SEMESTER LEARNING PLAN

OPTIMIZATION COURSES
(23H01131003)

TEACHING TEAM

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

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

Vision

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

Vision Strategy

Misson

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

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

Graduate Profiles

Gagal diterjemahkan

PLO charged to courses

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

CPL-4 (KU2) - The students are able to use their sufficiently mathematical critical thinking for abstraction and generalization of a mathematical problem

CPL-6 (KK2) - The students are able to apply the mathematical method for solving a mathematical related-problem with or without the aid of computers and software

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 can understand several mathematical methods and their concepts and apply these methods in several other related fields such as industry, economy and agriculture. (CPL3 dan CPL4)

CPMK-2: Students can analyze and implement several methods of optimization into other fields of study. (CPL4)

CPMK-3: Students can make several mathematical models, explain the procedure, and solve the problem of optimization using the right one and interpret the results obtained in other related fields. (CPL6)

CPMK-4: Students are able to communicate ideas, develop their abilities based on local wisdom and easily adapt in the community with different backgrounds. (CPL7)

Sub-CLO

Sub CPMK-1: Understand well the goals and uses of courses in general and the topics of courses in particular and their relationship with other courses. (CPMK-1 dan CPMK-2)

Sub CPMK-2: Students have knowledge in making (dynamic) decisions from examples of portfolios, and can distinguish between deterministic and probabilistic dynamic programs. (CPMK-1)

Sub CPMK-3: Students have broad insights in determining convex sets and zero number game models. Students are able to make decisions with their team in answering questions. (CPMK-1 dan CPMK-4)

Sub CPMK-4: Students are able to make pure and mixed strategy game models, as well as 2xm and NX2 games and MXN students can describe this game from simple secondary data. (CPMK-3)

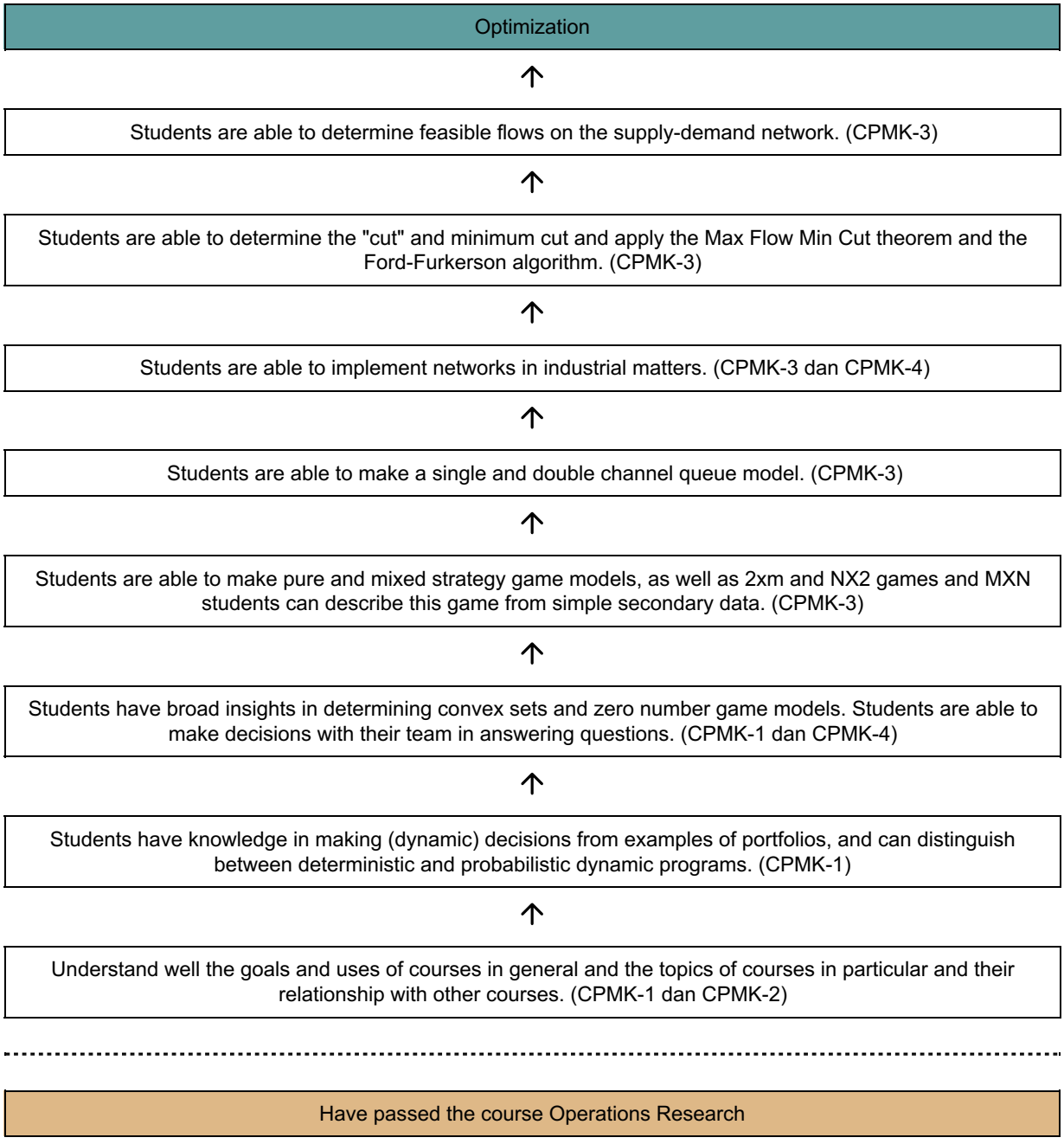
Sub CPMK-5: Students are able to make a single and double channel queue model. (CPMK-3)

Sub CPMK-6: Students are able to implement networks in industrial matters. (CPMK-3 dan CPMK-4)

Sub CPMK-7: Students are able to determine the "cut" and minimum cut and apply the Max Flow Min Cut theorem and the Ford-Furkerson algorithm. (CPMK-3)

Sub CPMK-8: Students are able to determine feasible flows on the supply-demand network. (CPMK-3)

Learning Analytics



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

Course	Code	Cource Group	Credits	SEMESTER	Compilation Date
Optimization	23H01131003	Applied Mathematics	3	5	8 Februari 2025

AUTHORITY	SLP Developer Lecturer	Coordinator	Head of Study Program
	Prof. Dr. Aidawayati Rangkuti, MS., Prof. Agustinus Ribal, S.Si.,M.Sc., Ph. D	Prof. Agustinus Ribal, S.Si.,M.Sc., Ph. D	Dr. Firman, S.Si.,M.Si.

Learning Outcomes Course	**SLOs that are imposed on the course**	
	SLO-3:	Mahasiswa mampu menganalisis suatu masalah matematika dengan logika, analitik, dan struktur sistematis
	SLO-4:	Mahasiswa dapat menggunakan pemikiran kritis matematis mereka yang cukup untuk abstraksi dan generalisasi masalah matematika berdasarkan hasil analisis informasi dan data
	SLO-6:	Mahasiswa dapat menerapkan metode matematika untuk memecahkan masalah terkait matematika dengan atau tanpa bantuan komputer dan perangkat lunak
	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:	
	SLO-3	**CLO-1:** Students can understand several mathematical methods and their concepts and apply these methods in several other related fields such as industry, economy and agriculture.
	SLO-4	**CLO-1:** Students can understand several mathematical methods and their concepts and apply these methods in several other related fields such as industry, economy and agriculture.
		CLO-2: Students can analyze and implement several methods of optimization into other fields of study.
	SLO-6	**CLO-3:** Students can make several mathematical models, explain the procedure, and solve the problem of optimization using the right one and interpret the results obtained in other related fields.
	SLO-7	**CLO-4:** Students are able to communicate ideas, develop their abilities based on local wisdom and easily adapt in the community with different backgrounds.
	CLO ⇒ Sub-CLO	
		Sub-CLO-1: Understand well the goals and uses of courses in general and the topics of courses in particular and their relationship with other courses.

	CLO-1	**Sub-CLO-2:**Students have knowledge in making (dynamic) decisions from examples of portfolios, and can distinguish between deterministic and probabilistic dynamic programs.
		Sub-CLO-3: Students have broad insights in determining convex sets and zero number game models. Students are able to make decisions with their team in answering questions.
	CLO-2	**Sub-CLO-1:**Understand well the goals and uses of courses in general and the topics of courses in particular and their relationship with other courses.
	CLO-4	**Sub-CLO-3:**Students have broad insights in determining convex sets and zero number game models. Students are able to make decisions with their team in answering questions.
		Sub-CLO-6: Students are able to implement networks in industrial matters.
	CLO-3	**Sub-CLO-4:**Students are able to make pure and mixed strategy game models, as well as 2xm and NX2 games and MXN students can describe this game from simple secondary data.
		Sub-CLO-5: Students are able to make a single and double channel queue model.
		Sub-CLO-6: Students are able to implement networks in industrial matters.
		Sub-CLO-7: Students are able to determine the "cut" and minimum cut and apply the Max Flow Min Cut theorem and the Ford-Furkerson algorithm.
		Sub-CLO-8: Students are able to determine feasible flows on the supply-demand network.
	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**						
				Project Based	**Case Studies**	**Written Exam**	**Written Exam**			
SLO-6	CLO-3	SUB-CLO-4	Model accuracy	30	0	20	0	50		
SLO-7	CLO-4	SUB-CLO-6	Accuracy of application	0	10	0	10	20		
SLO-6	CLO-3	SUB-CLO-8	Accuracy of application	0	15	0	15	30		
				30	25	20	25	100		

Course Description	Optimization course is an elective course in the study program Mathematics will give students the ability to apply several mathematical methods in optimization. In the first part of this course, we will focus on dynamic programming and game theory. Dynamic programming includes deterministic and probalistic dynamic programs while game theory includes zero-sum games and pure and mixed strategy games. In the second part we will discuss queuing theory and work networks. Queuing theory will cover single and multiple services while networking will cover the concept and application of the max flow – min cut theorem and the maximum flow algorithm.

Learning Materials/Subjects	1. Dynamic and Probabilistic programs. 2. Game theory with zero-sum games. 3. Pure and mixed strategy games 4. Queuing theory 5. Network flow 6. Maximum flow algorithm 7. Feasible flows
Reference	**Main References**
	1. Hiller, Liebermen, 2005. Introduction to Operation Research. Eighth edition, Mc Graw-Hill, Companies, one book, New York. 2. Caccetta, L., 2005. Network Optimization Lecture Notes. Perth: Curtin Publications.
	Additional References
	1. Frederick, S. H, Gerald, 2001.” Introduction to Operations Research”. seven edition, Mc Graw-Hill, New York. 2. Gass, Saul L, 1984. "Linear Programming: Method and Application". Fifth edition, Mc Graw- Hill, New York. 3. Ronal. E. Miller, 2000. “Optimization” Foundation and Application. Prentice Hall, Inc USA 4. Taha, Hamdy, 2007. “Operation Research”. Eighth edition Mc Graw- Hill, New York
Teaching Team	Prof. Dr. Aidawayati Rangkuti, MS., Prof. Agustinus Ribal, S.Si.,M.Sc., Ph. D
Course requirement	Operations Research

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	Understand well the goals and uses of courses in general and the topics of courses in particular and their relationship with other courses. (CPMK-1, CPMK-2)	**Formative:** Gagal diterjemahkan **Sumative:** Accuracy in explaining semester learning plans with good.	**Formative Criteria:** **Sumative Criteria:** **Assessment Technique:** Gagal diterjemahkan	**Studying:** Group discussion (Small Group Discussion), Simulation (Role-Play & Simulation) TM: 3x50		Lecture contract (purpose, scope, material, use of learning and its relationship to other courses and requirements for graduation)	0

2-3	Students have knowledge in making (dynamic) decisions from examples of portfolios, and can distinguish between deterministic and probabilistic dynamic programs. (CPMK-1)	**Formative:** Gagal diterjemahkan **Sumative:** Ability to apply dynamic programming in creating decision.	**Formative Criteria:** Accuracy of understanding **Sumative Criteria:** **Assessment Technique:** Non Test	**Studying:** Group discussion (Small Group Discussion), other methods TM: 2x3x50		Formulation of dynamic programming problems in making decisions and distinguishing between deterministic and probabilistic dynamic programs.	0
4-5	Students have broad insights in determining convex sets and zero number game models. Students are able to make decisions with their team in answering questions. (CPMK-1, CPMK-4)	**Formative:** Gagal diterjemahkan **Sumative:** Ability to complete the game with numbers zero.	**Formative Criteria:** Accuracy of completion **Sumative Criteria:** **Assessment Technique:** Test	**Other Forms:** Project-Based Learning (Project-based Learning) TM: 2x3x50		Zero-sum Game Theory.	0
6-7	Students are able to make pure and mixed strategy game models, as well as 2xm and NX2 games and MXN students can describe this game from simple secondary data. (CPMK-3)	**Formative:** Gagal diterjemahkan **Sumative:** Ability to model pure and mixed strategy games, as well as 2xm and nx2 and mxn.	**Formative Criteria:** Model accuracy **Sumative Criteria:** Project Based (30) dinilai dengan rubrik 02 **Assessment Technique:** Test	**Studying:** Project-Based Learning (Project-based Learning) TM: 2x2x50 **Other Forms:** Project-Based Learning (Project-based Learning) TM: 1x1x50		Pure and mixed strategy game models.	30
8	WRITTEN EXAMINATION						20

9-10	Students are able to make a single and double channel queue model. (CPMK-3)	**Formative:** Gagal diterjemahkan **Sumative:** Ability to implement single-channel queuing models and double.	**Formative Criteria:** Accuracy of application **Sumative Criteria:** **Assessment Technique:** Test	**Other Forms:** Project-Based Learning (Project-based Learning) TM: 2x3x50		Single and multiple service queue models.	0
11-12	Students are able to implement networks in industrial matters. (CPMK-3, CPMK-4)	**Formative:** Gagal diterjemahkan **Sumative:** Ability to apply network flow in cases industry	**Formative Criteria:** Accuracy of application **Sumative Criteria:** Case Studies (10) **Assessment Technique:** Non Test	**Studying:** Collaborative learning (Collaborative Learning) TM: 2x3x50 **Studying:** Cooperative learning (Cooperative learning) **[Material presented by: Muh. Arsal Aslah, S.Si, practitioner from PT. Unilever]** [2x3x60]		The working network includes single source single sink and multiple sources multiple sinks.	10
13-14	Students are able to determine the "cut" and minimum cut and apply the Max Flow Min Cut theorem and the Ford-Furkerson algorithm. (CPMK-3)	**Formative:** Gagal diterjemahkan **Sumative:** Ability for maximum flow algorithm in a network with using the max flow min cut theorem and the Ford_Furkerson algorithm.	**Formative Criteria:** Accuracy of application **Sumative Criteria:** **Assessment Technique:** Test	**Studying:** Group discussion (Small Group Discussion) TM: 2x3x50		Cut, minimum cut, max flow min cut and the Ford-Furkerson algorithm.	0

15	Students are able to determine feasible flows on the supply-demand network. (CPMK-3)	**Formative:** Gagal diterjemahkan **Sumative:** Ability to determine feasible flows on the network supply-demand.	**Formative Criteria:** Accuracy of application **Sumative Criteria:** Case Studies (15) **Assessment Technique:** Test	**Studying:** Group discussion (Small Group Discussion) TM: 2x3x50		Feasible flows.	15
16	WRITTEN EXAMINATION						25
							100

Matrix of SLO, CLO, and Assessment Method

SLO / CLO	CLO-1	CLO-2	CLO-3	CLO-4
CPL-3 (KU1)				
CPL-4 (KU2)				
CPL-6 (KK2)			Project Based (Weight 30%) Case Studies (Weight 10%) Case Studies (Weight 15%)	
CPL-7 (KK3)				Case Studies (Weight 10%)

Evaluation Type and Assessment Weight

Type	Assessment Weight
Project Based	30
Case Studies	25
Written Exam	20
Written Exam	25
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						
				Project Based	Case Studies	Written Exam	Written Exam			
SLO-6	CLO-3	SUB-CLO-4	Model accuracy	30	0	20	0	50		
SLO-7	CLO-4	SUB-CLO-6	Accuracy of application	0	10	0	10	20		
SLO-6	CLO-3	SUB-CLO-8	Accuracy of application	0	15	0	15	30		
				30	25	20	25	100		

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 menguas
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 mate dengan tidak sistem
Suara dan Ekspresi	Mahasiswa menjelaskan dengan suara yang sangat jelas, volume yang sangatsesuai, pengucapan istilah sangat tepat	Mahasiswa menjelaskan dengan suara yang jelas, volume yang sesuai, pengucapan istilah tepat	Mahasiswa menjelaskan dengan suara yang cukupjelas, volume yang cukup sesuai, pengucapan istilah cukup tepat	Mahasiswa menjelaskan dengan suara yang kurangjelas, volume yang kurangsesuai, pengucapan istilah kurang tepat	Mahasiswa menjelaskan de yang tidakjelas, volume yang pengucapan istilah tida
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 d tidak semangat, tidak dapat menular semangat dan antusiasme pada pendengar, tidak ada *eye cont* peserta (*audience*
Kemampuanmenjawab	Mahasiswa mampu menjawab semua pertanyaan dengan sangat tepat, 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 cukuptepat, cukup mendalam, dan cukup tajam	Mahasiswa mampu menjawab semua pertanyaan dengan kurangtepat, kurang mendalam, dan kurang tajam	Mahasiswa menjawab semua dengan tidak tepat, tidakmenda tajam
Kepemimpinan presentasi kelompok)	Mahasiwa sangat mampu menginisiasi, menggerakkan, mengarahkan, mengorganisir jalannya presentasi	Mahasiwa mampu menginisiasi, menggerakkan, mengarahkan, mengorganisir jalannya presentasi	Mahasiwa cukup mampu menginisiasi, menggerakkan, mengarahkan, mengorganisir jalannya presentasi	Mahasiwa kurang mampu menginisiasi, menggerakkan, mengarahkan, mengorganisir jalannya presentasi	Mahasiwa tidak mampu me menggerakkan, mengar mengorganisir jalannya p