

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce, and Science College, Ahmednagar
(Autonomous)
(Affiliated to Savitribai Phule Pune University, Pune)**



**National Education Policy (NEP)
Choice Based Credit System (CBCS)**

**Programme Skeleton and Syllabus of
Data Science (Minor)**

**Implemented from
Academic Year 2023-24**

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Board of Studies in Data Science

Sr. No.	Name	Designation
1.	Prof. Arun D.Gangarde	Chairman
2.	Prof.Priyamvada U. Patil	Member
3.	Prof.Bharati Danave	Member
4.	Dr.Shradhha V. Ingale	Member
5.	Prof.Aparna Kulkarni	Member
6.	Prof. Amit Apte	Academic Council Nominee
7.	Prof. Dr. Sanjeev Sabnis	Academic Council Nominee
8.	Dr. Chandrashekhar Patil	Vice-Chancellor Nominee
9.	Radhika Nimse	Alumni
10.	Dr. Shridhar D. Page	Industry Expert
11.	Mr. Milind Kanetkar	Member(co-opt)
12.	Dr.Harsha Hutridurga	Member(co-opt)

1. Prologue/ Introduction of the programme:

Artificial Intelligence and Data Science Programme prepare students with the skills to perform intelligent data analysis which is a key component in numerous real-world applications. During the past ten years, data science has emerged as one of the most high-growth, dynamic, and lucrative careers in technology. This course aims at providing not only the core technologies such as artificial intelligence, data mining and data modelling but also gives intensive inputs in the areas of machine learning and big data analytics. By the end of this course, the students will gain cross-disciplinary skills across fields such as statistics, computer science, machine learning, and logic, data scientists and will have career opportunities in healthcare, business, eCommerce, social networking companies, climatology, biotechnology, genetics, and other important areas. The major focus of this programme is to equip students with statistical, mathematical reasoning, machine learning, knowledge discovery, and visualization skills.

The Broad goals and objectives of the BSc(Data Science)are as follows :

- 1.To prepare students to develop strong analytical thinking skills and problem solving abilities that benefits graduate personally and professionally
2. While learning Data Science it is necessary to be aware with the skills of Artificial Intelligence to perform intelligent data analysis which is a key component in numerous realworld applications.
3. This course aims at providing not only the core technologies such as artificial intelligence, data mining and data modelling but also gives intensive inputs in the areas of machine learning and big data analytics and by the end of this course, the students will gain cross-disciplinary skills across fields such as statistics, computer science, machine learning, and logic, data scientists and will have career opportunities in healthcare, business, eCommerce, social networking companies, climatology, biotechnology, genetics, and other important areas.
4. The major focus of this programme is to equip students with statistical, mathematical reasoning, machine learning, knowledge discovery, and data visualization skills.
5. To achieve and demonstrate knowledge of statistical analysis techniques utilized in business decision making .
6. To explore,sort and analyze mega data from various sources in order to take advantage of Data Science applications and reach conclusions to optimize business processes for decision support.
7. To prepare necessary knowledge base for research and development in Computer Science

2. Programme Outcomes (POs) :

1. Data Science graduates will be able to design, and develop intelligent business applications to solve various industrial problems.
2. Students can use the latest tools and open source technologies to recommend the required solutions.
3. Students can figure out how to evaluate the ethical, legitimate, proficient and social standards of engineering knowledge and practices.
4. These graduates can also exhibit their domain knowledge in data handling, knowledge extraction, mobile and distributed application development, intelligence web/ecommerce development, database administration, computer hardware, networking, education and training and decision support systems using AI and Data Science tools and techniques.
5. Students will be able to analyze a given dataset and derive insights which provide value to the business and society at large
6. The syllabus also develops requisite professional skills and problem solving abilities for pursuing a career in domains like Healthcare, Business, Finance.
7. B.Sc. (Data Science) graduates can go for higher study in programmes like M.Sc. in Data Science and Big Data and Analytics to further add a professional touch to their knowledge and become ready for the corporate world.
8. Full Time Industry Project – Internship gives hands on experience in solving a real world problem

Credit Distribution: B.Sc.Data Science including Minor and OE and other courses.

	Type of Courses	III Yr	IV Yrs (Honours)	IV Yrs Research
Major Data Science	Discipline-Specific Courses (DSC)	46	74	66
	Discipline Specific Elective (DSE)	08	16	16
	Skill Enhancement Courses (SEC)	06	06	06
	Vocational Skill Courses (VSC)	08	08	08
	On-Job Training (OJT)	04	08	04
	Field Project (FP)	04	04	04
	Community Engagement and Service (CEP)	02	02	02
	Research project	00	00	12
	Research Methodology	00	04	04
	Total (I, II and III Year)	78	122	122
Minor	Minor	20	20	20
Other Courses	Open Elective (OE)/ Multidisciplinary Courses	12	12	12
	Indian Knowledge System	02	02	02
	Co-Curricular Courses	08	08	08
	Ability Enhancement Courses	08	08	08
	Value Education Courses	04	04	04
	Total	132	176	176

Programme Framework (Courses and Credits): B.Sc. Data Science (Minor)

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	4.5	MNR-1	BS-DS101	Fundamentals of Data Science	03
2.	I	II	4.5	MNR-2	BS-DS102	Data Visualization	03
3.	II	III	5.0	MNR-3	BS-DS103	Artificial Intelligence	03
4.	II	IV	5.0	MNR-4	BS-DS104	Image Processing	03
5.	III	V	5.5	MNR-5	BS-DS105	Deep Learning	04
6.	III	VI	5.5	MNR-6	BS-DS106	Natural Language Processing	04
							20

New Arts, Commerce and Science College, Ahmednagar (Autonomous) Syllabus B.Sc. Data Science (Minor)

Title of the Course: Fundamentals of Data Science								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-1	BS-DS101 T/P	02	01	03	60	30	70	100

Learning Objectives:

1. Understand the basics in Data Science.
2. Utilise EDA techniques
3. Understand Data Analytics using Advanced Excel

Course Outcomes (Cos):

After completion of the course student will :

1. Apply data visualisation in big-data analytics
2. Apply data pre-processing techniques
3. Be comfortable using commercial and open source tools such as the Excel for data analytics and visualization.

Detailed Syllabus:

Unit I	Introduction: 1.1 Big Data and Data Science - Big Data Analytics, 1.2 Business intelligence vs Big data 1.3 big data frameworks 1.4 Current landscape of analytics 1.5 data visualisation techniques, visualisation software 1.6 data repositories- analyst perspective 1.7 Business drivers for analytics 1.8 Typical analytical architecture 1.9 Drivers of Big data analytics 1.10 Role of data scientist in Big data ecosystem 1.11 Applications of Big data analytics	8
Unit II	Exploratory Data Analysis: 2.1 Exploratory Data Analysis (EDA) 2.2 Statistical measures 2.3 Basic tools (plots, graphs and summary statistics) of EDA	6
Unit III	Basic Statistical Inference : 3.1 Developing Initial Hypotheses 3.2 Identifying Potential Data Sources 3.3 EDA case study	8

	3.4 Testing hypotheses on means 3.5 Proportions and variances	
Unit IV	Data Analytics Lifecycle : 4.1 Need of Data analytic lifecycle 4.2 Key roles for successful analytic projects 4.3 Phases of Data analytic lifecycle: Discovery, Data Preparation, Model Planning, Model Building, Communicating Results, Operationalization	8
	Assignments	30
	Pivot Tables in Microsoft Excel: Creating Pivot Tables, More Pivot Table Functionality, Format pivot tables, Inserting Slicers, Multi-Select Option in Slicers, PivotTable Enhancements, Working with Pivot Tables, Inserting Pivot Charts.	
	Auditing Worksheets: Tracing Precedents, Tracing Dependents, remove precedent and dependent arrows, Showing Formulas, Check for errors frequently found in formulas	
	Working with Multiple Worksheets and Workbooks: Use Links and External References, use 3-D References, Consolidate Data.	
	Data Tools: Converting Text to Columns, Linking to External Data, Controlling Calculation Options, Data Validation, Using Data Validation, Consolidating Data, Goal Seek	
	Working with Others: Protecting Worksheets and Workbooks, Password Protecting a Workbook, Password Protecting a Worksheet, Password Protecting Ranges in a Worksheet, Marking a Workbook as Final.	
	Recording and Using Macros: Recording Macros, recording a Macro, Running Macros, Editing Macros, Adding Macros to the Quick Access Toolbar, Adding a Macro to the Quick Access Toolbar	
	Creating Sparklines and Random Useful Items: Sparklines, Inserting and Customizing Sparklines, Using Microsoft Translator, preparing a Workbook for Internationalization and Accessibility, Importing and Exporting Files, Importing Text Files, Copying Data from Excel to Word, Copying Charts from Excel to Word.	
	Use Excel in the Cloud: Save, Share, and collaborate with others using the clouds.	

Suggested Readings/Material:

REFERENCE BOOKS :

1. Doing Data Science, Straight Talk From The Frontline, Cathy O'Neil and Rachel Schutt, O'Reilly (2014).
2. Big Data and Business Analytics, Jay Liebowitz, CRC press (2013)
3. Introducing Data Science Big Data, Machine Learning, And More, Using Python Tools ,DAVY CIELEN ,ARNO D. B. MEYSMAN , MOHAMED ALI
4. Excel 2016 Bible 1st Edition, John Walkenbach, Wiley
5. Excel 2016 for Dummies, Greg Harvey
6. Excel: Quick Start Guide from Beginner to Expert, William Fischer

7.Excel 2016 from Scratch, Peter Kalmström

8.Microsoft Excel 2019 Pivot Table Data Crunching (Business Skills), Bill Jelen and Michael Alexander

9.Excel 2016 VBA and Macros, Tracy Syrstad

10.Advanced Excel Essentials is written, Jordan Goldmeier

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B.Sc. Data Science (Minor)

Title of the Course: Data Visualization								
Year: I					Semester: I			
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-2	BS-DS102T/P	02	01	03	60	30	70	100

Learning Objectives:

1. Familiarise students with basic concepts of data visualization.
2. Give an idea of data-analytic thinking, storytelling with data, data visualization using tableau 1.
3. Give an understanding of a decision analytic thinking, fitting a model to data.
4. Discuss the concept of visualizing model performance, data visualization using tableau 2, similarity, neighbors, and clusters.

Course Outcomes (Cos):

After completion of the course student will :

1. Understand the concept of data-analytic thinking.
2. Get in depth knowledge of the concept of data understanding; data preparation; modelling; evaluation; deployment. Analytic techniques and technologies.
3. Understand the use of storytelling with data and support vector machines, decision trees .
4. Be able to perform data visualization using tableau 1 and decision analytic thinking.
5. Be able to describe the fitting a model to data and visualizing model performance.

6. Be able to evaluate data visualization using tableau 2 and similarity, neighbors, and clusters.

Detailed Syllabus:

Unit I	Data-Analytic Thinking: 1.1 The Ubiquity of Data Opportunities, Data Processing and “Big Data” ,From Big Data 1.0 to Big Data 2.0 1.2 Data and Data Science Capability as a Strategic Asset. From Business Problems to Data Mining Tasks: Business Understanding; 1.3 Data Understanding; Data Preparation; Modeling; Evaluation; Deployment. Analytic techniques and technologies	6
Unit II	Story Telling with Data: 2.1 Importance of context ,Choosing an effective visual , Focus audience’s attention ,Thinking like designer . 2.2 Dissecting model visuals ;Lessons in story telling ;Putting it all together ; Case studies. 2.3 Introduction to Predictive Modeling: Linear Regression; Classification: Logistic, Regression, Support Vector Machines, Decision Trees.	6
Unit III	Building your first Visualization- 3.1 Creating Visual Analytics with tableau desktop, connecting to your data-How to Connect to your data, What are generated Values? Knowing when to use a direct connection, Joining tables with tableau, blending different data sources in a single worksheet 3.2 Chart types, Text Tables, Maps, bar chart, Line charts, Area Fill charts and Pie charts, scatter plot, Bullet graph, Gantt charts, Sorting data in tableau, Enhancing Views with filters, sets groups and hierarchies	9
Unit IV	Creating calculations to enhance your data- 4.1 What is aggregation, what are calculated values and table calculations, Using the calculation dialog box to create, Building formulas using table calculations, Using table calculation functions 4.2 Using maps to improve insights-Create a Standard Map View, Plotting your own locations on a map, Replace Tableau’s standard maps, Shaping data to enable Point-to-Point mapping. 4.3 Developing an Adhoc analysis environment- generating new data with forecasts, providing self evidence adhoc analysis with parameters, Editing views in tableau Server.	9
	Assignments	30
Assignment 1	Connect to data Sources	
Assignment 2	Create Univariate Charts	

Assignment 3	Create Bivariate and Multivariate charts	
Assignment 4	Create Maps	
Assignment 5	Calculate user-defined fields	
Assignment 6	Create a workbook data extract	
Assignment 7	Save a workbook on a Tableau server and web	
Assignment 8	Export images, data.	

Suggested Readings/Material:

Text books

- 1) Information Dashboard Design: Displaying Data for At-a-glance Monitoring” by Stephen Few
- 2) Beautiful Visualization, Looking at Data Through the Eyes of Experts by Julie Steele, Noah Iliinsky
Tableau your data-Daniel G. Murray and the Inter works BI team, Wiley Publications
3. Tableau Data Visualizaton Cookbook, AshutoshNandeshwar, PACKT publishing.
4. Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole NussbaumerKnafllic (2014)
5. ggplot2: Elegant Graphics for Data Analysis by Hadley Wickham (2009)

REFERENCE BOOKS:

1. Designing Data Visualizations: Representing Informational Relationships by Noah Iliinsky, Julie Steele (2011)
2. Alexandru C. Telea – “Data Visualization principles and practice” Second Edition, CRC Publications
3. Joshua N. Millign–“ Learning Tableau -2019” – Third Edition- Packt publication

Other references

1. The Accidental Analyst: Show Your Data Who’s Boss” by Eileen and Stephen McDanie