**Course Title: Applied Time Series Analysis for Stock Market**

**Course Description: This course will teach students how to use time series analysis techniques to analyze and forecast stock market data. Through a combination of theory and hands-on coding assignments, students will gain practical skills to make informed investment decisions and develop trading strategies.**

**Prerequisites:**

* **Basic knowledge of statistics**
* **Familiarity with Python programming**
* **Understanding of financial markets and terminology**

**Course Duration: 10 weeks (30 hours)**

**Instructor: [Dr. Hung Tran]**

**Week 1: Introduction to Time Series Analysis**

* **Overview of time series data**
* **Components of time series: trend, seasonality, and noise**
* **Time series decomposition**
* **Basic concepts in time series modeling**
* **Python and Pandas for time series data**

**Assignment: Python code to load and visualize stock price data using Pandas.**

**Week 2: Exploratory Data Analysis (EDA) for Stock Data**

* **Data visualization techniques**
* **Identifying trends and seasonality**
* **Autocorrelation and partial autocorrelation functions**
* **Stationarity and non-stationarity in time series data**

**Assignment: Calculate and plot autocorrelation and partial autocorrelation functions for a given stock.**

**Week 3: Time Series Decomposition and Smoothing**

* **Decomposition methods: additive and multiplicative**
* **Moving averages: simple, exponential, and weighted**
* **Exponential smoothing techniques in Python**

**Assignment: Implement exponential smoothing on stock data and compare results with moving averages.**

**Week 4: Introduction to ARIMA Models**

* **Autoregressive (AR) models**
* **Moving average (MA) models**
* **Combining AR and MA into ARIMA**
* **Model identification and order selection in Python**

**Assignment: Fit an ARIMA model to stock data and evaluate its performance.**

**Week 5: Model Estimation and Diagnostic Checking**

* **Parameter estimation using maximum likelihood**
* **Model diagnostics: ACF and PACF plots**
* **Residual analysis and model adequacy checks**
* **Model selection strategies in Python**

**Assignment: Perform diagnostic checks on the ARIMA model and select the best model using Python.**

**Week 6: Seasonal ARIMA (SARIMA) Models**

* **Introduction to seasonal time series modeling**
* **Seasonal decomposition of time series**
* **Building SARIMA models**
* **Forecasting with SARIMA models in Python**

**Assignment: Implement SARIMA modeling on stock data and make future price forecasts.**

**Week 7: GARCH Models for Volatility Analysis**

* **Understanding volatility in financial time series**
* **Introduction to GARCH models**
* **Estimating and interpreting GARCH models**
* **Volatility forecasting with GARCH in Python**

**Assignment: Estimate and use GARCH models to forecast stock price volatility.**

**Week 8: Cointegration and Error Correction Models**

* **Cointegration and its significance in finance**
* **Engle-Granger two-step cointegration test**
* **Vector Error Correction Models (VECM) in Python**
* **Trading strategies using cointegrated stocks**

**Assignment: Identify cointegrated stock pairs and develop a trading strategy using VECM in Python.**

**Week 9: Advanced Topics in Time Series Analysis**

* **Long Short-Term Memory (LSTM) networks for stock price prediction**
* **Handling high-frequency data**
* **Integration with financial APIs for real-time analysis**

**Assignment: Implement an LSTM model for stock price prediction and create a real-time stock price monitoring system using an API.**

**Week 10: Final Projects and Applications**

* **Students work on real-world stock market analysis projects**
* **Presentation of projects and findings**
* **Discussion of practical applications and insights**
* **Course review and recap**

**Assessment:**

* **Weekly coding assignments (40%)**
* **Mid-term project (20%)**
* **Final project and presentation (30%)**
* **Class participation and attendance (10%)**

**Recommended Textbooks:**

* **"Python for Data Analysis" by Wes McKinney**
* **"Time Series Analysis and Its Applications" by Robert H. Shumway and David S. Stoffer**
* **"Introduction to the Mathematics of Finance" by Steven Roman**

**Note: Students should have access to Python and libraries like Pandas, NumPy, Matplotlib, and Statsmodels for completing the coding assignments. The syllabus and course content may be subject to adjustments based on class needs and emerging trends in time series analysis and finance.**

**PHÂN TÍCH DỮ LIỆU TIME SERIES**

1- Download dữ liệu time series của 10 mã chứng khoán của US:

1- AAPL

2- MSFT

3- AMD

4- NVDA

5- TSM

6- INTEL

7- GOOG

8- HP

9- META

10- TSLA

Có thể tự động cập nhật dữ liệu theo chu kỳ thời gian/ngày.

2- Vẽ đồ thị nến Nhật, và các đường chỉ RSI, MACD, Bollinger Band, và Stochastic RSI cho mỗi mã chứng khoán và hiển thị kết quả.

3- Rút ra một số kết luận liên quan dựa trên việc phân tích dữ liệu

Tài liệu tham khảo:

1- <https://finance.yahoo.com/>

2- ChatGPT.com

3- Ngôn ngữ lập trình Python

4- CSDL: MySQL