



FORMAT FOR COURSE CURRICULUM

Course Title: Time Series Analysis for AI

Course Level: UG

Credit Units: 4

Course Code:

| L | T | P/S | SW/FW | No. of PSDA | TOTAL CREDIT UNITS |
|---|---|-----|-------|-------------|--------------------|
| 3 | 0 | 2 | 0 | - | 4 |

Course Objectives: The objective of this course is to familiarize the students with the various models used for performing Time Series analysis and their application in different areas. Time series analysis for Machine Learning and Deep Learning applications will help them build a model and evaluate its efficiency. The students will be able to understand and work on Model building and forecasting.

Pre-requisites: Statistics and Probability, Python Programming

Course Contents/Syllabus:

| | Weightage (%) |
|--|---------------|
| Module I : Time Series: An Introduction | |
| History of Time series in Diverse Applications, Origin of Statistical Time Series Analysis, Origin of Machine Learning Time Series Analysis, Finding and Wrangling Time Series Data, Where to find Time Series Data, Retrofitting a Time Series Data Collection from a Collection of Tables, Data Cleaning | 20% |
| Module II : Exploratory Data Analysis for Time Series | |
| Familiar Methods-Plotting, Histograms and Scatter Plots, Specific Exploratory Methods- Understanding Stationarity, Window Functions, Self correlation, Spurious correlations, Visualizations- 1D, 2D and 3D, Simulating Time Series Data, Storing Data- defining requirements of Live vs Stored Data, Database Solutions vs File Solutions | 20% |
| Module III : Statistical & State Space Models for Time Series | |
| Autoregressive Models, Moving Average Models, Autoregressive Integrated Moving Average Models, Vector Autoregression, State Space Models-Plusses and Minuses, Kalman Filter, Hidden Markov Model, Bayesian Structural Time Series | 20% |
| Module IV : Machine Learning & Deep Learning for Time Series | |
| Time Series Classification-Selecting and Generating Features, Decision Tree Methods, Clustering- Generating Features from the Data, Temporally Aware Distance Metrics, Clustering Code, Deep Learning Concepts-Programming Neural network, Feed Forward Networks- CNN and RNN | 25% |
| Module V : Performance Measurement and Applications of Time series Models | |
| Measuring Error- How to Test Forecasts, Applications of Time Series in Healthcare, Financial Applications, | 15% |

Course Learning Outcomes:**At the end of this course the students should be able to:**

1. Understand statistical theory and able to handle data in time series methods.
2. Perform exploratory data analysis for time series applications.
3. Apply knowledge of the statistical and state space models.
4. Apply Time series model to classification, clustering and neural network based problems.
5. Identify the limitations and possible sources of errors in the analysis

Pedagogy for Course Delivery: Lectures, e-Content using 4 Quadrant approach

Lab/ Practicals details, if applicable:**List of Experiments:**

- Introduction to Loading and Handling of Time Series in Pandas.
- Write a code for checking the cycle of time Series data and plot the raw data.
- Write a code for finding mean and variance of a stationary time series.
- Write a code for checking the stationarity of a Time Series.
- Write a code for estimating trend and seasonality in a time series.
- Write a code for estimating rolling mean and rolling standard deviation of a time series
- Write a code to develop a forecasting model using auto regressive integrated moving average method.

Assessment/ Examination Scheme:

| Theory L/T (%) | Lab/Practical/Studio (%) |
|----------------|--------------------------|
| 75 | 25 |

Theory Assessment (L&T):

| Continuous Assessment/Internal Assessment 40% | | | | | End Term Examination 60% |
|---|------------|------------|----|------|--------------------------|
| Components (Drop down) | Attendance | Class Test | HA | Quiz | EE |
| Weightage (%) | 5 | 15 | 10 | 10 | 60 |

Lab/ Practical/ Studio Assessment:

| Continuous Assessment/Internal Assessment 40% | | | | | End Term Examination 60% | |
|---|-------------|------------|------|------------|--------------------------|------|
| Components (Drop down) | Performance | Lab Record | Viva | Attendance | Practical | viva |
| Weightage (%) | 15 | 10 | 10 | 5 | 30 | 30 |

Text Reading:

- Practical Time Series Analysis: Prediction with Statistics and Machine Learning, Aileen Neilsen
- G. J. Janacek, Practical Time Series, Arnolds Texts in Statistics, 2001.
- Terence C. Mills, Applied Time Series Analysis: A Practical Guide to Modeling and Forecasting, 1st Edition, Academic Press, 2019, ISBN-13: 978-0128131176

References:

- Christopher Chatfield, The Analysis of Time Series: An Introduction, Chapman and Hall, 1984.
- Peter Diggle, Time Series: A Biostatistical Introduction, Oxford University Press, 1990.