Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus

Of

DJS23

Honors Program in Data Analytics

With effect from the Academic Year: 2025-2026

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA: 3.18)

Department of Computer Science and Engineering (IoT and Cyber Security with Block Chain Technology)
Scheme for Honors Degree Program in Data Analytics : Semester: VI
(Academic Year 2025-2026)

Sr. No.	Course Code	Course	Teaching Scheme			Semester End Examination (SEE) (A)						Continuous Assessment (CA) (B)						Aggregate (A+B)	Credits
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Duration	Theory	Oral	Pract	Oral & Pract	SEE Total	Term Test 1 (TT1)	Term Test 2 (TT2)	Term Test 2 (TT3)	Total	Term work	CA Total		
		SEM III																	
1	DJS23BCH1301	Fundamentals of Data Mining	3	--	--	2	60	--	--	--	60	15	15	10	40	--	40	100	3
		SEM IV																	
2	DJS23BCH1401	Data Analytics and Visualization	3	--	--	2	60	--	--	--	60	15	15	10	40	--	40	100	3
	DJS23BLH1401	Data Analytics and Visualization Laboratory	--	2	--	2	--	25	--	--	25	--	--	--	--	25	25	50	1
		SEM V																	
3	DJS23BCH1501	Natural Language Processing	3	--	--	2	60	--	--	--	60	15	15	10	40	--	40	100	3
	DJS23BLH1501	Natural Language Processing Laboratory	--	2	--	2	--	25	--	--	25	--	--	--	--	25	25	50	1
		SEM VI																	
4	DJS23BCH1601	Time Series and Forecasting Analytics	3	--	--	2	60	--	--	--	60	15	15	10	40	--	40	100	3
	DJS23BLH1601	Time Series and Forecasting Analytics Laboratory	--	2	--	2	--	25	--	--	25	--	--	--	--	25	25	50	1
		SEM VIII																	
5	DJS23BCH1801	Optimization for Decision Analytics	3	--	--	2	60	--	--	--	60	15	15	10	40	--	40	100	3
		Total	**15**	**6**	**0**	**16**	**300**	**75**	**0**	**0**	**375**	**75**	**75**	**50**	**200**	**75**	**275**	**650**	**18**

Prepared by | Checked by | Head of Department | Vice Principal | Principal

25/04/26.

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Program: B. Tech in Computer Science and Engineering (IoT and Cybersecurity with Block chain Technology)									T.Y.B.Tech				Semester: VI
Course: Time Series and Forecasting Analytics									Course Code: DJS23BCH1601				
Course: Time Series and Forecasting Analytics Laboratory									Course Code: DJS23BLH1601				
Teaching Scheme (Hours / week)				Evaluation Scheme									
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)						Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assignment		Total		
				60			15	15	10		40		100
				Laboratory Examination			Term work				Total Term work		
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work		Tutorial / Mini project /presentation/ Assignment				50
				25	–	--	15		10		25		

Prerequisite:

1. Probability and statistical Inference.
2. Python/R Programming

Course Objectives: The objective of the course is to

1. Understand Time Series Fundamentals.
2. Apply Forecasting and Smoothing Techniques.
3. Model Stationary and Non-Stationary Data.
4. Analyze Complex and Multivariate Time Series

Course Outcomes: On completion of the course, learners will be able to:

1. Interpret time series data and its components using visualization techniques.
2. Apply basic and advanced smoothing techniques for effective time series forecasting.
3. Assess stationarity and characterize dependencies using autocorrelation-based tools.
4. Develop and evaluate models for predicting single-variable time series data.
5. Analyze interdependencies among multiple time-dependent variables using multivariate modeling techniques.
6. Implement time series techniques for predictive analytics in IoT, CPS, and blockchain systems.

Detailed Syllabus:

Unit	Description	Duration
1	**Definition and Examples:** What is a time series? Examples from various fields (finance, economics, weather, sales). Objectives of Time Series Analysis: Description, explanation, forecasting, and control. Time Series Plotting and Visualization: Creating and interpreting time plots, Components of a Time Series: Trend, Seasonality, Cyclic Variation, Irregular/Random Component.	5
2	**Basic Forecasting Methods and Smoothing** **Naive Methods:** Last value, average, and seasonal naive forecasting. **Simple Averages and Moving Averages:** Calculation and limitations for forecasting. **Exponential Smoothing Methods (ES):** Simple Exponential Smoothing (SES), Holt's Linear Trend Method, Holt-Winters Seasonal Method, Evaluating forecast accuracy (MAE, MSE, RMSE, MAPE), Visualizing forecast results and confidence intervals.	8
3	**Fundamentals of Stationary Time Series:** Stochastic Processes and Random Walks, Concept of Stationarity Strict and Weak Stationarity; importance of stationarity in modeling. Tests for Stationarity and Unit Roots – Visual inspection, Dickey–Fuller and Augmented Dickey–Fuller (ADF) tests. Autocorrelation Function (ACF) and Correlogram, Partial Autocorrelation Function (PACF), White Noise and Random Error Terms. Identification of Model Orders.	7
4	**Univariate Time Series:** Autoregressive (AR) Models: Stationarity conditions for AR, Moving Average (MA) Models: Modelling the current value as a linear combination of current and past random error terms. Concept of Invertibility, Autoregressive Moving Average (ARMA) Models: components for stationary data, Brief overview of model fitting and diagnostics. Autoregressive Integrated Moving Average.	11
5	**Multivariate Time Series:** Difference from univariate, examples, Cross-correlation & cross-covariance, Stationarity in multivariate context, VAR: Structure, lag selection, parameter estimation, Granger causality, impulse response analysis.	7
6	**Application of Time Series in IoT and Cyber-Physical Systems (CPS):** Predictive Maintenance, Anomaly and Intrusion Detection, Dynamic Optimization and Control. Time Series in Blockchain and Smart Contracts: Decentralized Finance Analytics and Automation, Operationalizing Forecasts in Smart Contracts, Network and Security Analysis.	4
	Total	42

List of Laboratory Experiments:	
Sr. No.	**Suggested Experiments**
1	Detecting Trend in Time Series Data
2	Detecting Seasonality in Time Series Data
3	Time Series Decomposition
4	Data Wrangling and Pre-processing for Time Series
5	Smoothening methods in Time Series
6	Stationarity Testing and Making data stationary
7	Autoregressive Moving Average Models
8	Implementation of ARIMA Model for Time Series forecasting.
9	Implementation of Vector Autoregression (VAR) Model for Multivariate Time Series forecasting.
10	Mini project based on any Time Series and Forecasting application.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Text Books:

1. Forecasting: Principles and Practice, by Hyndman and Athanasopoulos, 3rd Ed/Pythonic Way, 2024.
2. Time Series Analysis and Its Applications, by Shumway and Stoffer, Springer International Publishing, 4th Ed, 2017.

Reference Books:

1. Introduction to Time Series Analysis and Forecasting, by Douglas C. Montgomery, Cheryl L. Jennings, and Murat Kulahci: The latest edition is the 3rd Edition, 2024.
2. Practical Time Series Analysis Prediction with Statistics & Machine Learning, Aileen Nielsen, O'reilly, 2019.

Web resources:

1. MIT Open courseware: https://ocw.mit.edu/courses/14-384-time-series-analysis-fall-2013/pages/lecture-notes/
2. Penn state Eberly College of Science: https://online.stat.psu.edu/stat510/
3. Forecasting: Principles and Practice (3rd ed): https://otexts.com/fpp3/
4. NIST Engineering Statistic Handbook : https://www.itl.nist.gov/div898/handbook/pmc/section4/pmc4.htm

Online Courses: NPTEL / Swayam

1. Time Series Modelling and Forecasting with Applications in R, By Prof. Sudeep Bapat IIT Bombay. https://onlinecourses.nptel.ac.in/noc25_cs71/preview
2. Applied Time-Series Analysis By Prof. Arun K. TangiralaIIT,Madras. https://onlinecourses.nptel.ac.in/noc21_ch28/preview
3. Application of Forecasting, Regression and Time Series Models, By Prof. Raghu Nandan SenguptaIIT Kanpur. https://onlinecourses.nptel.ac.in/noc25_mg77/preview

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Laboratory:

Oral examination will be based on the entire syllabus including, the practical's performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Term Test 1 (based on 40 % syllabus) of 15 marks for the duration of 45 min.
2. Term Test 2 (on next 40 % syllabus) of 15 marks for the duration of 45 min.
3. Assignment / course project / group discussion /presentation / quiz/ any other for 10 marks.

Laboratory: (Term work)

1. Term Work shall consist of at least 6 practical's based on the above list.
2. The distribution of marks for term work shall be as follows:
   i. Laboratory work (Performance of Experiments, Write-up): 15Marks
   ii. Mini Project/Case study/Presentation: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work, and upon fulfilling minimum passing criteria in the term work.

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

28/04/26.