# Sheth NKTT College of Commerce and Sheth JTT College of Arts, Thane (Autonomous)

# Credit Structure: Post Graduate Programme

### As per NEP-2020

Programme Name:M. Sc. (Data Science)Semester: II(w.e.f. 2025-26)

Category	Course	Credit
	Soft Computing	4
Mandatory	Soft Computing Practical	2
	Time Series Analysis and Forecasting	4
	Time Series Analysis and Forecasting Practical	2
	Ethical Issues in Data Science	2
OE (Any One)	Human Resource Analytics (2 TH +2PR)	4
	Public Healthcare Analytics (2 TH +2PR)	
	Social Media Analytics (2 TH +2PR)	
Field Project/OJT		4
	Total	22

# Semester-II M.Sc. ( Data Science )

Name of the Dept: Science and Technolgy

Course Title: Soft Computing	g
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Course Code:

Course Level:6.0

Type: Theory

Course Credit: 4 credits

Hours Allotted: 60 Hours

Marks Allotted: 100 Marks

# Course Objectives(CO):

- 1. To understand the fundamentals of artificial neural networks, including supervised, unsupervised, and associative learning models, and their applications in pattern recognition and classification.
- 2. To explore advanced and special neural networks, such as deep learning, spiking neural networks, and probabilistic neural networks, along with their architectures and functionalities.
- 3. To learn the principles of fuzzy logic, fuzzy sets, membership functions, fuzzy relations, and defuzzification methods for handling uncertainty and imprecision in data.
- 4. To apply genetic algorithms for optimization problems by understanding their biological inspiration, operators, and problem-solving capabilities compared to traditional algorithms.

# Course Outcomes (OC):

- OC1: Understanding Soft Computing Paradigms.
- OC2: Comprehend the principles and mathematical foundations of Fuzzy logic.
- OC3: Acquire knowledge of the theory and concepts underlying neural networks, including artificial neurons, activation functions.
- OC4: Explore the theoretical understanding of Genetic algorithms, including genetic operators (selection, crossover, mutation), encoding schemes, fitness evaluation

U	nit	No.	

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Ι	<ul> <li>Unit 1: Artificial Neural Network</li> <li>Fundamentalconcepts, Evolution of neural network, basic model of Artificial Neural Network, Important terminologies, McCulloch Pits neuron, linear separability, Hebb network Supervised Learning Network: Perceptron networks, Adaline, MAdaline, Backpropogation network, Radial Basis Function, Time Delay Network, Functional Link Networks, Tree Neural Network.</li> <li>UnSupervised Learning Networks: Fixed weight competitive nets, Kohonen self- organizing feature maps, learning vectors quantization, counter propogation networks, adaptive resonance theory networks. Associative Memory Networks: Training algorithm for pattern Association, Autoassociative memory network, hetroassociative memory network, bi- directional associative memory, Hopfield networks, iterative autoassociative memory networks, temporal associative memory networks</li> </ul>	
	Unit2: Special Networks Simulated annealing, Boltzman machine, Gaussian Machine, Cauchy Machine, Probabilistic neural net, cascade correlation network, cognition network, neo-cognition network, cellular neural network, optical neural network Third Generation Neural Networks: Spiking Neural networks, convolutional neural networks, deep learning neural networks, extreme learning machine model.	
II	<ul> <li>Unit 3: Fuzzy Logic</li> <li>Introduction to Fuzzy Logic, Classical sets, Fuzzy sets, Classical Relations and Fuzzy Relations: Cartesian Product of relation, classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Membership Function: features of the membership functions, fuzzificationand methods of membership value assignments. Defuzzification: Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods. Fuzzy Arithmetic and Fuzzy measures: fuzzy arithmetic, fuzzy measures, measures of fuzziness, fuzzy integrals</li> <li>Unit 4: Genetic Algorithm</li> <li>Biological Background, Traditional optimization and search techniques, genetic algorithm and search space, genetic algorithm, general genetic algorithm, operators in genetic algorithm, stopping condition for genetic algorithm, the schema theorem, classification of genetic algorithm, Holland classifier systems, genetic programming, advantages and limitations and applications of</li> </ul>	
	genetic algorithm	

- 1. Artificial Intelligence and Soft Computing by Anandita Das Bhattacharya, SPD, 3rd edition 2018
- Principles of Soft computing by S.N.SivanandamS.N.Deepa , Wiley, 3rd edition, 2019
- 3. Neuro-Fuzzy and Soft Computing by J.S.R.Jang, C.T.Sun and E.Mizutani, Prentice Hall of India, 1st edition, 2004
- Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications by S.Rajasekaran, G. A. Vijayalakshami, Prentice Hall of India, 1st edition, 2004
- 5. Fuzzy Logic with Engineering Applications, Timothy J.Ross, McGrawHill 1st edition, 1997
- 6. Genetic Algorithms: Search, Optimization and Machine Learning by Davis E.Goldberg, Addison Wesley, 1st edition, 1989
- 7. Introduction to AI and Expert System by Dan W. Patterson, Prentice Hall of India, 2nd edition, 2009

Sheth N.K.T.T College of Commerce and Sheth J.T.T College of Arts, (Autonomous) Thane (W)

Programme Name: M. Sc. (Data Science)

Semester: II

Course Category/Vertical: Mandatory
Name of the Dept: Science and Technology
Course Title: Soft Computing Practical
Course Code: Course Level:6.0
Type: Practical
Course Credit: 2 credits
Hours Allotted: 60 Hours
Marks Allotted: 50 Marks
Course Objectives(CO):
1. To implement and experiment with various neural network models, including
Perceptron, Backpropagation, and Hopfield networks for solving classification and
pattern recognition problems.
2. To explore and apply unsupervised learning techniques, such as Kohonen networks and associative memory models, for clustering and feature mapping tasks.
3. To simulate fuzzy logic systems, including fuzzy set operations, fuzzification,
defuzzification, and fuzzy inference systems for decision-making under uncertainty.
4. To apply genetic algorithms for solving optimization problems by designing fitness functions, using selection, crossover, and mutation operations effectively.
Course Outcomes (OC):
OC1: Understanding of the basic principles, concepts, and techniques of Soft Computing.
OC2: Acquire the knowledge and skills necessary to apply Soft Computing te chniques to
solve real-world problems.
OC3: Implement and program Soft Computing algorithms.
OC4: Provide foundation in Soft Computing.

Sr. No	Content	Hours
1	Write a program to implement logical gates AND, OR and NOT with McCulloch-Pitts.	
2	Write a program to implement Hebb <sup>s</sup> rule.	
3	Implement Kohonen Self organizing map.	
4	Solve the Hamming network given the exemplar vectors.	
5	Write a program for implementing BAM network.	
6	Implement a program to find the winning neuron using MaxNet.	
7	Implement De-Morgan"s Law.	
8	Implement Union, Intersection, Complement and Difference operations on	
	fuzzy sets.	
9	Create fuzzy relation by Cartesian product of any two fuzzy sets	

10	Perform max-min composition on any two fuzzy relations.	
		60

#### Programme Name: M. Sc. (Data Science)

Semester: II

Course Category/Vertical: Mandatory

# Name of the Dept: Science and Technology

# **Course Title : Time Series Analysis and Forecasting**

Course Code:

Course Level:6.0

Type: **Theory** Course Credit: 2 credits

Hours Allotted: 60 Hours

Hours Allotted: 60 Hours

Marks Allotted: 100 Marks

Course Objectives(CO):

- 1. To understand the fundamentals of time series data, its components, and various methods for trend estimation and decomposition.
- 2. To analyze seasonal patterns in time series, using methods like moving averages, ratio to trend, and link relatives for seasonal component estimation.
- 3. To apply forecasting techniques, including exponential smoothing, Box-Jenkins method, and short-term forecasting models for real-world data.
- 4. To explore cyclic and special processes like AR and MA models, and perform parameter estimation using methods such as the Yule-Walker equations.

# Course Outcomes (OC):

OC1: Forecast the trend pattern exhibited by the given data by using various methods

Oc2: Run and interpret time series models and regression models for time series

OC3: Use the Box-Jenkins approach to model and forecast time series data empirically

OC4: Analyze and estimate the cyclic components using special processes

Unit No.	Content	Hours
	<b>Unit 1: Introduction to Trend</b> Introduction to times series data, application of time series from various fields - Components of a time series - Decomposition of time	

	Variate component method - Stationary Time series: Weak stationary, autocorrelation function and correlogram of moving average	
	autocorrelation function and correlogram of moving average Forecasting: Exponential smoothing methods, short term forecasting	
	Forecasting: Exponential smoothing methods, short term forecasting	
	methods: Brown"s discounted regression, Box-Jenkins Method.	
	methods: Brown"s discounted regression, Box-Jenkins Method.	
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	methods: Brown"s discounted regression, Box-Jenkins Method.	
	methods. Brown''s discounted regression, Box-Jenkins Method	
	Forecasting: Exponential smoothing methods, short term forecasting	
	Forecasting: Exponential smoothing methods short term forecasting	
	autocorrelation function and correlogram of moving average	
	variate component method - Stationary Time series: weak stationary,	
	Unit 5: Forecasting	
11	Unit 2. Forecasting	
II	Ratio to mena, Ratio to moving average and link relatives	
	Ratio to Trend Ratio to moving average and Link relatives	
	simple averages,	
	Seasonal Component: Estimation of seasonal component by Method of	
	trend on other components of the time series.	
	Method of moving averages – Detrending - Effect of elimination of	
Ι	Unit2: Trend and Seasonal component	
	averages - fitting a various mathematical curve and growth curves.	
	Trend: Estimation of trend by free hand curve method - method of semi	

- 1. Kendall, M. (1976) Time Series. 2nd Edition, Charles Griffin and Co Ltd., London and High Wycombe.
- Chatfield C. (1980). The Analysis of Time Series –An Introduction, 6<sup>th</sup> Edition, Chapman & Hall.
- 3. Mukhopadhyay P. (2011). Applied Statistics, 2nd ed. Revised reprint, Books and Allied
- 4. Shumway, R. H., and Stoffer, D. S. (2006). Time Series Analysis and Its Applications With R Examples, 2 ed. Springer, New York, NY
- 5. Box, G. E. P., Jenkins, G. M., & Reinsel, G. C. (1994). Time Series
- 6. Analysis: Forecasting and Control. Prentice Hall, Inc., Upper Saddle River, NJ.
- 7. Yaffee, R. and McGee, M. (2000). Introduction to Time Series Analysis and Forecasting with Applications of SAS and SPSS. Academic Press, Inc., San Diego, CA.

Course Category/Vertical: Mandatory

Name of the Dept: Science and Technology

# Course Title: Time Series Analysis and Forecasting Practical

Course Level:6.0

Course Code: Type: practical

Course Credit: 2 credits

Hours Allotted: 60 Hours

Marks Allotted: 50 Marks

# Course Objectives(CO):

- 1. To develop skills in fitting and visualizing growth curves, such as modified exponential, Gompertz, and logistic curves for trend analysis.
- 2. To apply the moving average method for identifying and plotting trends in time series data.
- 3. To measure seasonal variations using techniques like Ratio-to-Trend, Ratio-to-Moving Average, and Link Relative methods.
- 4. To perform forecasting and variance analysis, using exponential smoothing, short-term forecasting methods, and the variate difference method for random components.

# **Course Outcomes (OC):**

OC1: Fit various growth curves, trend and to measure seasonal indices

- OC2: Understand forecasting by different methods
- OC3: Able to calculate variance of a random component

Unit No.	Content	Hours
1	Fitting and plotting of modified exponential curve.	
2	Fitting and plotting of Gompertz curve.	

3	Fitting and plotting of logistic curve.	
4	Fitting of trend by Moving Average Method.	
5	Measurement of Seasonal indices Ratio-to-Trend method.	
6	Measurement of Seasonal indices Ratio-to-Moving Average method.	
7	Measurement of seasonal indices Link Relative method.	
8	Calculation of variance of random component by variate difference method.	
9	Forecasting by exponential smoothing.	
10	Forecasting by short term forecasting methods.	
		60
Programme	Name:M. Sc. (Data Science)Semester: II	

# Course Category/Vertical: Mandatory Name of the Dept: Science and Technology Course Title : Ethical Issues in Data Science

Course Code:

Course Level:6.0

Type: Theory Course Credit: 2 credits

Hours Allotted: 30 Hours

Marks Allotted: 50 Marks

# Course Objectives(CO):

- 1. To understand the ethical principles and challenges related to data collection, storage, sharing, and automated decision-making in data science.
- 2. To explore emerging ethical issues in technologies like AI, IoT, and machine learning, and to promote responsible practices in data privacy, security, and research.

# Course Outcomes (OC):

- OC1: Understand the fundamental ethical issues that arise in the field of data science
- OC2: Understand the ethical implications of data collection, and decision-making processes
- OC3: Understand concerns related to data collection, storage, and sharing
- OC4: Understand the principles to make decisions in data science projects
- OC5: Recognize and address privacy concerns related to data collection, storage, and sharing

OC6: Reflect on the emerging ethical issues and future directions in data science

science projects. <b>Unit 2: Emerging Ethical issues in Data Science</b> Ethical Issues in Data Visualization, Ethical Issues in Machine Learning, Ethical challenges in emerging technologies e.g., AI, IoT, biometrics, blockebring Ethical shallenges in data science research. Ethical
governance frameworks and practices, Ensuring accountability in data science projects. <b>Unit 2: Emerging Ethical issues in Data Science</b> Ethical Issues in Data Visualization, Ethical Issues in Machine Learning, Ethical challenges in emerging technologies e.g., AI, IoT, biometrics, blockshein Ethical ehellenges in data science research Ethical
Unit 2: Emerging Ethical issues in Data Science Ethical Issues in Data Visualization, Ethical Issues in Machine Learning, Ethical challenges in emerging technologies e.g., AI, IoT, biometrics, blockabain, Ethical, shallenges, in data, science, research, Ethical
considerations in collaborative data science environments, Ethical issues in using the internet, privacy and security, in the context of

- Data Science Ethics, David Martens ISBN: 9780192847263 Oxford University Press 2023
- 2. Ethics of Big Data: Balancing Risk and Innovation" by Kord Davis and Doug Patterson O'Reilly 2012.
- 3. Data Science Ethics Resources Concepts, Techniques, and Cautionary Talesby David Martens-Oxford University Press-2022.
- Data Science Association, Data Science Code of Professional Conduct.https://www.datascienceassn.org/code-of-conduct.html

# Sheth N.K.T.T College of Commerce and Sheth J.T.T College of Arts, (Autonomous) Thane (W)

Programme Name: M. Sc (Data Science)	Semester: II		
Course Category/Vertical: Elective			
Name of the Dept: Science and Technology			
Course Title: Human Resource Analytics			
Course Code:	Course Level:6.0		
Type: Theory			
Course Credit: 2 credits			
Hours Allotted: 30 Hours			
Marks Allotted: 50 Marks			
Course Objectives(CO):			
<ol> <li>To understand the fundamentals and frame measurement, HRIS, and methods of HR a making.</li> <li>To apply analytics to various HR sub-syste management, and compensation, while ex</li> </ol>	works of HR analytics, including HR accounting and audit for effective decision- ems, such as staffing, performance ploring the impact of technology, big data,		
and predictive analytics on HR practices.			
Course Outcomes (OC):			
OC1: Analyze problems and issues in HR and the	relevance of HR analytics.		
OC2: Logically synthesize the tools, methods and	techniques of HR analytics to		
understand real world corporate scenario.			
OC3: Identify the application and uses of HR anal	lytics in various HR sub-systems		

Ι	<ul> <li>Unit 1: HR Measurement</li> <li>Need for HR Measurement, Significance and concept of HR Analytics, HR Analytics and business linkages, Prerequisites of HR Analytics; Models and frameworks of HR Analytics; Measuring intellectual capital, need and rationale for HR Accounting &amp; Audit, Approaches and methods of HR Accounting &amp; Audit</li> <li>HRIS for HR Analytics: What is Human Resource Information System; Role of HRIS in analytics; HRIS development and Implementation, the development process- need analysis, systems design, structure and culture; HRIS Applications-making HRIS work.</li> <li>Unit 2: Analytics for HR sub-systems</li> </ul>	15
	<ul> <li>HR Analytics for Staffing, Training &amp; Development, Performance Management Systems, Career Planning Systems, Rewards and Compensation Management, Employee Relations Systems.</li> <li>Analytics for HR system: HR performance frameworks and measurement systems; Measuring HR Climate and People Management Capabilities; Competency Management Frameworks &amp; Competency Mapping, Integration of competency-based HR System. Measuring HR Effectiveness, The HR Scorecard</li> <li>Trends and Future Challenges: Technology and changes in HR Analytics, Role of social media, Big Data and Predictive Analytics in HR, Assessing the effectiveness of HR Analytics, Post analysis steps, Review and monitoring, Issues in HR valuation and measurement; Emerging challenges: Global and Indian Experience</li> </ul>	15
	Total	30

- Ulrich, D. & Brockbank, W., The HR Value Proposition. Harvard Business School Press 2016
- 2. How to measure HRM by Jac Fitz-enz 2002
- Predictive Analytics for Human Resources by Jac Fitz-enz, John Mattox II, Wiley 2014
- 4. Making Human Capital Analytics Work: Measuring the ROI of Human Capital Processes and Outcomes. By by Jack Phillips,Patricia Pulliam Phillips- 2014

# Sheth J.T.T College of Arts, (Autonomous) Thane (W)

Programme Name: M.Sc (Data Science)	Semester: II	
Course Category/Vertical: Elective		
Name of the Dept: Science and Technology		
Course Title: Human Resource Analytics Practical		

Course Code:

Course Level:6.0

Type: Practical Course Credit: 2 credits

Hours Allotted: 60 Hours

Marks Allotted: 50 Marks

**Course Objectives(CO):** 

- 1. To gain hands-on experience in using HR analytics tools and techniques for analyzing HR functions like recruitment, training, performance, and compensation.
- 2. To apply data-driven approaches for measuring HR effectiveness, generating insights through HRIS, and making strategic HR decisions using real-world datasets.

**Course Outcomes (OC):** 

- Analyze HR analytics. •
- Use and understand tools require for HR analytics •
- Identify the application and uses of HR analytics in various HR sub-systems •

Unit No.	Content	Hours
1	<ul> <li>Analyze employee turnover rates and identify factors contributing to attrition <ul> <li>Collect historical employee data, including tenure, performance ratings, salary, and job satisfaction.</li> <li>Calculate employee turnover rates for different departments and job roles.</li> <li>Conduct statistical analysis to identify correlations between turnover and variables such as salary, job satisfaction, and performance.</li> </ul> </li> <li>Generate visualizations (e.g., charts, graphs) to present the findings and propose recommendations to reduce turnover.</li> </ul>	
2	<ul> <li>Develop a user-friendly HRIS dashboard for monitoring and analyzing HR metrics</li> <li>Identify key HR metrics to be displayed on the dashboard (e.g., headcount, recruitment pipeline, training hours).</li> <li>Design the layout and interface of the HRIS dashboard using appropriate programming languages and tools.</li> <li>Integrate data from various HR systems and databases to populate the dashboard in real-time.Implement interactive features, such as drill-down capabilities and data filters, to facilitate data exploration and analysis</li> </ul>	

3	Analyze training effectiveness and identify skill gaps in the organization	
	• Collect training data, including participant demographics, training	
	modules, pre/post-assessment scores, and performance metrics.	
	• Perform statistical analysis to evaluate the impact of training on	
	employee performance.	
	• Identify areas of improvement and recommend targeted training	
	programs based on identified skill gaps.	
	<ul> <li>Develop a visualization or report summarizing the training needs analysis results</li> </ul>	
4	Develop an HR scorecard to measure HR effectiveness and align HR	
-	strategies with organizational goals	
	• Identify key HR performance indicators aligned with the	
	organization's strategic objectives.	
	• Collect relevant data for each HR indicator, such as employee	
	satisfaction surveys, training investment data, and performance	
	metrics.	
	• Calculate HR metrics and indicators, such as turnover	
	rate, training ROI, and employee engagement index.	
	• Design a dashboard or report to present the HR scorecard and	
	analyze trends over time.	
5	Use predictive analytics to forecast employee attrition and develop	
	retention strategies	
	• Gather historical HR data, including employee demographics,	
	performance metrics, compensation, and employee exit data.	
	• Build a predictive model (e.g., logistic regression, decision tree) to predict employee attrition	
	<ul> <li>Validate the model's accuracy and evaluate its performance using</li> </ul>	
	appropriate evaluation metrics.	
	• Generate actionable insights and recommendations to proactively	
	address potential attrition risks.	
6	Use predictive analytics to forecast employee attrition and develop	
	retention strategies	
	• Gather historical HR data, including employee demographics,	
	performance metrics, compensation, and employee exit data.	
	• Build a predictive model (e.g., logistic regression, decision tree)	
	to predict employee attrition.	
	• Validate the model's accuracy and evaluate its performance using	
	appropriate evaluation metrics.	
	• Generate actionable insights and recommendations to proactively	
7	Measure and analyze employee engagement levels within the	
	organization	
	• Collect employee engagement survey data, including	
	responses to survey questions related to job satisfaction,	
	work environment, and organizational culture.	
	• Calculate engagement scores and identify key drivers of	

	engagement.	
	• Conduct a sentiment analysis on employee	1
	feedback to understand areas of improvement.	1
	Present the findings and propose strategies to	1
	enhance employee engagement based on the analysis	l
8	Develop a program to automate repetitive HR processes, such as leave	
	management or performance appraisal	1
	• Identify the HR process to be automated and define the	1
	required functionalities.	l
	• Design and implement a web-based application or script to	1
	streamline the process using appropriate programming	1
	languages and frameworks.	1
	• Integrate the application with relevant HR systems and	1
	databases to ensure data accuracy and consistency.	1
	Test and validate the automated process, considering different scenarios and	l
	user inputs.	1
9	Analyze the effectiveness of the organization's performance	1
	management system and provide insights for improvement.	l
	• Collect performance evaluation data, including performance	1
	A nelvze the distribution of performance ratings across	l
	Analyze the distribution of performance ratings across     different departments or job roles	1
	<ul> <li>Identify trands and patterns in performance data and assess</li> </ul>	1
	the fairness and consistency of the evaluation process	1
	<ul> <li>Propose recommendations for enhancing the performance</li> </ul>	1
	management system based on the analysis results.	l
10	Analyze the organization's compensation structure and compare it to	
-	industry benchmarks.	1
	• Gather salary data for different job roles and levels within	1
	the organization.	l
	• Perform a salary analysis, including measures like average	l
	salary, salary distribution, and salary competitiveness.	l
	• Conduct benchmarking by comparing the organization's	l
	salary data with industry standards or competitor data.	1

Programme Name: M.Sc (Data Science) Semester: II

Name of the Dept:       Science and Techonology         Course Title:       Public Health Analytics         Course Code:       Course Level:6.0         Type:       Theory         Course Allotted:       2 credits         Hours Allotted:       30 Hours         Marks Allotted:       50 Marks         Course Objectives(CO):       1.         1.       To understand the role of data analytics in public health, including data collection, analysis, and interpretation for informed decision-making.         2.       To apply statistical and analytical methods for identifying health trends, disease patterns, and evaluating health interventions.         3.       To explore tools and techniques used in public health data visualization, predictive modeling, and outcome measurement.         4.       To analyze real-world public health datasets for policy development, resource allocation, and improving community health outcomes.         Course Outcomes (OC):       • Discuss the evolving landscape of healthcare services, including the growing importance of value-based healthcare systems and the role of data in enhancing outcomes. Explore the utilization and management of data in electronic health record (EHR) systems. Identify and cite relevant sources of public health data and information.         • Discuss the evolving landscape of systems. Identify and cite relevant sources of public health data and information.         • Illustrate the various functions performed by data analysis in the field of public health. Apply commonly	Course Cat	regory/Vertical: Elective	
Course Title: Public Health Analytics         Course Code:       Course Level:6.0         Type: Theory       Course Credit: 2 credits         Hours Allotted: 30 Hours       Marks Allotted: 50 Marks         Course Objectives(CO):       1.         To understand the role of data analytics in public health, including data collection, analysis, and interpretation for informed decision-making.         2.       To apply statistical and analytical methods for identifying health trends, disease patterns, and evaluating health interventions.         3.       To explore tools and techniques used in public health data visualization, predictive modeling, and outcome measurement.         4.       To analyze real-world public health datasets for policy development, resource allocation, and improving community health outcomes.         Course Outcomes (OC):         •       Discuss the evolving landscape of healthcare services, including the growing importance of value-based healthcare systems and the role of data in electronic health record (EHR) systems. Identify and cite relevant sources of public health data and information.         •       Illustrate the various functions performed by data analysis in the field of public health. Apply commonly used graphical and descriptive techniques to summarize public health data effectively.         •       Investigate the reliability, accuracy, and comparability of health and genomic data. Examine the integrity of these data sets and their suitability for meaningful comparisons.	Name of the Dept: Science and Techonology		
Course Code:         Course Level:6.0           Type: Theory         Course Credit: 2 credits           Hours Allotted: 30 Hours         Marks Allotted: 50 Marks           Course Objectives(CO):         1.           To understand the role of data analytics in public health, including data collection, analysis, and interpretation for informed decision-making.           2.         To apply statistical and analytical methods for identifying health trends, disease patterns, and evaluating health interventions.           3.         To explore tools and techniques used in public health data visualization, predictive modeling, and outcome measurement.           4.         To analyze real-world public health datasets for policy development, resource allocation, and improving community health outcomes.           Course Outcomes (OC):         •           •         Discuss the evolving landscape of healthcare services, including the growing importance of value-based healthcare systems and the role of data in electronic health record (EHR) systems. Identify and cite relevant sources of public health data and information.           •         Illustrate the various functions performed by data analysis in the field of public health. Apply commonly used graphical and descriptive techniques to summarize public health data effectively.           •         Investigate the reliability, accuracy, and comparability of health and genomic data. Examine the integrity of these data sets and their suitability for meaningful comparisons.	Course Titl	e: Public Health Analytics	
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• Acquire fundamental skills in using popular software tools for conducting data	•	Acquire fundamental skills in using popular software tools for conducting data	
analyses.		analyses.	
<ul> <li>Develop data models that integrate patient information from multiple</li> </ul>	•	Develop data models that integrate patient information from multiple	
origins to create comprehensive and patient contribution archaetives	3	origins to create comprehensive and patient centric perspectives	

Unit No.	Content	Hours
	<ul> <li>Unit 1: Healthcare data management</li> <li>What is Health Data Management? Benefits and challenges of health data management, how to store all that data</li> </ul>	15

Programme	Name:M.Sc (Data Science)Semester: II	
	Total :	30
	<ul> <li>Medicine</li> <li>Natural Language Processing and Data Mining for Clinical Text, Mining the Biomedical- Social Media Analytics for Healthcare.</li> <li>Predictive Models for Integrating Clinical and Genomic Data, Privacy-Preserving Data, Publishing Methods in Healthcare</li> <li>Mobile Imaging and Analytics for Biomedical Data, Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems</li> </ul>	
	<ul> <li>Unit 2: Healthcare data Analysis:</li> <li>Biomedical Image and Signal Analysis, Genomic Data Analysis for Personalized</li> </ul>	15
Ι	<ul> <li>Systems- Benefits of EHR- Barrier to Adopting EHR Challenges</li> <li>Phenotyping Algorithms</li> <li>Statistical analysis of healthcare data- Measures of Central Tendency and Dispersion, Confidence Limits and Hypothesis Testing, Statistical Tests for Categorical Data, T-Tests for Related and Unrelated Data, Analysis of Variance</li> <li>Data Quality and Governance</li> </ul>	
	• Electronic Health Records– Components of EHR- Coding	

- Healthcare Business Intelligence + Website A Guide to Empowering Successful Data Reporting and Analytics Hardcover by LB Madsen (Author),2012
- 2. Practical Text Analytics: Interpreting Text and Unstructured Data for Business Intelligence (Marketing Science) 1st Edition by Dr. Steven Struhl,2016

# Course Category/Vertical: Elective

# Name of the Dept: Science and Techonology

# Course Title: Public Health Analytics Practical

Course Code:

Course Level:6.0

Type: Practical

Course Credit: 2 credits

Hours Allotted: 60 Hours

Marks Allotted: 50Marks

Course Objectives(CO):

- 1. **To develop practical skills in analysing public health data** using statistical tools and software for identifying health trends and patterns.
- 2. To apply data visualization and predictive techniques for evaluating health programs and supporting evidence-based public health decisions.

Course Outcomes (OC):

- Should be able to understand, visualize and infer healthcare data.
- Should be able to use linear regression and forecasting methods for predicting growth rates, expenditure or any other numeric variable related to the medical field.
- Should be able to demonstrate descriptive, diagnostic, and inferential statistics using Python, R or Excel
- Perform predictive analysis using machine learning algorithms and deep learning.
- Perform NLP and sentiment analysis.

Unit No.	Content	Hours
1	EHR data modeling, data mining, exploratory data analysis using tableau or power BI.	
2	Medical expenditure prediction	
3	A Twitter Healthcare data extraction, processing and sentiment analysis	

4	use keywords related to health (e.g., COVID-19 vaccine)	
5	Using classification algorithms in prediction of diseases	
6	Clinical Text Data Categorization and Feature Extraction	
7	Medical Image classification (x-rays)	
8	Image object detection using deep learning.	
9	Health forecasting using time-series.	
10	Heart sound classification using signal processing.	
Programme Name: M.Sc (Data Science) Semester: II		

# Course Category/Vertical: Elective

#### Name of the Dept: Science and Technology

#### Course Title: Social Media Analytics

Course Code:

Course Level:6.0

Type: Theory

Course Credit: 2 credits

Hours Allotted: 30 Hours

Marks Allotted: 50 Marks

# Course Objectives(CO):

- 1. **To understand the fundamentals of social media platforms** and their role in digital communication, marketing, and user engagement.
- 2. **To explore tools and techniques** for collecting, analysing, and interpreting social media data from various channels.
- 3. **To apply analytical methods** to measure campaign performance, sentiment analysis, and audience behaviour.
- 4. **To use social media insights** for strategic decision-making in business, branding, and public communication.

# **Course Outcomes (OC):**

- To understand and familiarize the learners with the concept of social media.
- Social media analytics integrates with the learners to understand the significance.
- Enable the learners to develop skills required for analyzing the effectiveness of
- social media.
- Familiarize the learner with different visualization techniques for social media
- decisions.
- Examine the ethical and legal implications of leveraging social media data.

Unit No.	Content	Hours
	Unit 1: Social Media Analytics: An Overview Core Characteristics of social media, Types of social media, social media landscape, Need for Social Media Analytics (SMA), Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Location Analytics - Sources of Location Data, Categories	15

Programme	Name: M.Sc (Data Science) Semester: II	1
	Total	30
	Case Study: LinkedIn	
	Terminologies, Network Analytics Tools.	
	Social Media Network Types, Types of Networks, Common Network	
	Social Media Network Analytics - Common Network Terms, Common	
	Correlations: Triangles, Clustering, and Assortative.	
	Graph Layout, Visualizing Network features, Scale Issues. Capturing	
	Connectivity, Centralization, Tie Strength & Trust. Network Visualization -	
	Describing the Networks Measures - Degree Distribution, Density,	
	Basics of Social Network Structure - Nodes, Edges & Tie	
	Unit 2: Social Network Structure, Measures & Visualization	15
	CaseStudy: Online Behavior on Twitter	
	KPI, formulating a Social Media Strategy, Managing Social Media Risks	
	Systems, understanding social media and Business Alignment, social media	
1	Recommendation systems, Traditional Vs social Recommendation	
т	Social Information Filtering: Social Sharing and filtering, Automated	
	of Location Analytics,	

- 1. Seven Layers of Social Media Analytics\_ Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, and Location Data, Gohar F. Khan, 2015
- 2. Analyzing the Social Web 1st Edition by Jennifer Golbeck, 2013
- 3. Mining the Social Web\_ Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites, Matthew A Russell, O,,Reilly, 2019
- 4. Charu Aggarwal (ed.), Social Network Data Analytics, Springer, 2011

# Useful Links

- 1. https://cse.iitkgp.ac.in/~pawang/courses/SC16.html
- 2. https://onlinecourses.nptel.ac.in/noc20\_cs78/preview
- 3. https://nptel.ac.in/courses/106106146
- 4. <u>https://7layersanalytics.com/</u>

#### Course Category/Vertical: Elective

#### Name of the Dept: Science and Technology

#### Course Title: Social Media Analytics Practical

Course Code:

Course Level:6.0

Type: Practical

Course Credit: 2 credits

Hours Allotted: 60 Hours

Marks Allotted: 50 Marks

# Course Objectives(CO):

- 1. **To gain hands-on experience with tools and techniques** for collecting, analyzing, and visualizing social media data from platforms like Twitter, Facebook, and Instagram.
- 2. To apply practical methods such as sentiment analysis, hashtag tracking, and engagement metrics to derive actionable insights for marketing and communication strategies.

# **Course Outcomes (OC):**

- To understand the fundamental concepts of social media networks.
- To Collect, monitor, store and track social media data
- To analyze and visualize social media data
- To design and develop social media analytics models.

Unit No.	Content	Hours
1	Study Various	60
	• Social Media platforms (Facebook, twitter, YouTube etc)	
	• Social Media analytics tools (Facebook insights, google analytics	
	netlyticetc)	
	• Social Media Analytics techniques and engagement metrics	
	(page level, post level, member level) using Gephi Tool	

2	Scrape an online Social Media Site for Data. Use python to scrape information from twitter. Exploratory Data Analysis and visualization of Social Media Data	
3	Create sociograms for the persons-by-persons network and the community- by- community network for a given relevant problem. Create a one-mode	
	node network for the same. Datasets: les-Misérables, Airlines, Internet Core Routers.	
4	Develop Content (text, emoticons, image, audio, video) based social media analytics model for business. (e.g., Content Based Analysis: Topic, Issue, Trend, sentiment/opinion analysis, audio, video, image analytics)	
5	Develop Structure based social media analytics model for any business. (e.g., Structure Based Models -community detection, influence analysis)	
6	Develop a dashboard and reporting tool based on real time social media data Using Power BI	
7	Use Google Visualization Charts to analyze social media data	
8	Analyze social media data Network Analysis with Orange Software	
9	Use Graph Neural Networks on the datasets (Planetoid Cora Dataset)/ Jazz Musicians Network.	
10	Analyze Twitter conversations to identify the most active and influential users using Machine Learning Algorithms with Gephi Tool.	

Programme Name:	M.Sc	(Data Science)	
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Course Category/Vertical:

Name of the Dept: Science and Technology

Course Title: On Job Training

Course Code:

Course Level:6.0

**Semester: II** 

Type: **Theory** Course Credit: 4 credits

Hours Allotted: 60 Hours

Marks Allotted: 100 Marks

Course Objectives(CO):

- 1. **To provide practical industry exposure** by allowing students to apply academic knowledge in real-world work environments and develop job-specific skills.
- 2. **To enhance professional competencies** such as communication, teamwork, problemsolving, and adaptability through hands-on experience in a professional setting.

**Course Outcomes (OC):** 

Sheth T. J. Education Society's Sheth N.K.T.T College of Commerce and Sheth J.T.T College of Arts, (Autonomous) Thane (W)

# A. Introduction

- On Job training (OJT) is an integral component of the M.Sc. Data Science program that provides students with a unique opportunity to bridge the gap between theoretical knowledge gained in the classroom and practical application in a real-world environment. This training aims to equip students with both technical and non-technical skills that are essential for success in the industry.
- By participating in OJT, students are able to apply the concepts and theories learned during their coursework to real-world scenarios. They gain hands-on experience, problem-solving skills, and a deeper understanding of how the industry operates. This practical exposure enhances their competence and confidence, preparing them to tackle the challenges they may encounter in their professional careers.
- From an organizational perspective, hosting OJT programs allows companies to gain insights into the curriculum and content of the M.Sc. Data Science program. They can provide valuable feedback on the relevance of the coursework and industry requirements, enabling academic institutions to continually improve the program's alignment with industry needs. This collaboration between academia and industry fosters a mutually beneficial relationship, ensuring that graduates are well-prepared for the job market.
- Moreover, OJT benefits the faculty members involved in the program. They have the opportunity to gain firsthand exposure to the industry and observe the type of work being performed. This experience enables them to enhance their teaching methodologies and delivery techniques, ensuring that they remain up-to-date with the latest industry practices. The insights gained from OJT also enable faculty members to provide relevant guidance and mentorship to students, preparing them for successful careers in the field of data science.

# **B. Enhancing Practical Skills through OJT**

- The OnJob Training (OJT) program spans 4-6 weeks, requiring a minimum of 120 hours of physical presence at the organization.
- Students are expected to find their own OJT placements, although the institution provides support and guidance in securing positions with reputable organizations.
- OJT must be conducted outside the home institution to expose students to real-world work environments.
- OJT covers any subject within the syllabus, allowing students to align their experience with their academic interests.
- In recognition of changing dynamics, some OJT sessions can be conducted online to accommodate virtual work environments.
- OJT will offer students the opportunity to apply classroom learning in a

real-world setting, fostering the development of technical and non-technical skills.

- Mutual Benefits: Organizations gain insights into the program's curriculum and industry requirements, enabling them to provide constructive feedback and enhance course relevance.
- OJT bridges the gap between theoretical knowledge and practical application, preparing students for successful careers in data science

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# C. Interning organization:

Students have the flexibility to pursue their OJT in various types of organizations, including but not limited to:

- Software Development Firms: Gain practical experience in software development and programming.
- Hardware/Manufacturing Firms: Learn about hardware design, manufacturing processes, and quality assurance.
- Small-Scale Industries/Service Providers: Explore opportunities in diverse sectors such as banking, clinics, NGOs, and professional institutions like CA firms or law firms.
- Civic Departments: Engage with local civic departments such as ward offices, post offices, police stations, or panchayats to understand their functioning and contribute to their activities.
- Research Centre"s/University Departments/Colleges: Contribute as research assistants or in similar roles for research projects or initiatives, fostering collaboration between academia and industry.

Note: The listed options provide a range of possible OJT placements, offering students valuable exposure to different sectors and professional settings.

# **D. OJT mentors:**

To enhance the learning experience and ensure the quality of the MSc program, each student participating in the OJT will be assigned two mentors: a faculty mentor from the institution and an industry mentor from the organization where the student is interning.

• **Industry Mentor Role:** The industry mentor plays a crucial role in guiding the student during the internship. They ensure that the internee fulfills the requirements of the organization and successfully meets the demands of the assigned project. Through their

expertise and experience, industry mentors provide valuable insights into real-world practices and industry expectations.

• Faculty Mentor Role: The faculty mentor serves as the overall coordinator of the OJT program. They oversee the entire internship

process and evaluate the quality of the OJT in a consistent manner across all students. The faculty mentor ensures that the OJT aligns with the program's objectives and provides valuable learning opportunities. They also facilitate communication between the institution, industry mentor, and student to ensure a fruitful OJT experience.

By having both an industry mentor and a faculty mentor, students benefit from a comprehensive guidance system that combines industry expertise and academic support. This dual mentoring approach ensures a well-rounded and rigorous OJT experience for every student in the program

# E. Submission of documentation for OJT

The student will make two documents as part of the OJT

- Online diary: This ensures that the student updates daily activity, which could be accessed by both the mentors. Daily entry can be of 3- 4 sentences giving a very brief account of the learning/activities/interaction taken place. The faculty mentor will be monitoring the entries in the diary regularly as shown in Appendix-I
- **OJT report:** A student is expected to make a report based on the OJT he or she has done in an organization. It should contain the following:
  - Certificate: A certificate in the prescribed Performa (given in Appendix II
    - and Appendix III) from the organization where the OJT was done.
  - **Title**: A suitable title giving the idea about what work the student has performed during the OJT.
  - **Description of the organization**: A small description of the organization where the student has interned
  - **Description of the activities** done by the section where the intern has worked: A description of the section or cell of the organization where the intern worked. This should give an idea about the type of activity a new employee is expected to do in that section of the organization.
  - **Description of work allottedand done by the intern:** A detailed description of the work allotted, and actual work performed by the intern during the OJT period. It shall be the condensed and structured version of the daily report mentioned in the online diary.
  - **Self-assessment**: A self-assessment by the intern on what he or she has learned during the OJT period. It shall contain both technical as well as interpersonal skills learned in the process.

#### F. Interaction between mentors:

To ensure the smooth conduct of the OJT a meet-up involving the intern, industry mentor, and the faculty mentor will be scheduled as a mid-term review. The meeting can preferably be online to save time and resources. The meeting ensures the synergy between all stakeholders of the OJT. A typical meeting can be of around 15 minutes where at the initial stage the intern brief about the work and interaction goes for about 10 minutes. This can be followed by the interaction of the mentors in the absence of the intern. This ensures that issues between the intern and the organization, if any, are resolved amicably.

#### G. OJT workload for the faculty:

Every student is provided with a faculty member as a mentor. So, a faculty mentor will have a few students under him/her. A faculty mentor is the overall in charge of the OJT of the student. He/she constantly monitors the progress of the OJT by regularly overseeing the diary, interacting with the industry mentor, and guiding on the report writing etc. Considering the time and effort involved, a faculty mentor who is in-charge of 20 students shall be provided by a workload of 3 hours.