Module Description/Course Syllabi

Study Programme : Magister of Mathematics
Faculty of Mathematics and Natural Sciences.
Universitas Andalas

1. *Course number and name*

MAT81232 Topic in Statistics 2

2. *Credits and contact hours/Number of ECTS credits allocated*

3 / 4,50 ECTS

3. *Instructors and course coordinator*

1. Prof. Dr. Ferra Yanuar, M.Sc
2. Dr. Dodi Devianto

4. *Text book, title, outhor, and year*

a. Bain, L. J. and Engelhardt, M. 2000. *Introduction to Probability and Mathematical Statistics*, Second Edition. Duxbury Press, California.
b. Bolstad, W. M. and Curran, J. M. 2016. *Introduction to Bayesian Statistics*, third edition. John Wiley & Sons, New Jersey.
c. Ntzoufras, I. 2009. *Bayesian Modeling Using WinBUGS*. John Wiley & Sons, Inc: Ney Jersey.

5. *Recommended reading and other learning resources/tools*

a. Rinne, H. 2009. *The Weibull Distribution A Handbook*. CRC Press: London.
b. (Selected articles based on research topic)

6. *Specific course information*

A. Brief description of the content of the course (catalog description)

The topics in this course are flexible, the material changes per semester according to current issues. The initial material is usually related to the implementation of Bayesian methods in the inference of discrete random variables and continuous random variables. The other materials are regarding the hybridizes Bayesian methods with other statistical methods. In implementing the method, we will use software such as SPSS, R and WinBUGS. The basic concepts of using the application will be explained at the meeting after midterm exam. To increase understanding and provide simple research experience to students, this lecture is also equipped with a final project, namely dissecting articles related to Bayesian hybrids using other methods and then presenting them individually.

B. Prerequisites or co-requisites

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C. Indicate whether a required or elective course in the program

Required

D. Level of course unit (according to EQF: first cycle Bachelor, second cycle Master)
Second Cycle master
E. Year of study when the course unit is delivered (if applicable)
1st Year
F. Semester when the course unit is delivered
Second Semester
G. Mode of delivery (face-to-face, distance learning)
Mixture (Face to face and Distance learning)
7. *Intended Leening Outcomes*
ILO-2: Mastering mathematical concepts and applications (real analysis, advanced linear algebra, and statistics) in solving complex mathematical problems. PI-1: Able to explain mathematical concepts (Real Analysis, Advanced Linear Algebra, and Statistics). PI-2: Able to identify complex mathematical problems. ILO-3: Able to master one or several mathematical problems in analysis, algebra, applied mathematics, statistics and combinatorics. PI-1: Able to identify theories used in related mathematical problems. PI-2: Able to apply theories for advancement in related fields (advanced theory). PI-3: Able 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: Able to apply mathematical techniques in research problem-solving. PI-2: Able to analyse research problems. PI-3: Able to formulate theorems/models and prove their validity. PI-4: Able to use various mathematical software to solve complex mathematical problems. ILO-5: Able to work and conduct research in 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. Able to employ relevant techniques for conducting research. PI-3. Capable of communicating research findings academically.
8. *Course Learning Outcomes* *ex. The student will be able to explain the significance of current research about a particular topic.*
1. Students are able to explain the concept of Bayesian analysis and use Bayesian inference on data distributions (discrete and continuous) (CPL-2: IK-1, IK-2, IK-3). 2. Students are able to use hybridization of the Bayesian method with several other statistical methods. 3. Students are able to use SPSS, R and WinBugs application software in the model estimation process. 4. Students are able to reason intuitively and analytically and are able to express

the results of their reasoning in writing, systematically and rigorously, both individually and in groups.
9. *Brief list of topics to be covered*
1. Bayesian inference on the distribution of discrete and continuous random variables. 2. Hybrid Bayesian method with other statistical methods (flexible material). 3. Basic concepts for using R and/or WinBugs applications in Bayesian analysis.
10. Learning and teaching methods
Presentation, Small Group Discussion, Directed Learning.
11. Language of instruction
Bahasa Indonesia
12. Assessment methods and criteria
Summative Assessment : 1. Assignment : 50% 2. Activeness : 10% 3. Midterm exam : 20% 4. Final exam : 20% **Formative Assessment**: 1. Thumb up and thumb down 2. Minutes paper

SEMESTER STUDY PLAN

STATISTICS TOPICS II

(ELECTIVE COURSES)

DEPARTMENT OF MATHEMATICS AND DATA SCIENCE

FACULTY OF MATHEMATICS AND NATURAL SCIENCES

UNIVERSITAS ANDALAS

2024

1 Study Plan

	SEMESTER STUDY PLAN **STUDY PROGRAM: MASTER OF MATHEMATICS** **FACULTY OF MATHEMATICS AND NATURAL SCIENCES** **UNIVERSITAS ANDALAS**

Course Name	Course Code	*I-Learn* URL	Credits	Semester	Compilation Date
STATISTICS TOPICS II	**MAT81232**	**http://sci.ilearn.unand.ac.id**	**3**	**2**	**May 8th, 2024**

Person in Charge	Study Plan Creator	Head of Research Group	Head of the study program
	Prof. Dr. Ferra Yanuar, M.Sc **Dr. Dodi Devianto**	**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. Able to explain mathematical concepts (Real Analysis, Advanced Linear Algebra, and Statistics). PI-2. Able to identify complex mathematical problems. PI-3. Able 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. Able to identify theories used in related mathematical problems. PI-2. Able to apply theories for advancement in related fields (advanced theory). PI-3. Able 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. Able to apply mathematical techniques in research problem-solving. PI-2. Able to analyse research problems. PI-3. Able to formulate theorems/models and prove their validity. PI-4. Able 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. Able to employ relevant techniques for conducting research. PI-3. Capable of communicating research findings in an academic manner.
	Course Learning Outcome (CLO)	
	CLO 1	Students are able to explain the concept of Bayesian analysis and use Bayesian inference on data distributions (discrete and continuous) (ILO-2: PI-1, PI-2, PI-3).
	CLO 2	Students are able to use hybridization of the Bayesian method with several other statistical methods (ILO-3: PI-1, PI-2, PI-3).
	CLO 3	Students are able to use SPSS, R, and WinBugs application software in the model estimation process (ILO-4: PI-1, PI-2, PI-3, PI-4).

	CLO 4	Students are able to reason intuitively and analytically and are able to express the results of their reasoning in writing, systematically and rigorously both individually and in groups (ILO-5: PI-1, PI-2, PI-3)
Short Description	This Topics in Statistics course is flexible; the curriculum changes each semester according to current issues. The initial material is usually related to the implementation of Bayesian methods in the inference of discrete and continuous random variables. The following material combines Bayesian methods with various other statistical methods. The method will be carried out with the software packages SPSS, R, and WinBUGS. The fundamental ideas for utilizing the application will be addressed at the meeting following the midterm exam. This lecture also includes a final project, which consists of analyzing publications about Bayesian hybrids with other methods and presenting them individually to students in order to better their understanding and provide them with basic research experience.	
Study Materials	1. Bayesian inference on distributions of discrete and continuous random variables. 2. Hybrid of Bayesian methods with other statistical methods (flexible material). 3. Basic concepts for using R and/or WinBUgs applications in Bayesian analysis 4. Presentation (article dissection on the development of Bayesian methods).	
References	**Main:**	
	Bain, L. J. and Engelhardt, M. 2000. *Introduction to Probability and Mathematical Statistics*, Second Edition. Duxbury Press, California. Bolstad, W. M. and Curran, J. M. 2016. *Introduction to Bayesian Statistics* , third edition. John Wiley & Sons, New Jersey. Ntzoufras, I. 2009. *Bayesian Modeling Using WinBUGS* . John Wiley & Sons, Inc: New Jersey	
	Supporting:	
	Rinne, H. 2009. *The Weibull Distribution A Handbook*. CRC Press: London. (Articles from reputable journals, selected topics)	

Learning Media	**Software:**	**Hardware:**
	• LMS Unand (http://sci.ilearn.unand.ac.id/) • Zoom meetings • WhatsApp • Software (SPSS, R and WinBUGS)	Computer/Laptop and LCD Projector
Team Teaching	Prof. Dr. Ferra Yanuar, M.Sc Dr. Dodi Devianto	
Assessment	Assignment, participation, midterm exam, final exam.	
Required Course	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)	

2. Weekly Lecture Plan

WEEK (1)	COURSE OUTCOME (2)	ASSESSMENT INDICATORS (3)	FORM OF ASSESSMENT (4)	LEARNING ACTIVITIES [Estimated Time]					LEARNING MATERIALS [Reference] (10)	ASSESSMENT LOAD (%) (11)
				Synchronous		Asynchronous		MEDIA (9)		
				Face to Face Offline (5)	Face to Face Online (6)	Independent (7)	Collaborative (8)			
1-2	CLO 1: Students are able to explain the concept of Bayesian analysis and use Bayesian inference on	• Discipline in implementing the college contract	Participation (5%)	Class: – introduction of semester		○ Students find out the references and study lecture		LMS (ilearn UNAND)	Material alternatives: Bayesian analysis of	15%

	data distributions (discrete and continuous) (ILO-2: PI-1, PI-2, PI-3).	• Accuracy in understanding related material	Midterm (10%)	learning plan – discussion about course material [2 x 3 x 50 minutes]		materials: basic concepts in statistics and modeling in statistics. [2x3x120 minutes]			the Weibull distribution. •	
3-7	CLO 2: Students are able to use hybridization of the Bayesian method with several other statistical methods (ILO-3: PI-1, PI-2, PI-3).	• Accurate understanding of related material • Accuracy in answering assignment questions • Neatness of task execution Originality of task results	Participation (5%) Midterm exam (10%) Assignment (20%)	Class: - explanation of concepts - discussion about course materials [5 x 3 x 50 minutes]		Students find out the references and study materials [5 x 3 x 60 minutes]	Students's discussion in groups [5x3x60]	LMS (ilearn UNAND)	Material alternatives: • Survival Analysis of Exponential Distribution of Right Censored Data Using Bayesian Methods. • Comparison of Classic *np* Control Maps and Bayes *np Control Maps.*	35%

									Bayesian Binary Logistic Regression Classification Method and Naive Bayes Classifier	
Midterm exam										
8-10	CLO 3: Students are able to use SPSS, R and WinBugs application software in the model estimation process (ILO-4: PI-1, PI-2, PI-3) .	• Accuracy in understanding related material • Accuracy in answering assignment questions • Neatness of assignment execution Originality of assignment results.	Final exam (10%) Assignment (10%)	Class: - Use of R and/or WinBugs applications - Discussion about course materials [3 x 3 x 50 minutes]		Students find out the references and study materials [3 x 3 x 60 minutes]	Students's discussion in groups [3x3x60] minutes	• LMS	• R coding for the model estimation that has been studied WinBugs coding for the model estimation that has been studied.	20%

11-14	CLO 4: 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 related material • Accuracy in answering assignment questions • Neatness of assignment execution Originality of assignment results	Final exam (10%) Participation (5%) Assignment (15%)	Exercise: - discussion about course materials - Group presentation [4 x 3 x 50] minutes		Students find out the references and study materials [4 x 3 x 60] minutes	Students's discussion in groups [4x3x60] minutes	• LMS	● Bayesian hybrid method with other statistical methods. Bayesian hybrid implementation with case data (using Spss, R or WinBugs).	30%
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: 35%
- CLO 3: 20%
- CLO 4: 30%

III. Assesment Plan Table

Form of assessment **Course Learning Outcomes (CLO)**	**Midterm exam**	**Final exam**	**Participation**	**Assignments**	**Total of Proportion**

1. Students are able to explain the concept of Bayesian analysis and use Bayesian inference on data distributions (discrete and continuous) (ILO-2: PI-1, PI-2, PI-3).	10%			5%	15%
2. Students are able to use hybridization of the Bayesian method with several other statistical methods (ILO-3: PI-1, PI-2, PI-3).	10%		5%	20%	35%
3. Students are able to use SPSS, R and WinBugs application software in the model estimation process (ILO-4: PI-1, PI-2, PI-3).		10%		10%	20%
4. Students are able to reason intuitively and analytically and are able to express the results of their reasoning in writing, systematically and rigorously both individually and in groups (ILO-5: PI -1, PI-2, PI-3).		10%	5%	15%	30%
Total of Proportion	20%	20%	10%	50%	100%