The LNMIIT, Jaipur Department of Electronics and Communication Engineering Applied Time Series Data Analysis (ECE-3132)	LNMIIT The LNM Institute of Information Technology

Program: B. Tech. (ECE)	Course Title: Time Series Data Analysis (TSDA)			Course Code: ECE- 3132
Type of Course: Program Elective	Prerequisites: M1, M2, Python/R			Total Contact Hours: 40
Year/Semester: 4/odd	Lecture Hrs/Week: 3	Tutorial Hrs/Week: 0	Practical Hrs/Week: 1	Credits: 3

Learning Objective:

Electronic devices generate the data with time stamp with the help of sensor and computational devices. The order of collection of data plays important role in analysis and forecasting of information. This course will introduce current approaches in time series data analysis with examples, hands-on and discussions. This course will also cover topics related to time series regression, exploratory data analysis, various models and operators in this domain.

Course outcomes (COs):

On completion of this course, the students will have the ability to:		Bloom's Level
CO-1	To **define**, **explain** and **examine** time series components with examples.	**2**
CO-2	To **recognize** and **evaluate**, principles and applications of various methods in time series analysis	**4**
CO-3	To **examine** and **demonstrate** various outcomes of the model based analysis	**3**
CO-4	To **recognize** and **Implement** time domain models and multi-process models for data analysis	**4**
CO-5	To **recognize** and **Implement** the Machine learning and neural network-based approach for time series analysis	**1**
CO-6	To **define**, **recognize** and **implement** forecasting techniques on various models.	**3**

Topics	Lecture Hours	
UNIT – I (Introduction)		6
1.1 Introduction, Motivation and Overview	2	
1.2 , Forecast, planning and Case Studies	2	
1.3 Time Series Patterns	2	
UNIT – II (Time Domain Models)		10
2.1 Autoregression Structure	2	
2.2 Autocorrelation Structure	2	
2.3 Partial Autocorrelation	1	
2.4 Estimation in AR models	1	
2.5 Auto-Regressive Moving Average models	2	
2.6 Forecasting ARMA Processes	2	

UNIT - III (Frequency Domain Models)		10
3.1 One –component model, peridogram	2	
3.2 Uncertain frequency components, facts and example	2	
3.3 Multivariate Time series	2	
3.4 Multi-process Models, TVAR and examples	4	
UNIT - IV Forecasting		
4.1 ARAR Algorithm	2	7
4.2 Memory Shortening	1	
4.3 ARIMA	2	
4.4 Stationarity and differencing, Long-Memory models	1	
4.5 ETS and AI	1	
UNIT - V Forecasting Hierarchical time series		
5.1 Grouped time series	2	7
5.2 Bottom-up and top down approaches	1	
5.3 Middle out approach and mapping matrices	2	
5.4 Complex seasonality	1	
5.5 Neural Network models	1	

Textbook References:

[1]. Time Series Modelling, computation and Inference by Raquel Prado, Mike West, CRC Press 1st edition, 2010

[2]. Forecasting Principles and practice by Rob Hyndman, George Athanasopoulos — Available freely online: https://otexts.com/fpp2/

Reference books:

[1]. Introduction to Time series and Forecasting by Peter J. Brockwell, Richard Davis, Springer, 3rd edition. 2006

[2]. J. D. Cryer and K.-S. Chan, Time Series Analysis. Springer New York, 2008.

Additional Resources (NPTEL, MIT VEdio Lectures, Web resources etc): [1]. https://nptel.ac.in/courses/103/106/103106123/

Evaluation Methods:

Item	Weightage	Associated CO

Quiz1	10	CO-1, CO-2
Quiz2		CO3, CO4
Project	20	CO-1 to CO-5
Midterm	30	CO1 to CO3
Final Examination	40	CO4, CO5 and CO6

* Please note, as per the existing institute's attendance policy the student should have a minimum of 75% attendance. Students who fail to attend a minimum of 75% lectures will be debarred from the End Term/Final/Comprehensive examination.

CO and PO Correlation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	**3**	**2**	**1**									**3**	**3**	**1**	
CO2	**3**	**3**	**2**									**3**	**3**	**1**	
CO3	**3**	**3**	**2**	**1**								**3**	**3**	**1**	
CO4	**3**	**3**	**3**	**2**								**3**	**3**	**2**	
CO5	**3**	**3**	**3**	**2**								**3**	**3**	**2**	
CO6	**3**	**3**	**3**	**3**								**3**	**3**	**2**	