SEMESTER STUDY PLAN
PROBABILITY THEORY
(COMPULSORY COURSES)

DEPARTMENT OF MATHEMATICS AND DATA SCIENCE
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
UNIVERSITAS ANDALAS
2023

1 Semester Study Plan

SEMESTER STUDY PLAN
STUDY PROGRAM OF S2 MATHEMATICS
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
UNIVERSITAS ANDALAS

SEMESTER STUDY PLAN					
Course	**Code**	**i-learn URL**	**Credits**	**Semester**	**Compilation Date**
PROBABILITY THEORY	**MAT 81131**	https://sci.ilearn.unand.ac.id	3	1	November 01, 2023
Person in Charge	**Study Plan Creator**		**Head of Research Group**	**Head of Study Program**	
	1. Dr. Dodi Devianto, M.Sc **2. Dr. Maiyastri, M.Sc**		**Yudiantri Asdi, M.Sc**	**Dr. Ferra Yanuar**	
Intended Learning Outcomes (ILO) and Performance Indicator (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 basic mathematical concepts			

		PI-2. An ability to provide examples that are relevant to basic mathematical concepts PI-3 An ability to determine solutions to simple problems using basic mathematical concepts.
	ILO-3	Master one or several theories comprehensively 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 theory for development in related fields (advanced theory) PI-3. An ability to use advanced theory in solving related mathematical problems.
	ILO-4	Mastering scientific techniques and developing them in solving research problems through a multidisciplinary or interdisciplinary approach. PI-1. An ability to use scientific techniques in solving research problems PI-2. An ability to analyze research problems PI-3. An ability to formulate theorems/models and prove their correctness PI-4. An ability to use several mathematical software to solve complex mathematical problems.
	ILO-5	An ability to work and conduct research in the field of mathematics and related fields of science in accordance with developments in current issues independently or collaboratively and communicate it academically. PI-1. An ability to prove mathematical statements formally and correctly. PI-2. An ability to use related techniques to conduct research PI-3. An ability to communicate research results academically.
	Course Learning Outcome (CLO)	

	CLO-1	Students are able to explain the concept of probability theory in mathematical statistics, that are measure theory and probability space. (**ILO-2**: PI-1, PI-2, PI-3)
	CLO-2	Students are able to explain the concept of random variables and distribution functions with their properties. (**ILO-3**: PI-1, PI-2, PI-3)
	CLO-3	Students are able to explain the concepts of convergence, expectation, and transformation of random variables with their properties. (ILO-3: PI-1, PI-2, PI-3)
	CLO-4	Students are able to use the concepts of probability theory and characterization of characteristic functions in infinitely divisible distribution and stable distributions. (ILO-4: PI-1, PI-2, PI-3, PI-4)
	CLO-5	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	In this course, material is given about sigma field, sigma Borel field, probability space, random variables, probability distribution functions and their properties, special random variables and their properties, convergence, large number law, convolution, characteristic functions, infinitely divided distribution, stable distribution, and applications of infinitely divided distribution and stable distribution.	
Course Materials	1. Measure theory and probability space 2. Random variable and distribution functions 3. Expectation value, variance and moment generating function 4. Conditional probability and expectations 5. Special distribution and its properties 6. Convergence and the large numbers law 7. Joint transformation and convolution	

	8. Characteristics function and its properties 9. Infinitely divisible distribution and stable distribution	
References	**Main:**	
	1. H. G. Tucker. (2014). *A graduate course in probability*. Dover Publications Inc., New York. 2. K. L. Chung. (2001). *A course in probability theory*. Academic Press, San Diego. 3. A. Gut. (2013). *Probability: a graduate course*. Springer, United States.	
	Additional:	
	1. M. Loeve. (2012). *Probability theory I*. Springer, United States. 2. B. E. Fristedt and L. F. Gray. (2018). *A modern approach to probability theory*. Springer, United States. 3. W. Feller. (1971). *An introduction to probability theory and its application – Volume II*. John Wiley & Sons, Canada. 4. G. Casella G and R. L. Berger. (2002). *Statistical inference*. Duxbury Press, United States. 5. E. Lukacs. (1970). *Characteristic functions*. Charles Griffin & Co, London. 6. Eugene Lukacs and R. G. Laha. (1971). *Applications of characteristics functions*. Hafner Publishing Company, US. 7. K. Sato. 1991. *Lévy processes and infinitely divisible distributions*. Cambridge University Press, England. 8. R. V. Hogg, J. W. McKean, and A. T. Craig. (2019). *Introduction to mathematical statistics*. Pearson, London. 9. A. N. Kolmogorov and Nathan Morrison. (2018). *Foundations of the theory of probability*. Dover Publications Inc., New York. 10. Manan Gajjar. (2019). *The Characteristics Function*. ASIN: B07N972WFJ.	
Instructional Media	**Software:**	**Hardware:**

	• LMS Unand (http://sci.ilearn.unand.ac.id/) • Zoom meeting • Whatsapp	• Computer/Laptop • Smartphones
Team Teaching	1. Dr. Dodi Devianto, M.Sc 2. Dr. Maiyastri, M.Sc	
Assessment	Assignment, Participation, Mid-Term exam, Final exam	
Required courses	-	
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)	

Weekly Study Plan

Week (1)	Course Outcome (2)	Indicators (3)	Form of Assessment (4)	Learning Activities [Estimated Time]					Learning Materials [Reference] (10)	Weight (11)
				Synchronous		Asynchronous		Media (9)		
				Face to Face Offline (5)	Face to Face Online (6)	Individual (7)	Collaboration (8)			
1-2	CLO 1: Students are able to explain the concept of probability theory in mathematical statistics, that are measure theory and probability space. (ILO-2: PI-1, PI-2, PI-3)	• Discipline in implementing the college contract • Accuracy in understanding related material	Midterm exam (10%) Independent assignment (5%)	Class: - introduction of semester learning plan - discussion about course material		Students find and read the references about measure theory and probability theory (probability space and sigma-field set in relation to the probability		LMS (ilearn UNAND)	• Introduction to Lectures (Assessment, Semester Study Plan, Syllabus, Tuition Contract) • Measure theory • Probability theory	**15%**

				[2 x 3 x 50 minutes]		distribution with their properties. - Independent work [2 x 3 x 120 minutes]				
3-7	CLO 2: Students are able to explain the concept of random variables and distribution functions with their properties. (ILO-3: PI-1, PI-2, PI-3)	• Accuracy in understanding related material • Accuracy in answering assignment questions • Neatness of assignment execution ● Originality of assignment results	Midterm exam (10%) Assignment (10%)	Class: - explanation of concepts - discussion about course materials [5 x 3 x 50 minutes]		Students find and read the references about the random variable and distribution function with their properties. [5 x 3 x 60 minutes]	Students's discussion in groups [5x3x60] minutes	LMS (ilearn UNAND)	● Random variable ● Distribution functions and their properties	**20%**
8	**Midterm exam**									
9-11	CLO 3: Students are able to explain the concepts of convergence, expectation, and transformation of random variables with	• Accuracy in understanding of related material • Accuracy in answering assignment questions	Final exam (5%) Participation (5%) Assignment (10%)	Class: - Explanation the concepts, - discussion about course materials		Students find out references and study material [3x 3 x 60 minutes]	Students discuss in groups [3x3x60]	● LMS	● Convergence ● Conditional expectation ● Transformation of random variable	**20%**

	their properties. (ILO-3: PI-1, PI-2, PI-3)	• Neatness in completing assignments • Originality of assignment results		[3 x 3 x 50 minutes]						
12-13	CLO 4: Students are able to use the concepts of probability theory and characterization of characteristic functions in infinitely divisible distribution and stable distributions. (ILO-4: PI-1, PI-2, PI-3, PI-4)	• Accuracy in understanding of related material • Accuracy in answering assignment questions • Neatness in completing assignments • Originality of assignment results	Final exam (5%) Assignment (10%)	Class: - Explanation the concepts, - discussion about course materials [2 x 3 x 50 minutes]		Students find out references and study material [2x 3 x 60 minutes]	Students discuss in groups [2x3x60]	● LMS	● Characteristic function ● Infinitely divisible distribution	**15%**
14-15	CLO 5: 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)	• Accuracy in understanding of related material • Accuracy in answering assignment questions • Neatness in completing assignments • Originality of assignment results	Assignment (15%) Final exam (10%) Participation (5%)	Practice: - Discussion about course materials. - Presentation group [2 x 3 x 50 minutes]		Students find out references and study material [2x 3 x 60 minutes]	Students discuss in groups [2x3x60 minutes]	● LMS	● Canonical representation model based on specific distribution ● Implementation of canonical representation.	**30%**

16	**Final exam**

II. Indicators, Criteria and Proportions of Assessment

NO	FORM OF ASSESSMENT	PROPORTION (%)
1	Assignment	50%
2	Participation	10%
3	Midterm exam	20 %
4	Final exam	20%
TOTAL		**100**

Assessment proportion for each Course Learning Outcome (CLO):

- CLO 1: 15 %
- CLO 2: 20%
- CLO 3: 20 %
- CLO 4: 15 %
- CLO 5: 30 %

III. Assessment Plan Table

Form of assessment Course Learning Outcomes (CLO)	Final exam	Mid-term exam	Assignments	Participation	Total
Students are able to explain the concept of probability theory in mathematical statistics, that are measure theory and probability space. (ILO-2: PI-1, PI-2, PI-3)		10%	5%		15%
Students are able to explain the concept of random variables and distribution functions with their properties. (ILO-3: PI-1, PI-2, PI-3)		10%	10%		20%
Students are able to explain the concepts of convergence, expectation, and transformation of random variables with their properties. (ILO-3: PI-1, PI-2, PI-3)	5%		10%	5%	20%
Students are able to use the concepts of probability theory and characterization of characteristic functions in infinitely divisible distribution and stable distributions. (ILO-4: PI-1, PI-2, PI-3, PI-4)	5%		10%		15%

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)	10%		15%	5%	30%
Total	20%	20%	50%	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													✓	✓	✓			