

Sub CPMK-7: Students can understand the concept of infinite series, Taylor and Laurent series, (CPMK-1, CPMK-2 dan CPMK-3)

Sub CPMK-8: Students can understand the concepts of the residue theorem and its calculations (CPMK-1, CPMK-2 dan CPMK-3)

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
Complex Functions		23H01130303	Analysis	3	5	10 Agustus 2024
AUTHORITY		SLP Developer Lecturer	Coordinator		Head of Study Program	
		Prof. Dr. Eng. Mawardi, S.Si., M.Si., Dr. Muh. Nur, S.Si., M.Si., Dr. Muhammad Zakir, M.Si.	Dr. Muhammad Zakir, 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-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 of the concept of complex variable functions.				
		CLO-3: able to reconstruct, modify, analyze the basics of complex function theory and other fields and be able to assess accuracy, interpret and communicate both orally and in writing.				
	SLO-2	CLO-2: Students are able to identify objects and master the techniques for proving complex variable function theorems.				
	CLO ⇒ Sub-CLO					
	CLO-1	Sub-CLO-1:Students master the basic concepts of operations on complex numbers, writing complex numbers in polar coordinates, and determining the roots of complex numbers.				
		Sub-CLO-2:Students understand complex number operations, functions and limits of complex functions.				
		Sub-CLO-3:Students are able to recognize complex functions, limits of complex functions and continuity of complex functions.				
		Sub-CLO-4:Students are able to identify differentiated functions				
		Sub-CLO-5:Students are able to understand the concept of analytical functions and can identify analytical functions				
		Sub-CLO-6:Students are able to understand the concept of integral complex functions				
		Sub-CLO-7:Students can understand the concept of infinite series, Taylor and Laurent series,				

		Sub-CLO-8: Students can understand the concepts of the residue theorem and its calculations
CLO-2	Sub-CLO-1: Students master the basic concepts of operations on complex numbers, writing complex numbers in polar coordinates, and determining the roots of complex numbers.	
	Sub-CLO-2: Students understand complex number operations, functions and limits of complex functions.	
	Sub-CLO-3: Students are able to recognize complex functions, limits of complex functions and continuity of complex functions.	
	Sub-CLO-4: Students are able to identify differentiated functions	
	Sub-CLO-5: Students are able to understand the concept of analytical functions and can identify analytical functions	
	Sub-CLO-6: Students are able to understand the concept of integral complex functions	
	Sub-CLO-7: Students can understand the concept of infinite series, Taylor and Laurent series,	
	Sub-CLO-8: Students can understand the concepts of the residue theorem and its calculations	
CLO-3	Sub-CLO-4: Students are able to identify differentiated functions	
	Sub-CLO-5: Students are able to understand the concept of analytical functions and can identify analytical functions	
	Sub-CLO-6: Students are able to understand the concept of integral complex functions	
	Sub-CLO-7: Students can understand the concept of infinite series, Taylor and Laurent series,	
	Sub-CLO-8: Students can understand the concepts of the residue theorem and its calculations	
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	Case Studies	Written Exam	Written Exam			
SLO-2	CLO-2	SUB-CLO-1	accuracy of understanding	0	5	6.67	0	11.67		
SLO-1	CLO-1	SUB-CLO-3	Comprehension Criteria	5	0	6.67	0	11.67		
SLO-1	CLO-3	SUB-CLO-4	accuracy of understanding	0	5	6.67	0	11.67		
SLO-1	CLO-3	SUB-CLO-5	accuracy of understanding	5	10	0	6.67	21.67		
SLO-1	CLO-3	SUB-CLO-6	Comprehension Criteria	0	10	0	4.44	14.44		
SLO-1	CLO-3	SUB-CLO-7	accuracy of understanding	0	10	0	4.44	14.44		
SLO-1	CLO-3	SUB-CLO-8	Comprehension Criteria	0	10	0	4.44	14.44		
				10	50	20	20	100		

Course Description		This course provides and discusses several basic and important concepts in the function of complex. This course also provides students with the opportunity to practice creative thinking in solving problems in complex functions. With reference to the targets above, this course is given with an emphasis on giving students relatively a lot of time to do problem-solving ranging from simple problems to quite complex ones. Although the presentation of this course does not have to be proof-like, one or two theorems need to be presented and proven in detail to provide examples of verbal argumentation. The material for this course includes: Complex number systems, Moivre's Theorem, roots of complex numbers, complex functions, limits and continuity of complex functions, Differential complex functions, analytical functions, Cauchy-Riemann equation, gradient, divergence, curl and Laplace's equation, Integral of complex functions, line integral of complex functions, Green's theorem, Theorem Cauchy-Goursat, Morera's theorem, infinite series, Taylor and Laurent series, Residue theorem and its calculations.					
Learning Materials/Subjects		1. Complex Numbers and Their Operations 2. Complex Functions Elementary, Limit and Continuity 3. Differential Complex Functions and Analytical Functions 4. Cauchy - Riemann Equations and Harmonic Functions 5. Integral Complex Functions 6. Cauchy's Integral Theorem 7. Taylor Series and Laurent Series 8. Theorem residue					
Reference		Main References					
		1. Ruel V Churchill and James Ward Brown, (2010), Complex Variables and Applications, McGRAW-HILL. 2. Murray Spigel (1964), Theory and Problems of Complex Variables, McGRAW-HILL.					
		Additional References					
		1. John Erik Fornaess (1993), Several Complexes Variables, Princeton University Press 2. Stephen D. Fisher (1990), Complex Variables, Dover Publications, INC.					
Teaching Team		Prof. Dr. Eng. Mawardi, S.Si., M.Si., Dr. Muh. Nur, S.Si., M.Si., Dr. Muhammad Zakir, M.Si.					
Course requirement		Introduction to Real Analysis					
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 master the basic concepts of operations on complex numbers, writing complex numbers in polar coordinates, and determining the roots of complex numbers. (CPMK-1, CPMK-2)	Formative: Student Abilities in understanding instructions Sumative: Students can operate complex numbers, both in rectangular coordinates and polar coordinates, and can determine the roots of complex numbers.	Formative Criteria: accuracy of understanding dinilai dengan rubrik 04 Sumative Criteria: Case Studies (5) dinilai dengan rubrik 01 Assessment Technique: Test and Non-Test	Studying: Case Study (Case Study) [TM:2x2x50]	College Contract Definition and operations on numbers Complexes, roots of complex numbers,	5
3-4	Students are able to recognize complex functions, limits of complex functions and continuity of complex functions. (CPMK-2, CPMK-1)	Formative: Gagal diterjemahkan Sumative: Students can calculate limits of complex functions and determine the continuity of complex functions.	Formative Criteria: Comprehension Criteria dinilai dengan rubrik 04 Sumative Criteria: Quiz (5) dinilai dengan rubrik 01 Assessment Technique: Test	Studying: Case Study (Case Study) [TM:2x2x50]	Complex functions,Limits of complex functions and continuity of complex functions	5
5-6	Students are able to identify differentiated functions (CPMK-1, CPMK-2, CPMK-3)	Formative: Gagal diterjemahkan Sumative: Students can determine the differential function complex by using the differential definition of a complex function, you can using the Cauchy-riemann theorem.	Formative Criteria: accuracy of understanding dinilai dengan rubrik 04 Sumative Criteria: Case Studies (5) dinilai dengan rubrik 01 Assessment Technique: Test and Non-Test	Studying: Group discussion (Small Group Discussion) [TM: 2x2x50]	Differential complex functions, Cauchy-Riemann theorem	5

7	Students are able to understand the concept of analytical functions and can identify analytical functions (CPMK-1, CPMK-2, CPMK-3)	Formative: Gagal diterjemahkan Sumative: Students can explain and differentiate analytical functions	Formative Criteria: accuracy of understanding dinilai dengan rubrik 04 Sumative Criteria: Quiz (5) dinilai dengan rubrik 01 Case Studies (10) dinilai dengan rubrik 03 Assessment Technique: Test and Non-Test	Studying: Case Study (Case Study) [TM:3x50]		Analytical Functions and their properties	15
8	Written Exam						20
9-11	Students are able to understand the concept of integral complex functions (CPMK-1, CPMK-2, CPMK-3)	Formative: Gagal diterjemahkan Sumative: Students are able to calculate integrals of complex functions	Formative Criteria: Comprehension Criteria dinilai dengan rubrik 04 Sumative Criteria: Case Studies (10) dinilai dengan rubrik 01 Assessment Technique: Test and Non-Test	Studying: Group discussion (Small Group Discussion) [TM:2x2x50]; [TM:1x3x50]		Complex function integral, line integral, Green's theorem, Cauchy-Goursat theorem	10

12-13	Students can understand the concept of infinite series, Taylor and Laurent series, (CPMK-1, CPMK-2, CPMK-3)	Formative: Gagal diterjemahkan Sumative: Students can create recursive functions and recurrence functions for sequences	Formative Criteria: accuracy of understanding dinilai dengan rubrik 04 Sumative Criteria: Case Studies (10) dinilai dengan rubrik 02 Assessment Technique: Test and Non-Test	Studying: Case Study (Case Study) [2x3x50]		infinite series, Taylor and Laurent series,	10
14-15	Students can understand the concepts of the residue theorem and its calculations (CPMK-1, CPMK-2, CPMK-3)	Formative: Gagal diterjemahkan Sumative: Students can calculate the Residue Theorem	Formative Criteria: Comprehension Criteria dinilai dengan rubrik 04 Sumative Criteria: Case Studies (10) dinilai dengan rubrik 01 Assessment Technique: Test and Non-Test	Studying: Case Study (Case Study) [2x3x50]		Residue theorem and its calculations	10
16	Written Exam						20
							100

Matrix of SLO, CLO, and Assessment Method

SLO / CLO	CLO-1	CLO-2	CLO-3
CPL-1 (ILO 1)	Case Studies (Weight 5%) Quiz (Weight 5%) Case Studies (Weight 5%) Quiz (Weight 5%) Case Studies (Weight 10%) Case Studies (Weight 10%) Case Studies (Weight 10%) Case Studies (Weight 10%)		Case Studies (Weight 5%) Quiz (Weight 5%) Case Studies (Weight 10%) Case Studies (Weight 10%) Case Studies (Weight 10%) Case Studies (Weight 10%)
CPL-2 (P2)		Case Studies (Weight 5%) Quiz (Weight 5%) Case Studies (Weight 5%) Quiz (Weight 5%) Case Studies (Weight 10%) Case Studies (Weight 10%) Case Studies (Weight 10%) Case Studies (Weight 10%)	
CPL-3 (KU1)			

Evaluation Type and Assessment Weight

Type	Assessment Weight
Quiz	10
Case Studies	50
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	Case Studies	Written Exam	Written Exam			
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SLO-1	CLO-3	SUB-CLO-4	accuracy of understanding	0	5	6.67	0	11.67		
SLO-1	CLO-3	SUB-CLO-5	accuracy of understanding	5	10	0	6.67	21.67		
SLO-1	CLO-3	SUB-CLO-6	Comprehension Criteria	0	10	0	4.44	14.44		
SLO-1	CLO-3	SUB-CLO-7	accuracy of understanding	0	10	0	4.44	14.44		
SLO-1	CLO-3	SUB-CLO-8	Comprehension Criteria	0	10	0	4.44	14.44		
				10	50	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/ 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 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.