Module Description/Course Syllabi

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

1. *Course number and name*

MAT82234 Topic in Statistics 1

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.

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

Ntzoufras, I. 2009. Bayesian Modeling Using WinBUGS. John Wiley & Sons, Inc: Ney Jersey

6. *Specific course information*

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

In this course, material is provided on basic concepts in Bayesian inference. Bayesian inference on several distributions of discrete and continuous random variables. To increase understanding and provide simple research experience to students, this lecture is also equipped with an assignment, namely criticizing articles written related to Bayesian methods and 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 basic concepts in statistics and modeling in statistics.
2. Students are able to explain the concept of Bayesian analysis and use Bayesian inference on data distribution (discrete and continuous).
3. Students are able to use hybridization of the Bayesian method with several other statistical methods.
4. Students are able to construct simple algorithms for modeling using Bayesian methods.
5. Students are able to use software and create algorithms to apply Bayesian and hybridization methods.
6. 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. Parameter estimation and hypothesis testing.
2. Basic concepts in Bayesian analysis.
3. Bayesian inference on the distribution of discrete random variables.
4. Bayesian inference on the distribution of continuous random variables.
5. Basic concepts for using the R application and/or WinBugs in Bayesian analysis
6. Reviewing articles related to Bayesian methods.

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 : 30%
2. Activeness : 10%
3. Midterm exam : 30%
4. Final exam : 30%

Formative Assessment:

1. Thumb up and thumb down
2. Minutes paper

SEMESTER STUDY PLAN
TOPIC IN STATISTICS 1
(ELECTIVE COURSES)

DEPARTMENT OF MATHEMATICS AND DATA SCIENCE

FACULTY OF MATHEMATICS AND NATURAL SCIENCES

UNIVERSITAS ANDALAS

2024

	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
TOPIC IN STATISTICS 1	**MAT82234**	**http://sci.ilearn.unand.ac.id**	**3**	**2**	**May 3rd, 2024**

	Study Plan Creator	Head of Research Group	Head of the Study Pprogram
Person in Charge	**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)	**Intended Learning Outcome (ILO)**	
	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)	
	1	Students are able to explain basic concepts in statistics and modeling in statistics (ILO-2: PI-1, PI-2)
	2	Students are able to explain the concept of Bayesian analysis and use Bayesian inference on data distribution (discrete and continuous) (ILO-2: PI-3)

	3	Students are able to use hybridization of the Bayesian method with several other statistical methods (ILO-3: PI-1, PI-2, PI-3).
	4	Students are able to construct simple algorithms for modeling using Bayesian methods (ILO-4: PI-1, PI-2).
	5	Students are able to use software and create algorithms to apply Bayesian and hybridization methods (ILO-4: PI-3).
	6	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).
Brief Description	In this course, material is provided on basic concepts in Bayesian inference, Bayesian inference on several distributions of discrete and continuous random variables. To increase understanding and provide simple research experience to students, this lecture is also equipped with an assignment, namely criticizing articles written related to Bayesian methods and expressing them individually..	
Study Materials	1. Parameter estimation and hypothesis testing. 2. Basic concepts in Bayesian analysis. 3. Bayesian inference on the distribution of discrete random variables. 4. Bayesian inference on the distribution of continuous random variables. 5. Basic concepts for using the R application and/or WinBugs in Bayesian analysis 6. Reviewing articles related to Bayesian methods.	
References	**Main:**	

<table>
<tr><td></td><td colspan="2">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.</td></tr>
<tr><td></td><td colspan="2">Supporting :</td></tr>
<tr><td></td><td colspan="2">Ntzoufras, I. 2009. Bayesian Modeling Using WinBUGS. John Wiley & Sons, Inc: Ney Jersey.</td></tr>
<tr><td>Learning Media</td><td>Software:</td><td>Hardware:</td></tr>
<tr><td></td><td>• LMS Unand (http://sci.ilearn.unand.ac.id/)
• Zoom meeting
• Whatsapp
• Software (SPSS, R dan WinBUGS)</td><td>Komputer/Laptop dan LCD Projector</td></tr>
<tr><td>Team Teaching</td><td colspan="2">Prof. Dr. Ferra Yanuar, M.Sc

Dr. Dodi Devianto</td></tr>
<tr><td>Assessment</td><td colspan="2">Assignment, participation, midterm exam, final exam</td></tr>
<tr><td>Required courses</td><td colspan="2">MAT81131 PROBABILITY THEORY</td></tr>
<tr><td>Academic Norms</td><td colspan="2">Follow the Academic Regulations of Undergraduate Program, Universitas Andalas</td></tr>
</table>

	(https://akademik.unand.ac.id/images/2022-03-30%20Peraturan%20Rektor%20Nomor%207%20Tahun%202022%20Penyelenggaraan%20Pendidikan-khusus%20Bab%20II.pdf)

I. Weekly Study Plan

WEEK (1)	COURSE OUTCOME (2)	ASSESSMENT 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)	Independent (7)	Collaborative (8)			
1-2	CLO 1 Students are able to explain basic concepts in statistics and modeling in statistics (ILO-2: PI-1, PI-2).	Discipline in implementing the college contract Accuracy in understanding related material	Participation (2.5%) Midterm exam (10%) Assignment (5%)	Class: – introduction of semester learning plan – discussion about		o Students look for references and study lecture material: basic concepts in statistics and modeling in statistics		LMS (ilearn UNAND)	Basic concepts in statistics and modeling in statistics	17.5%

				course material [2 x 3 x 50 minutes]		[2 x 3 x 120] minutes				
3-4	CLO 2 Students are able to explain the concept of Bayesian analysis and use Bayesian inference on data distribution (discrete and continuous) (ILO-2: PI-3).	• Accuracy in understanding related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of task results	Midterm exam (10%) Assignment (5%)	Class: - explanation of concepts - discussion about course materials [2 x 3 x 50 minutes]		Students look for references and study material [2 x 3 x 60 minutes]	Students' discussion in groups [2x3x60] minutes	LMS (ilearn UNAND)	Material Alternatives: ● Bayesian inference on discrete (Poisson) distributions ● Bayesian inference on continuous (Exponential) distributions.	15%

5-7	CLO 3 Students are able to use hybridization of the Bayesian method with several other statistical methods (ILO-3: PI-1,PI-2, PI-3).	• Accuracy in understanding related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of task results	Midterm exam (10%) Participation (2.5%) Assignment (5%)	- Quiz, - discussion about course materials [3 x 3 x 50 minutes]		Students look for references and study material: ● Bayesian Self Error Loss Function (SELF) method. ● Bayesian Linux Loss Function Method ● Cox professional hazard regression method with Weibull distribution. [3 x 3 x 60 minutes]	Students' s discussio n in groups [3x3x60] minutes		Material alternatives: ● Bayesian Self Error Loss Function (SELF) method. ● Bayesian Linux Loss Function Method	17.5%
MIDTERM EXAM										

8-10	CLO 4 Students are able to construct simple algorithms for modeling using Bayesian methods (ILO-4: PI-1, PI-2).	• Accuracy in understanding related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of task results	Final exam (10%) Assignment (5%)	Class: - Explanation the concepts, - discussion about course materials [4 x 3 x 50 minutes]		Students look for references and study lecture material [4 x 3 x 60 minutes]	Students' s discussion in groups [4x3x60] minute s	● LMS	● Coding in Bayesian method ● Practice WinBugs ● Bayesian Inference with WinBugs	15%
11-14	CLO 5 Students are able to use software and create algorithms to apply Bayesian and hybridization methods (ILO-4: PI-3).	• Accuracy in understanding related material • Accuracy in answering assignment questions • Neatness of task execution • Originality of task results	Final exam (10%+10%) Participation (2.5%+2,5%) Assignment (5%+5%)	Class: - Explanation the concepts, - discussion about course materials [4 x 3 x 50 minutes]		Students look for references and study lecture material [4 x 3 x 60 minutes]	Students' s discussion in groups [4x3x60] minute s	● LMS ● Zoom	Alternative topics: ● Bayesian Self Error Loss Function (SELF) method. ● Bayesian Linux Loss Function Method	35%

	CLO 6 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) .									
FINAL EXAM										

II. Indicators, Criteria and Proportions of Assessment

NO	FORM OF ASSESSMENT	PROPORTION (%)
1	Assignment	30%

2	Participation	10%
3	Midterm exam	30 %
4	Final exam	30%
TOTAL		**100**

Assessment proportion for each Course Learning Outcome (CLO):

- CLO-1: 17.5 %
- CLO 2: 15%
- CLO 3: 17.5 %
- CLO 4: 15 %
- CLO 5: 17.5 %
- CLO 6: 17.5 %

III. Assessment Plan Table

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

1. Students are able to explain basic concepts in statistics and modeling in statistics (ILO-2: PI-1, PI-2)	10%		2.5%	5%	17.5%
2. Students are able to explain the concept of Bayesian analysis and use Bayesian inference on data distribution (discrete and continuous) (ILO-2: PI-3)	10%			5%	15%
3. Students are able to use hybridization of the Bayesian method with several other statistical methods (ILO-3: PI-1, PI-2, PI-3).	10%		2.5%	5%	17.5%
4. Students are able to construct simple algorithms for modeling using the Bayesian method (ILO-4: PI-1, PI-2).		10%		5%	15%
5. Students are able to use software and create algorithms to apply Bayesian and hybridization methods (ILO-4: PI-3).		10%	2.5%	5%	17.5%
6. 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%	2.5%	5%	17.5%
Total of Proportion	30%	30%	10%	30%	100%