MATH 3890 FOUNDATIONS OF TIME SERIES ANALYSIS (3 credit hours)

Elmira College

SPRING 2025

Required Text:

1. Ruey S. Tsay(2010). ***Analysis of Financial Time Series***(3rd ed.). Wiley-Blackwell.
2. George E. P. Box(2015). ***Time Series Analysis: Forecasting and Control***(5th ed.). Wiley-Blackwell.
3. Peter J. Brockwell and Richard A. Davis(2008). ***Introduction to Time Series Analysis and Forecasting***(2nd ed.). Springer.

Supplemental readings might be included to illustrate or expand on textbook readings.

Pre-requisites: MATH 2423 Probability; MATH 3010 Regression Analysis

Course Description

This course is designed to provide students with a comprehensive understanding of time series data and the fundamental techniques and methods used to analyze and model such data. Time series data is prevalent in various fields, including economics, finance, environmental science, engineering, and more. This course will equip students with the knowledge and skills to make informed decisions, predictions, and forecasts based on time-dependent data.

Course Objectives and Goals

- Gain a deep understanding of time series data, including its characteristics, components, and various applications in fields such as finance, economics, environmental science, and more;
- Study basic statistical models for time series analysis, including autoregressive (AR), moving average (MA), and autoregressive integrated moving average (ARIMA) models;
- Develop skills in time series forecasting, including selecting appropriate models, model diagnostics, and assessing forecast accuracy;
- Explore techniques to visualize and summarize time series data to uncover patterns and gain insights;
- Be able to discuss practical applications of time series analysis in fields like finance, economics, and environmental science.

Evaluation of Performance

Your grade will be based upon your performance on exams, assignments, and participation.

4 Assignments	20%
3 Projects	30%
Midterm Exam	25%

Final Exam	25%
Total	100%

Grades will be assigned as follows:

A	93% and above	B-	80 - 82%	D+	67 - 69%
A-	90 - 92%	C+	77 - 79%	D	63 - 66%
B+	87 - 89%	C	73 - 76%	D-	60 - 62%
B	83 - 86%	C-	70 - 72%	F	59% or below

Withdrawal Policy: Please see Elmira College Bulletin for information on this policy.

Academic Honesty: Please read the section on Academic Honesty in the **Code of Conduct**. Briefly, academic dishonesty includes: cheating, fabrication, facilitating academic dishonesty, and plagiarism. Ask if you have any questions on whether something constitutes as academic dishonesty. All work must be original and new. Past assignments from current or other courses will not be accepted. Academic dishonesty will not be tolerated. It will result in zero on the assignment, and a report will be filed with the school. Continued practice will result in failure of the class. Institutional penalties may also apply with repeated acts of academic honesty.

Student Responsibility:

- It is your responsibility to keep track of assignments and due dates.
- You should ask questions concerning assignments and lectures, if you need any clarifications.
- If you are struggling in class, have concerns, and/or unsure about expectations, please stop by during office hours or make an appointment for another time.

Tentative Schedule of Topics

Topic	Materials	Tasks & Evaluations
Financial Time Series and Their Characteristics	Chapter 1	
The Nature and Uses of Forecasts	Chapter 2	
Numerical Description of Time Series Data	Chapter 3	Assignment 1
Use of Data Transformations and Adjustments	Chapter 4	
Simple ARMA Models	Chapter 5	
Autoregressive and Moving Average Processes	Chapter 6	Assignment 2
Mixed Autoregressive – Moving Average Processes	Chapter 7	
Unit-Root Nonstationarity	Chapter 8	Project 1
Trend-Stationary Time Series	Chapter 9	
General Unit-Root Nonstationary Models	Chapter 10	
State-Space Model Representation for the ARIMA Process	Chapter 11	Midterm Exam
Least Squares Estimation in Linear Regression Models.	Chapter 12	
Regression Models With Time Series Error Terms	Chapter 13	Project 2
Lagged regression	Chapter 14	
Quantile Regression	Chapter 15	
Specification of the Deterministic Function	Chapter 16	Assignment 3
Deterministic and Statistical Time Series	Chapter 17	

Random Coefficient Autoregressive Models	Chapter 18	
Functional Coefficient AR Model	Chapter 19	
High-Frequency Data Analysis and Market Microstructure	Chapter 20	Assignment 4
Empirical Characteristics of Transactions Data	Chapter 21	
Multivariate Time Series Models and Forecasting	Chapter 22	Project 3
Neural Networks and Forecasting	Chapter 23	Final Exam