浙江大學

MATH909

Time Series Analysis and Forecasting

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Instructor Contact Details

Lecturer-in-charge: Ye ZHOU

Email: wlwyxy_29@zju.edu.cn
Office location: Huajiachi Campus, Zhejiang University, Hangzhou, China
Consultation Time: Book appointment by sending email to: wlwyxy_29@zju.edu.cn

Teaching Times, Modes and Locations

Course Duration: 11 Jan 2026 to 30 Jan 2026
Modes: Face-to-face
Location: Huajiachi Campus, Zhejiang University via face-to-face

Academic Level

Postgraduate

Credit Points:

The course is worth 6 units of credit point.

Credit Hours

The number of credit hours of this course equals to the credits of a standard semester- long course.

Contact Hours

The course contains a total of 53 contact hours, which consists of orientation, lectures, seminars, quiz, discussion, research, case study, small tests, assignments, on-site field trip(s), in-class and after-class activities, revision, self-study, and final exam. Students will receive an official transcript which is issued by Zhejiang University when completing this course.

Enrolment Requirements

Eligibility requires enrollment in an overseas university as an undergraduate or postgraduate student, proficiency in English, and pre-approval from the student's home institution.

Course Description:

This unit provides a rigorous and application-driven exploration of time series analysis at the postgraduate level. It equips students with both theoretical understanding and practical tools to analyze temporal data with serial dependence. Core topics include stationarity, autocorrelation structures, ARIMA and SARIMA models, spectral analysis, long-memory processes, and volatility modelling using ARCH/GARCH frameworks. The course also introduces vector autoregressive (VAR) and state-space models, with an emphasis on estimation, diagnostic techniques, and forecasting. Applications are drawn from fields such as finance, economics, engineering, and environmental sciences. By the end of this unit, students will be prepared to apply time series methods to complex real-world problems and undertake further research or professional work in data-intensive domains.

Prerequisite:

N/A

Learning Resources

- R.S. Tsay, Analysis of Financial Time Series, 3rd Edition, John Wiley & Sons, 2010.
- C. Chatfield and H. Xing, The Analysis of Time Series: An Introduction with R, 7th Edition, Chapman and Hall/CRC, 2019.

Learning Objectives

By the end of this course, you should be able to:

- Identify and decompose time series data, including the detection and removal of trends, seasonality, and other components to prepare data for modeling.
- Understand and model stationary and nonstationary time series, including ARIMA, SARIMA, and integrated models, using sample autocorrelations, partial autocorrelations, and related probabilistic concepts.
- Estimate and fit time series models using methods such as Method of Moments (MM) and Maximum Likelihood Estimation (MLE) and conduct hypothesis testing and diagnostic checks.
- Develop and evaluate forecasts based on time series models, particularly ARIMA-type models, using appropriate statistical techniques and performance measures.
- Apply spectral analysis techniques, including periodograms and consistent spectral estimation, to understand time series in the frequency domain.
- Model financial and multivariate time series, including volatility models such

as GARCH and vector autoregressive models, and apply these techniques to real-world data.

Course Delivery:

- Face-to-face Lecture mode includes lectures, seminars, quiz, discussion, research, case study, small tests, assignments, on-site field trip(s), in-class and after-class activities, revision, and final exam.

The following course will be taught in English. There will also be guest speakers and optional field trips available for students who would like to enhance their learning experience. All courses and other sessions will be run during weekdays.

Topics and Course Schedule:

WK	Topic	Activities
1	Introduction to time series data, its components, and basic R programming for time series analysis.	Lecture; Tutorial
1	Understanding stationarity, autocorrelation (ACF), and partial autocorrelation (PACF) with practical interpretation.	Lecture; Tutorial
1	Modeling with AR and MA processes, including properties, invertibility, and stationarity.	Lecture; Tutorial
1	Development and identification of ARMA and ARIMA models for nonstationary time series.	Lecture; Tutorial
1	Estimation of ARIMA models using MM and MLE methods, and diagnostic checking including AIC and residual analysis.	Lecture; Tutorial
2	Forecasting with ARIMA models, minimum mean square error forecasting, and forecast evaluation.	Lecture; Tutorial
2	In-class Test	Closed book
2	Introduction to spectral analysis and interpretation of spectral density functions of time series.	Lecture; Tutorial
2	Estimation of spectral density using periodograms and smoothed spectral estimators.	Lecture; Tutorial
2	Modeling long memory processes using fractional differencing and ARFIMA models.	Lecture; Tutorial
3	Exploration of generalized fractional processes including Gegenbauer models and parameter estimation.	Lecture; Tutorial
3	Modeling volatility in financial time series using ARCH, GARCH, and stochastic volatility models.	Lecture; Tutorial

3	Introduction to vector time series models including VAR and vector ARIMA, with estimation techniques.	Lecture; Tutorial
3	State-space models and filtering techniques, including Quasi Maximum Likelihood Estimation (QMLE).	Lecture; Tutorial
3	Revision	Tutorial
	Final exam	Closed book

Assessments:

Class participation	15%
In-class Test	15%
Assignments	20%
Final exam	50%

Grade Descriptors:

HD	High Distinction	85-100
D	Distinction	75-84
Cr	Credit	65-74
P	Pass	50-64
F	Fail	0-49

High Distinction 85-100

- Treatment of material evidences an advanced synthesis of ideas Demonstration of initiative, complex understanding, and analysis.
- Work is well-written and stylistically sophisticated, including appropriate referencing, clarity, and some creativity where appropriate.
- All criteria addressed to a high level.

Distinction 75-84

- Treatment of material evidences an advanced understanding of ideas Demonstration of initiative, complex understanding and analysis Work is well-written and stylistically strong.
- All criteria addressed strongly.

Credit 65-74

- Treatment of material displays a good understanding of ideas
- Work is well-written and stylistically sound, with a minimum of syntactical errors.
- All criteria addressed clearly.

Pass 50-64

- Treatment of material indicates a satisfactory understanding of ideas Work is adequately written, with some syntactical errors.
- Most criteria addressed adequately.

Fail 0-49

- Treatment of ideas indicates an inadequate understanding of ideas Written style inappropriate to task, major problems with expression.
- Most criteria not clearly or adequately addressed.

Academic Integrity

Students are expected to uphold the university's academic honesty principles which are an integral part of the university's core values and principles. If a student fails to observe the acceptable standards of academic honesty, they could attract penalties and even disqualification from the course in more serious circumstances. Students are responsible for knowing and observing accepted principles of research, writing and any other task which they are required to complete.

Academic dishonesty or cheating includes acts of plagiarism, misrepresentation, fabrication, failure to reference materials used properly and forgery. These may include, but are not limited to: claiming the work of others as your own, deliberately applying false and inaccurate information, copying the work of others in part or whole, allowing others in the course to copy your work in part or whole, failing to appropriately acknowledge the work of other scholars/authors through acceptable referencing standards, purchasing papers or writing papers for other students and submitting the same paper twice for the same subject.

This Academic Integrity policy applies to all students of the Zhejiang University in all programs of study, including non-graduating students. It is to reinforce the University's commitment to maintain integrity and honesty in all academic activities of the University community.

Policy

The foundation of good academic work is honesty. Maintaining academic integrity upholds the standards of the University. The responsibility for maintaining integrity in all the activities of the academic community lies with the students as well as the faculty and the University. Everyone in this community must work together to ensure that the values of truth, trust and justice are upheld.

Academic dishonesty affects the University's reputation and devalues the degrees offered. The University will impose serious penalties on students who are found to have violated this policy. The following penalties may be imposed:

- ✓ Expulsion
- ✓ Suspension
- ✓ Zero mark /fail grade
- ✓ Marking down
- ✓ Re-doing/re-submitting of assignments or reports, and
- ✓ Verbal or written warning.