21AIE461	Financial Time Series Analysis	L-T-P-C: 2-0-3-3

Course Objectives

- This course will cover the tools and techniques required to analyse financial data
- The course will focus on the linear time series analysis, nonlinear time series analysis, ML/DL methods for predictive analytics and the state of the art data decomposition techniques such Variational Mode Decomposition, Dynamic Mode Decomposition etc.
- The course will also focus on generating models from non-stationary and stationary data generated in financial markets.

Course Outcomes

After completing this course, students will be able

CO1: Analyse the stock data by employing tools from linear and nonlinear time series analysis

CO2: Apply different decomposition techniques such as DMD & VMD to explore the dynamics of financial markets

CO3: Implement ML/DL models to perform predictive analytics on financial data

CO4: Generate data driven models from financial data

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	3	-	-	-	-	-	2	2	2	2	2	2
CO2	2	3	2	3	-	-	-	-	1	2	2	2	2	2	2
CO3	2	3	3	3	2	-	-	-	1	2	2	2	3	2	2
CO4	2	3	3	3	2	-	-	-	2	2	2	2	3	2	3

Syllabus

Introduction – Review of basic statistics – Stationarity – Ergodicity – Autocorrelation – Partial Autocorrelation – Linear Models – Autoregressive Models – Moving Average Models – ARMA – ARIMA – SARIMA – VAR – Conditional Heteroscedastic Models – ARCH Model – GARCH Model – Nonlinear Models – Tests for Stationarity – Tests for nonlinearity – State Space Models – Machine Learning Models – Deep Learning Models – Variational Mode Decomposition – Dynamic Mode Decomposition – Complex Network Analysis – Precursors for Catastrophic Transitions in Financial Markets.

Text Books / References

Jonathan D Cryer & Kung Silk Chan, Time Series Analysis With Applications in R, Second Edition, Springer, 2008

Robert H Shumway & David S Stoffer, Time Series Analysis and Its Applications with R examples, Third Edition, Springer,2011

G E P Box, G M Jenkins, G C Reinsel, G M Ljung, Time Series Analysis: Forecasting and Control, fifth edition, Wiley, 2016

Ruey S Tsay, Analysis of Financial Time Series, Wiley, 2002

Aileen Nielsen, Practical Time Series Analysis Prediction with Statistics and Machine Learning, O'Reilly, first edition, 2019

Walter Enders, Applied Economic Time Series, fourth edition, Wiley, 2014

J. Nathan Kutz, Steven L Brunton, B W Brunton, J L Proctor, Dynamic Mode Decomposition : Data Driven Modelling of Complex Systems, SIAM, 2016

S L Brunton & J N Kutz, Data-Driven Science and Engineering: Machine Learning, Dynamical Systems and Control, Cambridge University Press, 2019

Evaluation Pattern

Assessment	Weightage (%)
Internal (Minimum 10 assessments)	70
Project (External Component)	30