

Course Code	PAD21G03T	Course Name	TIME SERIES ANALYSIS	Course Category	G	Generic Elective	L	T	P	C
							4	0	0	4

Pre-requisite Courses	<i>Nil</i>	Co-requisite Courses	<i>Nil</i>	Progressive Courses	<i>Nil</i>
Course Offering Department	<i>Mathematics and Statistics</i>	Data Book / Codes/Standards	<i>Statistical Table and Graph sheet</i>		

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>	Learning	Program Learning Outcomes (PLO)
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CLR-1 :	To provide basic knowledge of times series Analysis	1	2	3
CLR-2 :	To understand the Concepts of Autoregressive moving average and Auto regression	Level of Thinking	Ex	Ex
CLR-3 :	To learn the concepts of		pe	pe
CLR-4 :	To acquire the knowledge of Vector Error Correction model		cte	cte
CLR-5 :	To learn the application of ARMA, ARIMA and VAR		d	d
CLR-6 :	To understand the concept of forecasting of time series analysis		Pr	Att
		of	of	

Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:	Weighting (Blom)	Percentage (%)	Percentage (%)
CLO-1 :	To acquire the knowledge of basic characteristic of time series		3	85	80
CLO-2 :	To understand the concepts of ARMA, ARIMA model		3	80	75
CLO-3 :	To understand the Vector Autoregression model		3	85	80
CLO-4 :	To gain the knowledge of Cointegration, spurious regression and super consistency		3	85	80
CLO-5 :	To acquire the skill of constructing the VECM and VAR model		3	85	80
CLO-6 :	To understand the forecasting techniques for time series		3	85	80

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Model Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
L	L	-	L	M	-	-	-	M	M	-	M	-	-	-
M	M	-	H	L	-	-	-	M	M	-	H	-	-	-
M	H	M	H	M	-	-	-	M	M	-	M	-	-	-
M	H	H	H	M	-	-	-	M	M	-	H	-	-	-
H	H	H	M	M	-	-	-	M	M	-	H	-	-	-
M	M	H	M	L	-	-	-	L	M		H	-	-	-

		Learning Unit / Module 1	Learning Unit / Module 2	Learning Unit / Module 3	Learning Unit / Module 4	Learning Unit / Module 5
Duration (hour)		12	12	12	12	12
S-1	SLO-1	Concepts of Time series	Introduction to stationary process -Linear process– properties,	Stochastic vs. deterministic trends	Introduction of VEC model	Modeling the Break Process
	SLO-2	Objective of time series analysis	Concepts of Auto regression, moving average models	The random walk process	Construction of VEC model	Model Comparisons Under Different Numbers of Breaks

S-2	SLO-1	Components of time series	Problems on moving average	Impulse-response functions and variance decompositions	Cointegrated VAR Models	Uncertainty about Out-of-Sample Breaks
	SLO-2	Simple models of time series	Introduction to ARMA	Example for Impulse-response functions and variance decompositions	Cointegrated VAR structure	No new Break
S-3	SLO-1	Zero mean model	Properties of Mean and autocorrelation	Impulse-response functions and variance decompositions	Cointegrated VAR structure	Single out-of-sample Break
	SLO-2	Models with trends and seasonality	ARMA(p, q) Processes The ACF and PACF of an ARMA(p, q) Process.	Impulse-response functions and variance decompositions	Estimation of Cointegrated VAR	Multiple out-of-sample Breaks
S-4	SLO-1	General approach to time series modeling	Calculation of the ACVF	Unit root tests	Estimation of Cointegrated VAR	Filtering – filter function
	SLO-2	Stationary models and the auto regression function	Calculation of the ACVF	Spurious regressions	Estimation of Cointegrated VAR	Filtering Sine and cosine - concepts
S-5	SLO-1	Sample auto correlation function	Partial Autocorrelation Function	Example for Spurious regressions	Estimation of Cointegrated VAR	Filtering Sine and cosine
	SLO-2	Model for the Lake Huron Data	Spectral Densities – problems	Definition cointegration	Example for estimation of cointegrated VAR	Filtering general series
S-6	SLO-1	Model for the Lake Huron Data	Spectral Densities – problems	Example for cointegration	Example for estimation of cointegrated VAR	Sequential filtering- concepts
	SLO-2	Models in trend and seasonality	Spectral Densities – problems	Example for cointegration	Testing of Cointegrated VAR	Linear model - Kalman filtering – concept, model construction
S-7	SLO-1	Estimation and Elimination of Trend in the Absence of Seasonality	State space models – ARIMA	Testing Bivariate Cointegrating Relationships	Testing Procedure for Cointegrated VAR	Mean and variance for kalman filtering
	SLO-2	Estimation and elimination of trend	Estimation state-space models	Dickey-Fuller test- Augmented Dickey-Fuller test	Testing for Cointegrated VAR - example	Examples for kalman filtering
S-8	SLO-1	Estimation and elimination of trend	State space model with missing values	Dickey-Fuller test- Augmented Dickey-Fuller test - examples	Testing for Cointegrated VAR - example	Forecasting using kalman filtering
	SLO-2	Estimation and elimination of seasonal variation	EM algorithm – problem	Dickey-Fuller test- Augmented Dickey-Fuller test - examples	Forecasting (Johansen)- model	Application of kalman filtering

S - 9	SLO-1	Estimation and elimination of seasonal variation	Forecasting ARMA Processes	<i>Test on white noise Procedure</i>	Forecasting (Johansen)-procedure	Application of kalman filtering
	SLO-2	Estimation and elimination of seasonal variation	ARMA(p, q) Processes	Problems on test on white noise	Example Forecasting Johansen	Non-linear model – ARCH model
S - 10	SLO-1	Elimination of seasonal variation in trend	Properties – causality	Problems on test on white noise	Example Forecasting Johansen	GARCH – definition, construction
	SLO-2	Elimination of both trend and seasonal components	ACF and PACF of the ARMA model	Spurious Regression procedure	Example Forecasting Johansen	Mean, variance, autocorrelation
S-11	SLO-1	Eliminating the noise sequence	ACF and PACF of the ARMA model – problems	Spurious Regression - problems	Example Forecasting Johansen	GARCH Model of Order p, q GARH(p,q):
	SLO-2	Eliminating the noise sequence	ACF and PACF of the ARMA model – problems	Spurious Regression - problems	Forecasting and Granger Causality in a VAR model	Interpretation of GARCH
S-12	SLO-1	Eliminating the noise sequence	Forecasting of ARMA model	Causes of spurious regression	Granger Causality in a VAR procedure	Application of GARCH
	SLO-2	Eliminating the noise sequence	Forecasting of ARMA model	Causes of spurious regression	Granger Causality in a VAR example	Application of GARCH

Learning Resources	Theory: 1. B V Vishwas and ASHISH PATEL, Hands-on Time Series Analysis with Python: From Basics to Bleeding Edge Techniques, August 2020	2.. Aileen Nielsen, Practical Time Series Analysis, October 2019 3. Marc S. Paoletta, Linear Models and Time-Series Analysis, December 2018

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA 1 (10%)		CLA 2 (10%)		CLA 3 (20%)		CLA 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	30%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Academic	Internal Experts
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