SEMESTER STUDY PLAN
ADVANCED MULTIVARIATE ANALYSIS
(ELECTIVE COURSES)

DEPARTMENT OF MATHEMATICS AND DATA SCIENCE
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
UNIVERSITAS ANDALAS
2024

1. Semester Study Plan

	SEMESTER STUDY PLAN **STUDY PROGRAM : MASTER OF MATHEMATICS** **FACULTY OF MATHEMATICS AND NATURAL SCIENCES** **UNIVERSITAS ANDALAS**				
COURSE	**CODE**	**i-LEARN COURSE URL**	**CREDITS**	**SEMESTER**	**COMPILATION DATE**
ADVANCED MULTIVARIATE ANALYSIS	**MAT 81233**	https://sci.ilearn.unand.ac.id	3	3	May 4th, 2024
Person in Charge	**Study Plan Creator**		**Head of Research Group**	**Head of the study program**	
	Prof. Dr. Ferra Yanuar, M.Sc **Prof. Dr. Rahat Syahni, M.Sc**		**Yudiantri Asdi, M.Sc**	**Prof. Dr. Ferra Yanuar, M.Sc**	
Intended Learning Outcomes (ILO) and Performance Indicators (PI)	**ILO-Study Program**				
	ILO-2	Mastering mathematical concepts and applications (real analysis, advanced linear algebra, and statistics) in solving complex mathematical problems. PI-1. An ability to explain mathematical concepts (Real Analysis, Advanced Linear Algebra, and Statistics). PI-2. An ability to identify complex mathematical problems. PI-3. An ability to solve complex mathematical problems.			

	ILO-3	Comprehensive mastery of one or several theories for development in the fields of analysis, algebra, applied mathematics, statistics and combinatorial mathematics. PI-1. An ability to identify theories used in related mathematical problems. PI-2. An ability to apply theories for advancement in related fields (advanced theory). PI-3. An ability to use advanced theory to solve related mathematical problems.
	ILO-4	Mastering scientific techniques and developing them in solving research problems through multidisciplinary or interdisciplinary approaches. PI-1. An ability to apply mathematical techniques in research problem-solving. PI-2. An ability to analyze research problems. PI-3. An ability to formulate theorems/models and prove their validity. PI-4. An ability to use various mathematical software to solve complex mathematical problems.
	ILO-5	Able to work and conduct research in the field of mathematics and related fields of science by developing the latest issues independently or collaboratively and communicating them academically PI-1. Capable of formally and correctly proving mathematical statements. PI-2. An ability to employ relevant techniques for conducting research. PI-3. Capable of communicating research findings in an academic manner.
	Course Learning Outcome (CLO)	
	1. Students are able to explain multivariate data and are able to determine the multivariate mean vector, variance-covariance matrix and correlation matrix (ILO-2: PI-1, PI-2). 2. Students are able to explain inference about the mean vector for one population and two populations (ILO-2: PI-3). 3. Students are able to explain and use one-way and two-way multivariate analysis of variance (ILO-3: PI-1).	

	4. Students are able to use multivariate regression analysis (ILO-3: PI-2, PI-3). 5. Students are able to use SAE analysis and its development (ILO-4: PI-1, PI-2, PI-3). 6. Students are able to use Bayesian methods and Bayesian hybrids with other methods (ILO-4: PI-1, PI-2, PI-3). 7. Students are able to reason intuitively and analytically and are able to express the results of their reasoning in writing, systematically and rigorously (ILO-5: PI-1, PI-2, PI-3).
Brief Description	The lecture begins by discussing multivariate data, mean vector, variance-covariance matrix, mean vector test, MANOVA. These basic concepts are then used in applicable material, namely the multivariate regression, fuzzy time series analysis, and Bayesian method analysis.
Study Materials	Mean vector, variance-covariance matrix, mean vector test, MANOVA, multivariate regression, fuzzy time series analysis and its development, and Bayesian method analysis.
References	**Main:** Johnson, R. and Winchern, D. 2013. Applied Multivariate Statistical Analysis (6th ed). Prentice Hall International, Inc., USA. Davino, C., Furno, M., and Vistocco, D. 2014. Quantile Regression Theory and Applications. John Wiley dan Sons, Ltd., United Kingdom. Bolstad, W. M. and Curran, J. M. 2017. Introduction to Bayesian statistics (3rd ed). John Wiley & Sons, New Jersey.

	Supporting: Chatfield, C. and AJ Collins. 1980. Introduction to Multivariate Analysis. Chapman and Hall, London	
Learning Media	**Software:**	**Hardware:**
	• LMS Unand (http://sci.ilearn.unand.ac.id/) • Zoom meeting • Whatsapp	• Computer/Laptop • Smartphones
Team Teaching	1. Prof. Dr. Rahmat Syahni, M.Sc 2. Prof. Dr. Ferra Yanuar, M.Sc	
Assessment	Assignment, participation, quiz, midterm exam, final exam.	
Required courses	MAT81131 PROBABILITY THEORY	
Academic Norms	Follow the Academic Regulations of Undergraduate Program, Universitas Andalas (https://akademik.unand.ac.id/images/2022-03-30%20Peraturan%20Rektor%20Nomor%207%20Tahun%202022%20Penyelenggaraan%20Pendidikan-khusus%20Bab%20II.pdf)	

1. **Weekly Study Plan**

WEEK (1)	COURSE LEARNING OUTCOME (CLO) / LESSON LEARNING OUTCOME (LLO) (2)	ASSESSMENT INDICATORS (3)	FORM OF ASSESSMENT (4)	LEARNING ACTIVITIES [Estimated Time]				MEDIA (9)	LEARNING MATERIALS [Reference] (10)	WEIGHT (11)
				Synchronous		Asynchronous				
				Face to Face Offline (5)	Face to Face Online (6)	Independent (7)	Collaborative (8)			
1-2	CLO 1: Students are able to explain multivariate data and are able to determine the mean vector, variance-covariance matrix and correlation matrix (ILO-2: PI-1, PI-2).	• Discipline in implementing the college contract • Accuracy in understanding related material	Midterm exam (5%) Assignment (5%)	Class: - introduction of semester learning plan - discussion about course material	•	○ Student know multivariate data ○ Student find out the references and study lecture materials: mean vectors,		LMS (ilearn UNAND)	Multivariate data, mean vector, variance-covariancematrix and correlation matrix	10%

				[2 x 3 x 50 minutes]		variance-covariance matrix, and correlation matrix [2 x 3 x 120 minutes]				
3-4	CLO 2: Students are able to explain Inference about mean vector for one population and two populations (ILO-2: PI-3).	• Accuracy in understanding related material • Accuracy in answering assignment questions • Neatness of assignment execution ● Originality of assignment results	Midterm exam (5%) Quiz (10%) Participation (2.5%)	Class: - explanation of concepts - discussion about course materials [2 x 3 x 50 minutes]		Students find out the references and study materials [2 x 3 x 60 minutes]	Students's discussion in groups [2x3x60] minutes	LMS (ilearn UNAND)	□ Inference about mean vector for one population □ Inference about mean vector for two populations	17.5%

5-6	CLO 3: Students are able to explain and use one-way and two-ways multivariate analysis of variance (ILO-3: PI-1).	• Accurate understanding of related material • Accuracy in answering assignment questions • Neatness in completing assignments • Originality of assignment results	Midterm exam (10%) Assignment (5%)	- Quiz, - discussion about course materials [2 x 3 x 50 minutes]		Students find out references and study material [2 x 3 x 60 minutes]	Students discuss in groups [2x3x60]		One-way and two-ways multivariate analysis of variance	15%
7	CLO 4: Students are able to use multivariate regression analysis (ILO-3: PI-2, PI-3).	• Accurate understanding of related material • Accuracy in answering assignment questions • Neatness in completing assignments • Originality of assignment results	Midterm exam (10%) Participation (2.5%) Assignment (5%)	- Quiz, - discussion about course materials [1 x 3 x 50 minutes]		Students find out references and study material [1 x 3 x 60 minutes]	Students discuss in groups [1x3x60]		Multivariate regression analysis	17.5%

Midterm exam										
8-10	CLO 5: Students are able to use SAE analysis and its development (ILO-4: PI-1, PI-2, PI-3).	• Accuracy in understanding of related material • Accuracy in answering assignment questions • Neatness in completing assignments • Originality of assignment results	Final exam (10%) Participation (5%)	Class: - Explanation the concepts, - discussion about course materials [3 x 3 x 50 minutes]		Students find out references and study material [3x 3 x 60 minutes]	Students discuss in groups [3x3x60]	● LMS	SAE (Small Area Estimation) Analysis	15%
11-14	CLO 6: Students are able to use Bayesian methods and Bayesian hybrids with other methods (ILO-4: PI-1, PI-2, PI-3). CLO 7: Students are able to reason intuitively and analytically and are able to express the results of their	• Accuracy in understanding of related material • Accuracy in answering assignment questions • Neatness in completing assignments • Originality of assignment results	Final exam (10%+10%) Assignment (2.5% +2.5%)	Class: - Explanation the concepts, - discussion about course materials [4 x 3 x 50 minutes]		Students find out references and study material [4x 3 x 60 minutes]	Students discuss in groups [4x3x60]	● LMS ● Zoom	□ Bayesian method □ Quantile regression □ Bayesian quantile method	25%

	reasoning in writing, systematically and rigorously (ILO-5: PI-1, PI-2, PI-3).									
Final exam										

II. Indicators, Criteria and Proportions of Assessment

NO	FORM OF ASSESSMENT	PROPORTION (%)
1	Assignment	20%
2	Participation	10%
3	Quiz	10%
4	Midterm exam	30 %
4	Final exam	30%

TOTAL	100

Assessment proportion for each Course Learning Outcome (CLO):

- CLO 1: 15 %
- CLO 2: 12%
- CLO 3: 12 %
- CLO 4: 12 %
- CLO 5: 12 %
- CLO 6: 12 %
- CLO 7: 25 %

III. Assessment Plan Table

Form of assessment Course Learning Outcomes (CLO)	Assignment	Participation	Quiz	Midterm Exam	Final Exam	Total of Proportion
1. Students are able to explain about multivariate data and are able to determine the multivariate mean vector,	5%			5%		10%

variance-covariance matrix, and correlation matrix (ILO-2: PI-1, PI-2).						
2. Students are able to explain inference about the mean vector for one population and two populations (ILO-2: PI-3).		2.5%	10%	5%		17.5%
3. Students are able to explain and use one-way and two-way multivariate analysis of variance (ILO-3: PI-1).	5%			10%		15%
4. Students are able to use multivariate regression analysis (ILO-3: PI-2, PI-3).		2.5%		10%		17.5%
5. Students are able to use SAE analysis and its development (ILO-4: PI-1, PI-2, PI-3).		5%			10%	15%
6. Students are able to use Bayesian methods and Bayesian hybrids with other methods (ILO-4: PI-1, PI-2, PI-3).	2.5%				10%	12.5%
7. Students are able to reason intuitively and analytically and are able to express the results of their reasoning in writing, systematically and rigorously (ILO-5: PI-1, PI-2, PI-3).	2.5%				10%	12.5 %
Total of Proportion	30%	30%	20%	10%	10%	100%

Matrix of CLO and ILO

CLO	ILO																	
	1		2			3			4				5			6		
	PI		PI			PI			PI				PI			PI		
	1	2	1	2	3	1	2	3	1	2	3	4	1	2	3	1	2	3
1			✓	✓	✓													
2						✓	✓	✓										
3						✓	✓	✓										
4									✓	✓	✓	✓						

5													✓	✓	✓			