LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **STATISTICS**

SECOND SEMESTER – **APRIL 2025**

PST2ME01 – TIME SERIES MODELLING

Date: 07-05-2025 Dept. No. Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

	SECTION A – K1 (CO1)
	Answer ALL the questions **(5 x 1 = 5)**
1	**True or False**
a)	Holt's linear method is also known as Double exponential smoothing.
b)	In a multiplicative time series model the s**easonal fluctuations** grow or shrink **proportionally** to the level of the trend.
c)	ACF at lag 1 is equal to PACF at lag 1.
d)	A autoregressive model is also known as distributed lag model.
e)	In a ARIMA model with parameters p,d,q the value of q cannot be zero.
	SECTION A – K2 (CO1)
	Answer ALL the questions **(5 x 1 = 5)**
2	**Match the following**
a)	Y_{t-k} - Holt Winter
b)	Order of differencing - no predictable pattern
c)	Stationarity - d
d)	Smoothing - Augumented Dickey Fuller test
e)	White noise - Lag of order k
	SECTION B – K3 (CO2)
	Answer any THREE of the following **(3 x 10 = 30)**
3	Discuss any ten real life applications of time series forecasting models.
4	(i) Discuss additive model, multiplicative model and its various components. (ii) Explain Single Exponential Smoothing, Holt's linear method and Holt-Winter's trend and seasonality method of smoothening
5	Define Autocorrelation of order 1, order 2, order k and partial autocorrelation of order 1, order 2 and order k and discuss the methods to determine autocorrelation of order k and partial autocorrelation of order k
6	Discuss (i) Random Walk model (ii) Random walk with drift (iii) Use of Back-shift notation (3+3+4)
7	Discuss Box-Jenkins method of constructing ARIMA model

SECTION C – K4 (CO3)

	Answer any TWO of the following	**(2 x 12.5 = 25)**
8	Obtain quarterly forecast for the next year using multiplicative model. Year : 1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 Quarter : Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Sales : 4.8, 4.1, 6, 6.5, 5.8, 5.2, 6.8, 7.4, 6, 5.6, 7.5, 7.8, 6.3, 5.9, 8, 8.4	
9	Explain stationary in time series analysis and discuss the test for stationarity of time series data.	
10	Determine auto correlation of order 1 and order 2 based on the following data: 5, 7, 6, 8, 10, 12, 14, 13, 11,15	
11	i) Explain Koyck model in detail (10 Marks) (ii) What is out-of-time model validation in time series? Explain with an example (2.5 Marks)	

SECTION D – K5 (CO4)

	Answer any ONE of the following	**(1 x 15 = 15)**
12	Determine any four model performance measures used in time series based on the data given below Actual Y : 112 98 102 112 87 96 112 101 99 105 123 143 Forecasted Y : 106.5 96.5 108 121 81 90 121 95 97 101 132 139	
13	Determine Partial autocorrelation of order 1, order 2 and order 3 for the data given below: Sales: 3, 5, 7, 9, 10, 12	

SECTION E – K6 (CO5)

	Answer any ONE of the following	**(1 x 20 = 20)**
14	Use linear regression with dummay variables and obtain the half-yearly forecast for the year 2025. Half_year = 0 indicates Jan-Jun, Half_year = 1 indicates Jul-Dec Year: 2021 2021 2022 2022 2023 2023 2024 2024 Half_year: 0 1 0 1 0 1 0 1 Sales: 19.9 22.5 21 24.2 21.6 25.3 22.2 26.4	
15	i) Discuss the following in detail (a) Auto-regressive Model of order k (b) Moving average model of order k (c) ARMA model (d) ARIMA model and (e) SARIMA model. (15 Marks) ii) Explain how would you determine the optimal p,d,q in ARIMA using Train,Test and Validation datasets. (5 Marks)	

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