Course Introduction and Syllabus

Zhejiang University

Course code：2023113   **Course title：Time Series Analysis**

Credit：2   **Teaching hour per week：3.5 hours/week**

Target students： Master students

Instructor: Dr. Gao Zhaoxing   **Email: zhaoxing_gao@zju.edu.cn**

Prerequisites：R\ Probability \ Linear algebra \ Statistics

I. Course Introduction

There are two main goals of time series analysis. One is to identify the nature of the phenomenon represented by the sequence of observations, and the other is to forecast (predicting future values of the time series variables). This course introduces the students to the statistical analysis of time series data and some commonly used time series models. Topics covered will include what time series analysis can be useful for; autocorrelation; stationarity, trend removal, and seasonal adjustment, basic time series models including AR, MA, and ARMA; invertibility; estimation; forecasting; introduction to financial time series and the GARCH models; unit root processes; multivariate models; and their applications. This course emphasizes on covering the main ideas and the most popular and widely used methods, and the use of a computer to practice the methods; it will help students bridge the gap between theory and practice.

II. Teaching Objectives

i. Learning Objectives

By the conclusion of the course of study, students are expected to:

1) be capable of selecting, carrying out and interpreting appropriate statistical methods for describing and analyzing time series data

2) have an appreciation of a range of methods for analyzing time series data and their use and limitations in a research context;

3) be able to examine critically their own and other researchers' use of methods of analysis for time series data.

ii. Measurable Learning Outcomes

Expected learning outcomes for students include:

1) Utilize basic time series data analysis models and analyze applications in finance and economics.

2) Utilize programming to build and implement time series models to real data

III. Course Requirements

i. Teaching Methods and Requirements

1) Every week students must attend one 3.5-hour lecture.

2) **Lectures** will be given to present the key conceptual material through discussion and interaction between lecturer and students. Lectures are supported by readings, class discussions and illustrations of real-world case examples.

3) **Guest speaker** may be invited to give lectures/seminars on specific issues related to the social media marketing or digital platform industries to enhance students' understanding of the theories presented in lecture.

4) **Course Calendar** The course calendar (as presented below) details scheduling information. Note that this calendar may change as the course proceeds. Any changes will be announced.

Students are expected to prepare for and attend all classes to gain full benefit from the course

ii. Course Evaluation and Grading

All material presented is examinable (except where stated otherwise) by assignments and the final examination. All important assessment information such as due dates and times, content, guidelines and so on will be discussed at lectures. Students are responsible for ensuring that they are aware of

this information, keeping track of their own progress, and catching up on any missed classes. Homework will be assigned on a biweekly basis (beginning of the week, Monday, if suitable) via email or archived on coursesite at http://course.zju.edu.cn/. Homework will be collected on the Monday (in class) after the next week and spot grading will be applied. You may discuss homework problems with your peer classmates or consult the instructor, but you should write the solutions on your own without copying. Late paper would not be accepted, unless a document-proven emergency occur. Early submission of HW paper could be arranged. Your final grade will be determined on the following basis:

Assessment	% of final grade
Homework	50%
Final Exam (Project)	50%

Extensions can only be given by your lecturer and only in special circumstances such as:
- Illness: a medical certificate is required
- family emergency
- representative activities (sport, cultural, academic etc.)

Verification of circumstances is required to validate extensions.

Computer problems are not deemed to warrant extensions, except in the situation of Zhejiang University's computer system failure. Students should ensure they allow sufficient time to overcome these problems before the assignment is due. **Students are expected to keep hard copies, draft and backup files of work done.** These can then be used in cases of computer failure, plagiarism, and in other circumstances as required. **Full academic workloads and work commitments are not deemed to warrant extensions**, as students are aware of requirements at the beginning of semester as featured in syllabus.

IV. Teaching Schedule

Lecture	Topic
1	Introduction to time series data, stationarity and autocorrelation
2	Estimation of autocovariance and autocorrelation coefficient of linear process
3	Some properties of the ARMA model
4	Linear prediction and partial autocorrelation coefficient

5	The estimation method of the <u>ARMA</u> model
6	Time series data modeling procedure
7	Non-stationary time series and seasonal time series
8	Financial data modeling, introduction to <u>GARCH</u> model

V. References and Recommended Readings

1. Robert H. Shumway, and David S. Stoffer. Time Series Analysis and Its Applications: With R Examples. 4th edition. New York: Springer, 2017

2. Montgomery, Douglas C., Cheryl L. Jennings, and Murat Kulahci. Introduction to time series analysis and forecasting. John Wiley & Sons, 2015.

3. Chatfield Chris. The Analysis of Time Series: An Introduction, Sixth Edition. Chapman & Hall/CRC, 2003