B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

February / March 2023 Semester End Main Examinations

Programme: B.E.   **Semester: V**
Branch: Artificial Intelligence and Machine Learning   **Duration: 3 hrs.**
Course Code: 22AM5HSTFM   **Max Marks: 100**
Course: Time Series and Financial Mathematics   **Date: 03.03.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
               2. Missing data, if any, may be suitably assumed.

UNIT - I

1   a)   Elucidate the components of Time Series analysis and discuss the need to decompose a time series.   **10**

      b)   What is the reasons for studying trend?   **5**

      c)   Why deasonalizing is required before analysing the trend?   **5**

OR

2   a)   Analyse the Pros and Cons of semi-average method, moving-average method and least square method in measuring Trend.   **10**

      b)   Below are the given figures of production (in thousand tonnes) of a fertilizer factory.   **10**

Year	2015	2016	2017	2018	2019	2020	2021
Production	70	75	90	98	84	91	99

Fit a straight line trend by the method of least squares and estimate trend value for 2023.

UNIT - II

3   a)   Explain in detail the four kinds of variation involved in Time-Series analysis.   **10**

      b)   Determine the monthly seasonal indices for the following data of production of a commodity for the years 2020, 2021 and 2022 using the method of simple averages.   **10**

Months/Year	Production in Tonnes		
	2020	2021	2022
Jan	120	150	160
Feb	110	140	150
Mar	100	130	140

Apr	140	160	160
May	150	160	150
June	150	150	170
July	160	170	160
August	130	120	130
Sept	110	130	100
Oct	100	120	100
Nov	120	130	110
Dec	150	140	150

UNIT - III

4 a) Explain in detail about Laspeyre's and Paasche's weighted index computation. **8**

b) A firm specializes in producing sports equipments. To forecast the future sales based on an analysis of its past patterns of sales, the firm has collected the information as provided below: **12**

	Sales per Quarter (x \$10,000)			
Year	**I**	**II**	**III**	**IV**
1991	16	21	9	18
1992	15	20	10	18
1993	17	24	13	22
1994	17	25	11	21
1995	18	26	14	25

Using the data provided calculate sessional indices by link relative method.

UNIT - IV

5 a) If L is Lag operator of TS and TS can express as $Y_t = -9L\,Y_t - 6L\,Y_t - 9L^2\,Y_t$ check a given TS is Stationary and if not on what condition the TS is non-stationary **6**

b) Time Series (TS) function is in the form of cosine wave, hence prove that TS is not stationary **6**

c) Marks obtained by 5 students in IML and INN as given below **8**

Course	1	2	3	4	5
IML	36	35	32	20	18
INN	39	38	30	30	27

Calculate the Pearson correlation coefficient

UNIT - V

6 a) Compare the Random walk model with MA (1) model **6**

b) Time Series (TS) $Y_t = \mu + \sum \alpha Y_{t-i}$ where $i = 1….P$, express the series with Lag operator (L) **8**

c)   Check a given TS is non-stationary or not $x_t = -0.5x_{t-1} + z_t$ **6**

<center>**OR**</center>

7   a)   Suppose we would like to predict a single stationary series x_t with zero mean
         and autocorrelation function $\gamma(h)$ at some time in the future, say, $t + \ell$, $\ell > 0$.   **10**
         If we predict using only xt and some scalar multiplier A, show that the mean-
         square prediction error $MSE(A) = E[(x_{t+\ell} - Ax_t)2]$ is minimized by the value
         $A = \rho(\ell)$ and Show that the minimum mean-square prediction error is $MSE(A)$
         $= \gamma(0)[1 - \rho2(\ell)]$.

    b)   Ice cream sale of vendor is MA (1) Process: $Y_t = \mu + \alpha\text{€}_{t-1}$ estimate sale for 5   **10**
         days for $\mu = 25$ and $\alpha = 0.8$

Days	1	2	3	4	5
€_t	-2	2	0	3	-3

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