

| Subject Code | Subject Name (Lab oriented Theory Courses) | Category | L | T | P | C |
|--------------|--|----------|---|---|---|---|
| AI19642      | TIME SERIES ANALYSIS AND FORECASTING       | PC       | 3 | 0 | 2 | 4 |

| Objectives: |  |  |  |  |  |  |
|-------------|--|--|--|--|--|--|
| ●           | To understand the basic concepts of time series analysis.  |  |  |  |  |  |
| ●           | To familiarize the basic statistical methods to modeling, analyzing, and forecasting time series data. |  |  |  |  |  |
| ●           | To learn the application of regression models for forecasting.   |  |  |  |  |  |
| ●           | To explore Autoregressive Integrated Moving Average (ARIMA) Models.                                    |  |  |  |  |  |
| ●           | To introduce multivariate time series and forecasting models.  |  |  |  |  |  |

| UNIT-I  | INTRODUCTION OF TIMESERIES ANALYSIS                     | 9                                |
|---|---|----------------------------------|
| Time Series and Forecasting -Different types of data-Internal structures of time series-Models for time series analysis- Autocorrelation and Partial Autocorrelation-Examples of Time series- Nature and uses of forecasting-Forecasting Process-Data for forecasting –Resources for forecasting.(T2-CHAPTER NO:1, T1-CHAPTER NO 1) |   |                                  |
| UNIT-II   | STATISTICS BACKGROUND FOR FORECASTING                   | 9                                |
| Graphical Displays-Time Series Plots - Plotting Smoothed Data - Numerical Description of Time Series Data - Use of Data Transformations and Adjustments- General Approach to Time Series Modelling and Forecasting- Evaluating and Monitoring Forecasting Model Performance. (T1- CHAPTER NO:2)                                     |   |                                  |
| UNIT-III  | REGRESSION ANALYSIS AND FORECASTING                     | 9                                |
| Introduction - Least Squares Estimation in Linear Regression Models - Statistical Inference in Linear Regression- Prediction of New Observations - Model Adequacy Checking -Variable Selection Methods in Regression - Generalized and Weighted Least Squares- Regression Models for General Time Series Data. (T1- CHAPTER NO:2)   |   |                                  |
| UNIT-IV   | AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) MODELS | 9                                |
| Linear models for stationary time series - Finite order moving average processes - Finite order autoregressive processes -Mixed autoregressive–moving average Processes – Non stationary processes - Time series model building forecasting ARIMA processes - Seasonal processes. (T1- CHAPTER NO:5)                                |   |                                  |
| UNIT-V  | MULTIVARIATE TIME SERIES MODELS AND FORECASTING METHODS | 9                                |
| Multivariate Time Series Models and Forecasting - Multivariate Stationary Process- Vector ARIMA Models - Vector AR (VAR) Models - Neural Networks and Forecasting -Spectral Analysis – Bayesian Methods in Forecasting. (T1- CHAPTER NO:7)  |   |                                  |
|   |   | <b>Contact Hours</b> : <b>45</b> |

| List of Experiments |   |                            |             |
|---------------------|---|----------------------------|-------------|
| 1.                  | Implement programs for time series data cleaning, loading and handling times series data and pre-processing techniques. |                            |             |
| 2.                  | Implement programs for visualizing time series data.  |                            |             |
| 3.                  | Implement programs to check stationary of a time series data.   |                            |             |
| 4.                  | Implement programs for estimating & eliminating trend in time series data- aggregation, smoothing.                      |                            |             |
| 5.                  | Develop a linear regression model for forecasting time series data.   |                            |             |
| 6.                  | Implement program to apply moving average smoothing for data preparation and time series forecasting.                   |                            |             |
| 7.                  | Implement program for decomposing time series data into trend and seasonality.  |                            |             |
| 8.                  | Create an ARIMA model for time series forecasting.  |                            |             |
| 9.                  | Develop neural network-based time series forecasting model.   |                            |             |
| 10.                 | Develop vector auto regression model for multivariate time series data forecasting.                                     |                            |             |
|                     |   | <b>Contact Hours</b>       | : <b>30</b> |
|                     |   | <b>Total Contact Hours</b> | : <b>75</b> |

| Course Outcomes:  |   |
|---|---|
| On completion of the course, the students will be able to |   |
| ●   | Explain the basic concepts in time series analysis and forecasting.           |
| ●   | Apply various time series models for forecasting.                             |
| ●   | Analyze various time series regression models.                                |
| ●   | Distinguish the ARIMA modelling of stationary and non stationary time series. |
| ●   | Compare with multivariate times series and other methods of applications.     |

| <b>Text Books:</b> |  |
|--------------------|--|
| 1                  | Introduction To Time Series Analysis and Forecasting, 2nd Edition, Wiley Series in Probability and Statistics, By Douglas C. Montgomery, Cheryl L. Jen (2015). |
| 2                  | Master Time Series Data Processing, Visualization, And Modeling Using Python Dr. Avishek PalDr. Pks Prakash (2017) .   |

| <b>Reference Books:</b> |  |
|-------------------------|--|
| 1                       | Time Series Analysis and Forecasting by Example Soren Bisgaard Murat Kulahci Technical University of Denmark Copyright c2011 By John Wiley & Sons, Inc.                        |
| 2                       | Peter J. Brockwell Richard A. Davis Introduction to Time Series and Forecasting Third Edition. (2016).   |
| 3                       | Multivariate Time Series Analysis and Applications William W.S. Wei Department of Statistical Science Temple University, Philadelphia, PA, SA 2019 John Wiley & Sons Ltd 2019. |
| 4                       | Time Series Analysis and Forecasting by Example Soren Bisgaard Murat Kulahci Technical University Of Denmark Copyright c 2011 By John Wiley & Sons, Inc.                       |

**Web link:**

1. <https://b-ok.cc/book/3413340/2eb247>
2. <https://b-ok.cc/book/2542456/2fa941>
3. <https://b-ok.cc/book/1183901/9be7ed>
4. <https://www.coursera.org/learn/practical-time-series-analysis>

**CO - PO – PSO matrices of course**

| PO/PSO           | PO | PO  | PO  | PO | PO  | PO | PO | PO | PO | PO | PO | PO | PO | PSO | PSO | PSO |
|------------------|----|-----|-----|----|-----|----|----|----|----|----|----|----|----|-----|-----|-----|
| CO               | 1  | 2   | 3   | 4  | 5   | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 1  | 2   | 3   |     |
| <b>AI19642.1</b> | 2  | 1   | 1   | 1  | 2   | -  | -  | -  | -  | -  | -  | 2  | 3  | 3   | 2   |     |
| <b>AI19642.2</b> | 2  | 2   | 1   | 1  | 2   | -  | -  | -  | -  | -  | -  | 2  | 3  | 3   | 2   |     |
| <b>AI19642.3</b> | 2  | 2   | 3   | 1  | 3   | -  | -  | -  | 1  | -  | 1  | 2  | 3  | 3   | 2   |     |
| <b>AI19642.4</b> | 2  | 2   | 3   | 1  | 3   | -  | -  | -  | 1  | -  | 1  | 2  | 3  | 3   | 2   |     |
| <b>AI19642.5</b> | 2  | 2   | 3   | 1  | 3   | -  | -  | -  | 1  | -  | 1  | 2  | 3  | 3   | 2   |     |
| Average          | 2  | 1.8 | 2.2 | 1  | 2.6 | -  | -  | -  | 1  | -  | 1  | 2  | 3  | 3   | 2   |     |

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: “-”