HASANUDDIN UNIVERSITY
FAKULTY OF MATH AND NATURAL SCIENCE
STATISTICS STUDY PROGRAM

SEMESTER LEARNING PLAN

MATA KULIAH (MK)	CODE	Rumpun MK	BOBOT (sks)		SEMESTER	Creation Date
Time Series Analysis *(Time Series Analysis)*	18H05130303	Mata Kuliah Pilihan	T=2	P=1	5	20-08-2019

	SLP Developer	CD Coordinator	Head of Study Program
OTORISASI Ketua Departement Statistika FMIPA Unhas	Sitti Sahriman, S.Si, M.Si	Sitti Sahriman, S.Si, M.Si	Dr. Nurtiti Sunusi, M. Si

Learning Outcomes (LO)	CPL-PRODI yang dibebankan pada MK/*Intended Learning Outcomes for this course*	
	ILO 3	Menjunjung tinggi etika akademik, semangat kemandirian, dan kewirausahaan *(Uphold academic ethics, the spirit of independence, and entrepreneurship)*
	ILO 5	Mengelola pembelajaran mandiri dan pemecahan masalah untuk mengambil keputusan yang tepat berdasarkan hasil analisis data *(Manage independent learning and problem solving to make the right decisions based on the results of data analysis)*
	ILO 10	Mampu menyelesaikan masalah nyata secara statistik dan mengkomunikasikannya secara tertulis dan lisan *(Able to solve real problems statistically and communicate them in writing and orally)*
	ILO 11	Memiliki etika profesi dalam penerapan statistika *(Have professional ethics in the application of statistics)*
	Capaian Pembelajaran Mata Kuliah (CPMK)/*Course Outcome*	
	CLO 1 CLO 2 CLO 3	Be able to explain basic concepts in Time Series Analysis Be able to apply deterministic models and stochastic models in solving a problem Able to make written reports and presentations

Short Course Description	Time series analysis is a subject in the Statistics Study Program at the Faculty of Mathematics and Natural Sciences, Hasanuddin University with the course code 18H05130303. This course is a compulsory subject for undergraduate students which is presented in semester 5 (five). This course studies the basic concepts of understanding time series and their properties. Next, introduce stationary and non-stationary time series models. In addition, it examines how the specification, estimation, diagnostics and forecasting of the time series model are. The seasonal time series model will also be introduced and ended with time series analysis application material in forecasting. The learning materials taught in this course include basic terms in Time Series Analysis, Basic Concepts in Time Series Analysis, Deterministic Trend Models (Smoothing and Regression Methods), Stationary Time Series Models, Non-Stationary Time Series Models, Forecasting, Parameter Estimation, Diagnostic Examination , Model selection, and Forecasting, and Seasonal Stochastic Models.
Study Materials / Learning Materials	1. Fundamental terms in Time Series Analysis 2. Basic Concepts in Time Series Analysis of Deterministic Trend Models (Smoothing and Regression Methods)Model runtun waktu stasioner 3. Nonstationary time series modelEstimasi Parameter 4. Model Diagnostics and Best Model Selection 5. Forecasting 6. Seasonal Stochastic Models

References	**Main :**	
	1. William W. S. Wei, "Time Series Analysis: Univariate and Multivariate Methods (Second Edition)", 2006. 2. Muhammad Arif Tiro, "Analisis runtun waktu", 2006 3. Spyros G. Makridakis, Steven C. Wheelwright, Rob J Hyndman, "Forecasting Methods and Applications", 1997	
	Supporting :	
	Jonathan D. Cryer, Kung-Sik Chan, "Time Series Analysis With Applications in R (Second Edition)", 2008	

Supporting Lecturer	Sitti Sahriman, S.Si, M.Si Dr. La Podje Talangko, M.Si Dr. Anna Islamiyati, S.Si, M.Si
Requirements Course	Calculus I, Calculus II, Data Analysis, Statistical Methods, Probability Theory
Course Requirements	Survey Analysis and Design, Statistical Modeling, spatial data analysis, Stochastic Process, Introduction to Bayesian Statistics

Week-	Sub-CLO (The final ability of each learning stage)	Assessment		Learning Forms, Learning Methods, Student Assigments, [Estimated Time]		Learning Materials [References]	Assessment Weight (%)
		Indicator	Form & Criteria	Offline	Online		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Able to recognize terms that often appear in time series analysis	The accuracy of defining time series data, forecasting and their use in various fields of science as well as time series components	**Criteria**: Accuracy In 1. The concepts and methods used 2. Systematic s Writing 3. Geometry / graph interpretation **4.** Calculation (**Rubric available on SPP Meeting 1**) **Assessment Form**: 1. 1st Task (Individually) : Terms in Time Series Analysis **Instruction**: Problem Task 1 is available in SIKOLA section Learning Flow Meeting I	**Form**: Studying **Method**: Interactive Learning **[FTF: 1x3x50]**	**SIKOLA (Modul e 1 and Task 1) SA + IL [(1+1)x(3x60")+** **IL:** Students read Module 1 in Wei Chapter 2 and write a summary of the reading that has been read **SA:** Class participants register at SIKOLA and do Task 1: practice questions in module 1 and submit to SIKOLA	**Learning Contract, SLP, CLO, Basic Terms in Time Series Analysis: Definition of time series data and its differences with cross section data and longitudinal data, definition of forecasting, utility of forecasting, forecasting methods, forecasting processes, time series components**	4

| 2 | Able to explain the basic concepts of Time Series Analysis | Accuracy in explaining stochastic processes, autocovariance functions, autocorrelation, partial autocorrelation functions, white noise processes, differencing, and the principle of parsimony | **Criteria**: Accuracy in
1. The concepts and methods used
2. Systematic s Writing
3. Geometry/ graph interpretation
4. Calculation (**Rubric available on SPP Meeting 2**)

Assessment Form:
1. 2nd Task (Individually) :Basic Concepts of Time Series Analysis

Instruction: Problem Task 1 is available in SIKOLA section Learning Flow Meeting II | **Form**: Studying **Method**: Interactive **[FTF: 2x3x50]** | **SIKOLA (Modul e2 and Task 2) SA + IL [(1+1)x(3x60")+**
IL: Students read Module 2 in Wei Chapter 2 and write a summary of the reading that has been read
SA: Class participants register at SIKOLA and do Task 2: practice questions in module 2 and submit to SIKOLA | **Basic Concepts of Time Series Analysis:** **Stochastic and Stationary Processes, autocovariance and autocorrelation functions, partial autocorrelation functions, white noise processes, differencing, and the principle of parsimony** | 4 |

| 3-4 | Be able to explain deterministic models (smoothing and regression methods) and their application in solving a problem | The completeness of explaining and describing the deterministic model with the method of Single Moving Average, Double Moving Average, Single Exponential Smoothing, Double Exponential Smoothing and obtaining forecasting with these methods | **Criteria**: Accuracy in
1. The concepts and methods used
2. Systematics Writing
3. Geometry/ graph interpretation
4.   Calculation
(**Rubric available on SPP Meeting 3 and 4**) | **Form**: Interactive Learning, Collaborative Learning **[FTF: 2x3x50]** | **SIKOLA (Module 3 and Task 3)**
SA + IL[(2+2)x(3x60")+
BM: Students read module 3 and Makridakis Book Chapter 3,4,5, Wei's book Chapter 3 and write a summary of the reading that has been read.
SA: Class participants work on practice questions in module 3, then submit them to SIKOLA | **Deterministic Model:**
Single Moving Average, Double Moving Average, Single Exponential Smoothing, Double Exponential Smoothing, Winter Method for additive seasonality, Winter Method for multiplicative seasonality, trend regression

Stationary Model:
Autoregressivemodel (AR), moving average (MA), Autoregressive moving averge (ARMA) | 8 |
| | | The completeness of explaining and describing the deterministic model with the Winter method for additive seasonality, the Winter method for multiplicative seasonality, trend regression and obtaining forecasts using these methods | **Assignment Form**:
1. 3rd Task (Individually): Deterministic Model and Stationary ARIMA Model

Instruction: The 3rd Task Question is available in SIKOLA section of Meeting Learning Flow IV | | | | |

5-6	Able to explain the stationary time series model and its application In solving problem	Accuracy in explaining stationary time series models, accuracy in describing the structure of covariance variance, autocorrelation, and accuracy in describing and interpreting ACF and PACF plots from AR and MA models	**Criteria**: Accuracy in 1. The concepts and methods used 2. Systematic s Writing 3. Geometry/ graph interpretation 4. Calculation	**Form**: Interactive Learning, Collaborative Learning **[FTF: 2x3x50]**	**SIKOLA (Module 4)** **SA + IL [(2+2)x(3x60")+** **IL:** Students read module 4 and Makridakis Book Chapter 3,4,5, Wei's book Chapter 3 and write a summary of the reading that has been read.	**Stationary Model:** **Autoregressivemodel (AR), moving average (MA), Autoregressive moving averge (ARMA)**	10

		Accuracy in explaining stationary time series models, accuracy in describing the structure of covariance variance, autocorrelation, and accuracy in describing and interpreting ACF and PACF plots from AR and ARMA models	(**Rubric available on SPP Meeting 5 and 6**) **Assignment Form**: 1. Quiz 1 **Instruction**: Quiz 1 is available on SIKOLA section of Meeting Learning Flow VI		**SA:** College participants work on practice questions in module 4, then submit it to SIKOLA	

7

| 7 | Able to explain the non-stationary time series model and its application in solving a problem | Accuracy in explaining stationary time series models and accuracy in describing the structure of covariance variance, autocorrelation, and accuracy in describing and interpreting ACF and PACF plots from ARI, IMA, and ARIMA models | **Criteria:** Accuracy in
1. The concepst and methods used
2. Systematics Writing
3. Geometry/ graph interpretation
4.   Perhitungan
(Rubric available on SPP Meeting 7)

Assessment Form:
1. 4th Task (Group): Stationary Time Series model

Instruction: The 4th Task Question is available in SIKOLA section of Meeting Learning Flow VII | **Form**: Interactive learning,
[FTF: 1x2x50],
Methods: Interactive learning, Small Group Discussion, Tutorial
 [FTF: 1x1x50] | **SIKOLA (Module 5)**
SA + IL *(1+1)x(3x60")+
IL: Students read module 5 and Wei Book Chapter 4 writes down a summary of each module before the lecture starts.
SA: Class participants work on the practice questions in module 5 in groups and are submitted to SIKOLA | **Nonstattonary Model:**
Non-stationary in mean, ARI model, IMA model, and ARIMA model, non-stationary in variance and autocovariance | 4 |

8	**Mid-Semester Evaluation through Middle Examination** **Semester : SubCLO 1 - SubCLO 5**	**Criteria:** Accuracy in 1. Concepts and Methods used 2. Systematics Writing 3. Geometry/graph interpretation 4. Calculation (**Rubric available on SPP Meeting 8**)				20
9-10	Able to obtain model parameter estimates with the moment method, least squares method, and maximum likelihood estimator in theory and its application to the data	The accuracy in estimating the parameters of stationary and non-stationary models using the moment method and the theoretical least squares method and their application to data using minitab, SAS, SPSS, or R software The accuracy in estimating the parameters of stationary models and non-stationary models with the maximum likelihood estimator method in theory and its application to data using minitab, SAS, SPSS, or R software	**Criteria:** Accuracy in 1. Concepts and methods used 2. Systematic s Writing 3. Geomtery/ graph interpretation Calculation (**Rubric available on SPP Meeting 9 & 10**) **Assessment Form:** 1. 5th Task (Individually): Estimated parameters for stationary models (AR, MA, and ARMA) and non-stationary models (ARI, IMA, and ARIMA) **Instruction**: Problem Task 5 is available in SIKOLA section of Meeting Learning Flow X	**Form**: Interactive learning **[FTF: 2x2x50]** Problem Based Learning **[FTF:2x1x50]**	**SIKOLA (Module 6)** **SA + IL [(2+2)x(3x60")+** Students read module 6 and Wei Chapter 7's book and write a summary of each module before lectures begin. **IL**: Class participants work on the practice questions in module 6 and independently and are submitted to SIKOLA	**Estimated Parameters:** moment method, least squares method, maximum likelihood estimator method	8

11-12	Students are able to analyze the rest of the model / diagnostic checking, choose the best model, and its application to the data	The accuracy in analyzing the rest of the model / diagnostic checking and the accuracy in interpreting the software output	**Criteria:** Accuracy in 1. Concepts and Methods used 2. Systematic s writing 3. Geometry/ graph interpretation 4. Calculation (**Rubric available on SPP Meeting 11 & 12**) **Assessment Form:** 1. 6th Task (Group): Diagnostic checking **Instruction**: Task 6 is available in SIKOLA, the Learning Flow of Meeting XII	**Form**: Interactive learning **[FTF: 2x2x50]** Problem Based Learning **[FTF:2x1x50]**	**SIKOLA (Module 7 and Task 6) SA+ IL [(2+2)x(3x60")+** Students read module 7, and Wei's book Chapter 7 and write a summary of each module before itkuliah dimulai. **IL:** Lecture participants work on the practice questions in module 7 in groups and are submitted to SIKOLA	*Diagnostic Checking*: **Parameter significance test, Model Fit Test, Overfitting, and Best Model Selection**	8
		Accuracy in overfitting and accuracy in choosing the best model					
13	Able to distinguish stationary and non-stationary time series forecasting models and their application to data	The completeness in describing the forecasting of stationary time series models and non-stationary time series models	**Criteria:** Accuracy in 1. Concepts and methods used 2. Systematic s Writing 3. Geometry/ graph interpretation 4. Calculation (**Rubric available on SPP Meeting 13**) **Assessment Form:** 1. 7th Task (Group):	**Bentuk**: Interactive learning **FTF: 1x2x50]** Problem Based Learning **[FTF:1x1x50]**	**SIKOLA (Module 8 and Task 7) SA + IL [(1+1)x(3x60")+** Students read module 8, and Wei Chapter 5's book and write a summary of each module before lectures begin. **IL:** Class participants work on the practice questions in module 8 in groups and are submitted to SIKOLA	*Forecasting*: **Estimating minimum mean square error, computation of forecasting, ARIMA forecasting, updating forecasts**	4

			Forecasting **Instruction**: The 7th Task Question is available in SIKOLA chapter XIII Meeting Learning Flow			
14-15	Able to explain seasonal stochastic models and their application in solving a problem	The completeness in explaining seasonal stochastic models (Seasonal ARIMA), completeness in determining Seasonal ARIMA models, and accuracy in predicting time series data using Seasonal ARIMA models	**Criteria:** Accuracy in 1. The concepts and methods used 2. Systematic s Writing 3. Geometry/ graph interpretation 4. Calculation **(Rubrics available on SPP Meeting 14 & 15)** **Assessment Form:** 1. Quiz 2 **Instruction**: Quiz 2 questions are available in SIKOLA section of Meeting Learning Flow XIV	**Form**: Interactive learning, Collaborative Learning **[FTF: 2x3x50]**	**SIKOLA (Module 9)** **SA + IL *(2+2)x(3x60")+** **IL:** Students read module 9 and Wei's book Chapter 8 and write a summary of what they read before class begins. **SA:** Class participants work on practice questions in module 9 then submit them to SIKOLA	**Seasonal ARIMA model:** **General concept,** **Regression Method,** **Moving Average Method,** **Seasonal ARIMA Model**	10
		The completeness in applying seasonal stochastic models (Seasonal ARIMA) to the data					
16	**Final Semester Evaluation through Final Examination** **Semester : : SubCLO 6 - SubCLO 9**		**Criteria:** Accuracy in 1. The concepts and methods used 2. Systematics Writing 3. Geometry/ graph interpretation 4. Calculation **(Rubric available on SPP Meeting 16)**				20