Semester	SIX
Course	Major
Paper Code	C3ST230621T
Paper Title	Time Series Analysis & Non-Parametric Methods
No. of Credits	4
Theory / Practical /Composite	Theory
Classes per week	Module 1: 2 periods/week Module 2: 2 periods/week
Module	2

Course Outcomes for Module I

1.	**Remember** the definitions and types of time series
2.	**Understand** the basic concept of time series and the ultimate objective of time series analysis along with the idea of stationarity.
3.	**Apply** the different techniques for decomposition of a time series into its classical components
4.	**Analyze** real life data on a time series to obtain meaningful insights
5.	**Evaluate** the randomness or otherwise of the residual series
6.	**Create** self -designed problems of time series analysis from the real world and work on it for a meaningful conclusion.

Course Outcomes for Module II

1.	**Remember** the basic ideas and assumptions in non - parametric methods
2.	**Understand** the difference between non-parametric and distribution free methods
3.	**Apply** the different tests for studying location and scale of population distribution
4.	**Analyze** real life problems with non-parametric methods
5.	**Evaluate** the goodness of fit of distributions under a non –parametric approach
6.	**Create** self- designed problems from the real world which admit of non - parametric analysis

Syllabus

Unit/Module	Content	No. of lectures	CO mapping	Cognitive levels
Module I				
	Introduction: Idea of a Time Series. Time Series data. Examples of Time Series data from various fields. Evolutive and Stationary time series.	2	CO1 CO2	K1 K2
	Evolutive time series: Idea of Trend,			

	Seasonal and Cyclical fluctuations. Classical decomposition of an evolutive time series. Estimation of trend by fitting mathematical curves and moving averages. Determination of indices of seasonal variation in a detrended series: Method of Averages. Fitting of asymptotic growth curves.	16	CO3 CO4	K3 K4
	Stationary Time Series: Idea of Stationarity. Weak Stationarity. Auto-correlation function (acf) and Partial Auto-correlation functions (pacf). Correlogram. Illustrative examples.	8	CO1 CO2 CO3 CO4 CO5 CO6	K1 K2 K3 K4 K5 K6
Module II				
	Introduction: Basic idea of non-parametric methods. Concept of a Run. One-sample test for randomness using runs.	4	CO1 CO2	K1 K2
	Tests for goodness of fit: Definition and properties of empirical distribution function (edf). Graphical representation of edf. Kolmogorov-Smirnov test for goodness of fit.	4	CO4	K4
	Tests for location: One-sample problem. Sign Test and Wilcoxon Signed Rank Test. Two-sample problem. Wilcoxon Rank Sum Test and Mann-Whitney U Test.Test for location of k independent populations: Kruskal-Wallis Test.	14	CO3 CO4 CO5	K3 K4 K5
	Tests for scale: Mood test, Ansari-Bradley test and Seigel-Tukey test	2	CO3 CO4 CO5	K3 K4 K5
	Interval Estimation: Concept of non-parametric tolerance intervals.	2	CO3 CO4 CO5	K3 K4 K5

Reading/Reference list

1.	Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol 2, 8th edition, The world Press, Kolkata
2.	Cooray, TMJA (2008): Applied Time Series, Analysis and forecasting, Narosa Publishing house
3.	Brockwell, P. J., & Davis, R. A. (Eds.). (2002): Introduction to time series and forecasting. New York, NY: Springer New York.
4.	Box, G. E., Jenkins, G. M., Reinsel, G. C., & Ljung, G. M. (2015): Time series analysis: forecasting and control. John Wiley & Sons.
5.	Brockwell, P. J., & Davis, R. A. (Eds.). (2002):. Introduction to time series and forecasting. New York, NY: Springer New York.
6.	Shumway, R. H., & Stoffer, D. S. (2006): Time series analysis and its applications: with R examples. New York, NY: Springer New York.
7.	Gibbons, J. D. and Chakraborty, S (2003): Nonparametric Statistical Inference. 4th Edition. Marcel Dekker, CRC.

Evaluation

	CIA: 30 End-Sem: 70 Total: 100	
Paper Structure for Semester Exam	**Module1 (35 marks)**	**Module 2 (35 marks)**
	Short questions (5 marks each): 4 out of 6 Long questions (15 marks each): 1 out of 2	Short questions (5 marks each): 4 out of 6 Long questions (15 marks each): 1 out of 2

CO	CO Description for Module I	Cognitive levels
CO1	**Remember** the definitions and types of time series	K1
CO2	**Understand** the basic concept of time series and the ultimate objective of time series analysis along with the idea of stationarity.	K2
CO3	**Apply** the different techniques for decomposition of a time series into its classical components	K3
CO4	**Analyze** real life data on a time series to obtain meaningful insights	K4
CO5	**Evaluate** the randomness or otherwise of the residual series	K5
CO6	**Create** self designed problems of time series analysis from the real world and work on it for a meaningful conclusion.	K6

CO	CO Description for Module II	Cognitive levels
CO1	**Remember** the basic ideas and assumptions in non - parametric methods	K1
CO2	**Understand** the difference between non-parametric and distribution free methods	K2
CO3	**Apply** the different tests for studying location and scale of population distribution	K3
CO4	**Analyze** real life problems with non-parametric methods	K4
CO5	**Evaluate** the goodness of fit of distributions under a non –parametric approach	K5
CO6	**Create** self- designed problems from the real world which admit of non - parametric analysis	K6