

C P Patel & F H Shah Commerce (Autonomous) College, Anand
PROGRAMME STRUCTURE
Master of Science
M.Sc. Data Science
Semester: 1

(Syllabus with effect from the Academic Year June 2024)

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| Course Objectives - For M.Sc. Data Science Semester-I Programme | <p>After successful completion of this course, the student will be able to:</p> <ol style="list-style-type: none"> 1. The primary objective of the M.Sc. in Data Science program is to develop skilled professional workforce that is prepared to address the increasing needs in the rapidly expanding area of big data analytics. 2. The program aims to provide skills in quantitative data analysis, data mining, data modeling and prediction, data storage and management, machine learning, big data processing, data visualization, multimedia big data, programming and communication skills. Get familiarity with aspects of Business Environment. 3. Value Added Course/ training and a large number of practical case studies have been integrated in the program to boost the learner confidence and market acceptability. |
| Programme Specific Outcome (PSO) - For M.Sc. Data Science Semester - 1 | <p>After successful completion of this semester, the student will be able to:</p> <ol style="list-style-type: none"> 1. Implement professional knowledge in setting up road map to be an entrepreneur and identify research areas. 2. Ability to develop skills to address and solve social and environmental problem with ethics and perform multidisciplinary projects with advance technologies and tools. 3. Data Science Post Graduates are able to become leaders in the society with the help of advanced knowledge and skill, which can empower them to analyses, design, develop and implement their learning to develop the society. |

| Course Type | Course Code | Course Title | T/P | Credit | Exam Duration Hours | Component of Marks | | |
|-------------------|-------------|--|-----|--------|---------------------|--------------------|----------|---------|
| | | | | | | Internal | External | Total |
| Core Courses | PG01CMDS01 | Programming in Python | T | 4 | 3 | 30/12 | 70/28 | 100/40 |
| | PG01CMDS02 | Data Structures and Algorithms | T | 4 | 3 | 30/12 | 70/28 | 100/40 |
| | PG01CMDS03 | Data Analysis using MS Excel | T | 4 | 3 | 30/12 | 70/28 | 100/40 |
| | PG01CMDS04 | Principles of Data Science | T | 4 | 3 | 30/12 | 70/28 | 100/40 |
| | PG01CMDS05 | Applied Mathematics | T | 4 | 3 | 30/12 | 70/28 | 100/40 |
| Practical Ability | PG01PMDS06 | Practical's of Python and Advance MS Excel | P | 5 | 3 | -- | 100/40 | 100/40 |
| | | Total | | 25 | | 150/60 | 450/180 | 600/240 |

3 (Lectures) + 1 (CSDS) + 1 (Assignments)

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| To Pass: | <ol style="list-style-type: none"> 1. At least 40% Marks in the University Examination in each paper and 2. At least 40% Marks in the individual Head of passing or 30% marks in aggregate at the internal tests conducted by the PG Centers |
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GUJARAT INSTITUTIONAL RATING FRAMEWORK (4 STAR)

AAA Reaccredited CGPA 3.56 – GRADE **A⁺** KCG-Dept of Edu. Got of Gujarat-April 2017

NAAC Reaccredited - CGPA 3.30 - GRADE **'A⁺'** UGC – MHRD, Govt of India – June 2022

Effective from the Academic Year 2024-2025

Master of Science (Data Science)

Semester –1

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|-----------------------------|------------|---------------------|-----------------------|
| Course Code | PG01CMD501 | Title of the Course | Programming in Python |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives | <ul style="list-style-type: none">To learn the fundamentals of the Python programming language. Understand development of procedural as well as object-oriented Python programs.To Learn Python uses with different Data Analysis factorsBrief learning about numpy, pandas and matplotlib librariesBuilt in functions with different libraries uses in Data Analytics |
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| Course Outcomes | <ul style="list-style-type: none">To study how to work with data and analyzing with different operation.For practical knowledge of python widely uses library with data manipulation and data visualization. |
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| Course Content | | |
|----------------|---|----------------|
| Unit | Description | Weight age (%) |
| 1. | Python Language Basics, Built in Data Structure, Function <ul style="list-style-type: none">Python Introduction, advantages of python over data science.Python Installation, Interpreter, IDEs (PyCharm) and Text EditorsData structure and sequences (Tuple, List Dict, Set, Built in Sequences Functions)Python basic Programming (conditionals, loops)Functions : Local, Scope, Lamda FunctionBuilt in Functions | 25% |
| 2. | Introduction and Basics of Numpy, Scipy <ul style="list-style-type: none">Numpyndarrays (Creation, Datatypes, Arithmatcs with ndarray)Universal Functions (UFancs), ScipyFuctionsAggregations between ndarraysSorting Arrays (K-Nearest Neighbors example)Linear Algebra, Pseudorandom Number GenerationBasic Indexing and Slicing with ndarray | 25% |

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| 3. | Data manipulation with Pandas <ul style="list-style-type: none">• Introduction of Pandas Data Structures (Series, Data Frames, Index)• Data Indexing and Selection• Arithmetic and Data Alignment• Concatenate, append, merge and join of combining Datasets• Aggregation and Grouping• Pivot tables, Pandas String Operations | 25% |
| 4. | Visualization with Matplotlib <ul style="list-style-type: none">• General Introduction about Matplotlib basics• Line Plots, Scatter Plots, Visualizing Errors• Histogram, Binnings and Density• Customizing Plot, Color bars, Ticks• Multiple Subplots• Three Dimensional Plotting in Matplotlib | 25% |

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| Teaching-Learning Methodology | Material for this course will be presented using multiple teaching approach: lecture and discussion, exploration and inquiry, cooperative groupwork, demonstrations, and presentations |
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| Evaluation Pattern | | |
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| Sr. No. | Details of the Evaluation | Weightage |
| 1. | Internal Written | 30% |
| 2. | Internal Continuous Assessment in the form of Quizzes, Seminars, Assignments, Attendance | |
| 3. | External Examination | 70% |

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| Suggested References: | |
|------------------------------|---|
| S r .No. | References |
| 1 | Python Data Science Handbook Essential Tools for Working with Data (O'REILLY) Jake VanderPlas |
| 2 | Python for Data Analysis DATA WRANGLING WITH PANDAS, NUMPY, AND IPYTHON (2 nd Edition) |
| 3 | Learning Python by Mark Lutz (4 th Edition) |
| 4 | Online Sources: https://www.w3schools.com/datascience/ds_python.asp https://www.geeksforgeeks.org/data-science-with-python-tutorial/ |

Master of Science (Data Science)**Semester –1**

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|------------------------------------|-------------------|----------------------------|---------------------------------------|
| Course Code | PG01CMD502 | Title of the Course | Data Structures and Algorithms |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives | <ul style="list-style-type: none"> To learn the basic and advanced data structure and algorithms for different problem solving in Data Science. To Learn Linked list for data maintain and uses with different operations Detail learning about all algorithms of difficult scenario Trees, Graphs algorithms study uses in Data Analysis. |
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| Course Outcomes | <ul style="list-style-type: none"> To study with data structures and analyzing with sorting and searching data. For Logical, knowledge of data structure widely uses algorithms with data manipulation. |
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| Course Content | | |
|-----------------------|--|-----------------------|
| Unit | Description | Weight age (%) |
| 1. | Overview Data Structures and Algorithms <ul style="list-style-type: none"> Introduction of Data Structure and Algorithms Definitions of Database, Record, Field, Key Databases VS. Data Structure Analysis of Algorithms Basic Data Structures, Types and Recursion | 25% |
| 2. | Stacks, Queues and Deques <ul style="list-style-type: none"> Basics of Stacks, Simple Arrays based Stack implementation Algorithms Reversing Data using a Stack. Basics of Queues, Simple Arrays based Queue implementation Algorithms Double-ended Queues, Simple Arrays based Dequeue implementation Algorithms | 25% |

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| 3. | Linked Lists Data Structure <ul style="list-style-type: none">• Singly Linked Lists Implementing Algorithms• Circular Linked Lists Implementing Algorithms• Doubly Linked Lists Implementing Algorithms• Sorting and Searching Algorithms (Merge sort, Quick sort)• Link base VS Array Based Sequences | 25% |
| 4. | Trees, Text Processing and Graphs <ul style="list-style-type: none">• Trees Definition and properties, Binary Trees algorithm• Tree Traversal Algorithms (Breath-First, In order)• Brute Force Text Processing Algorithm• Data Structure for Graphs• DFS and BFS Graphs Algorithm | 25% |

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| Teaching-Learning Methodology | Material for this course will be presented using multiple teaching approach: lecture and discussion, exploration and inquiry, cooperative group work, demonstrations, and presentations |
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| EvaluationPattern | | |
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| Sr. No. | Details of the Evaluation | Weightage |
| 1. | Internal Written | 30% |
| 2. | Internal Continuous Assessment in the form of Quizzes, Seminars, Assignments, Attendance | |
| 3. | External Examination | 70% |

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| Suggested References: | |
|------------------------------|---|
| S r .No. | References |
| 1 | Data Strcutres& Algorithms with python Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser |
| 2 | Problem Solving with Algorithms andDataStructuresRelease 3.0 Brad Miller, David Ranum |
| 3 | Data Structures & Algorithms in Python John Canning Alan Broder Robert Lafore |
| 4 | Online Sources: https://jovian.com/learn/data-structures-and-algorithms-in-python https://www.geeksforgeeks.org/python-data-structures-and-algorithms/ |

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Master of Science (Data Science)

Semester –1

| | | | |
|-----------------------------|------------|---------------------|----------------------------------|
| Course Code | PG01CMD503 | Title of the Course | Data Analysis using Office Tools |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives | <ul style="list-style-type: none">To learn heavily on Office Tools to prepare charts, tables, and professional reports that involve complex data.To Learn in-depth knowledge of pivot tables, audit and analyze worksheet data.Learn the most advanced formulas, functions, charts and types of financial analysis to be an Office Tool power user.Built in functions with different features about data analysis. |
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| Course Outcomes | <ul style="list-style-type: none">To study how to work with data and analyzing with different Office Features.For practical knowledge of Office Tools widely uses its features with data manipulation and data visualization. |
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| Course Content | | |
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| Unit | Description | Weight age (%) |
| 1. | Introduction of Spreadsheets Table <ul style="list-style-type: none">Basic Office Spread Sheets, import or export data.Deleting unnecessary columns and rows (Resize, Duplication etc.)Cleaning data for analysis (Formatting Data with Text Functions)Using validation to keep data cleanCleaning Data Containing Date ValuesConditional Formatting | 25% |
| 2. | Sorting, Filtering, Ranges and Quick Function <ul style="list-style-type: none">Sort by Text, Number, Date or Time etc.Filtering by Text, Date, and Color etc.Subtotals with specific rangesQuick analysis with Totals: Sum, Avg, Count, %Total, Sum of Columns | 25% |

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| 3. | Advanced Excel Function, Pivot Tables & Pivot Charts <ul style="list-style-type: none">• VLOOKUP Function Introduction• VLOOKUP Function with range_lookup• HLOOKUP Function Introduction• HLOOKUP Function with range_lookup• Index and Match Function• Working with pivot tables and Charts | 25% |
| 4. | Advanced Data Analysis <ul style="list-style-type: none">• Data Visualization (Bar Chart, Gantt Chart etc.)• Financial Analysis (Calculating Interest Rate, Term of Loan, Decisions on Investments)• Data Consolidation• What-If Analysis (What-If Analysis with Scenario Manager)• Statistics Functions uses (Standard Deviation, Normal Distribution) | 25% |

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| Teaching-Learning Methodology | Material for this course will be presented using multiple teaching approach: lecture and discussion, exploration and inquiry, cooperative group work, demonstrations, and presentations |
|--------------------------------------|---|

| Evaluation Pattern | | |
|---------------------------|--|-----------|
| Sr. No. | Details of the Evaluation | Weightage |
| 1. | Internal Written | 30% |
| 2. | Internal Continuous Assessment in the form of Quizzes, Seminars, Assignments, Attendance | |
| 3. | External Examination | 70% |

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| Suggested References: | |
|------------------------------|---|
| S r .No. | References |
| 1 | Excel Data Analysis For Dummies, 2nd Edition Published by: John Wiley & Sons, Inc |
| 2 | Data Analysis with Excel 2016 by Tutorials Point (I) Pvt. Ltd |
| 3 | Advanced Data Analysis: F anced Data Analysis: From Excel Pivcel PivotTables t ables to Microsoft Christopher C. Brown Denise Pan Gabrielle Wiersma |
| 4 | Online Sources: https://www.tutorialspoint.com/advanced_excel/advanced_excel_instant_data_analysis.htm https://support.microsoft.com/en-us/office/analyze-data-in-excel-3223aab8-f543-4fda-85ed-76bb0295ffc4 |

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Effective from the Academic Year 2024-2025

Master of Science (Data Science) Semester –1

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|-----------------------------|------------|---------------------|----------------------------|
| Course Code | PG01CMD504 | Title of the Course | Principles of Data Science |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives | <ul style="list-style-type: none">• Explore the fundamental concepts of data science.• Understand data analysis techniques for applications handling large data.• Visualize and present the inference using various tools• Built in functions with different features about data analysis.• Develop and appreciate various techniques for data modeling and mining.• Preparation, analysis, modeling and visualization of data, covering both conceptual and practical issues. |
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| Course Outcomes | <ul style="list-style-type: none">• To provide strong foundation for data science and application area related to information technology and understand the underlying core concepts and emerging technologies in data science.• Recognize various disciplines to a successful data science effort. |
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| Course Content | | |
|----------------|---|----------------|
| Unit | Description | Weight age (%) |
| 1. | Introduction to core concepts and technologies <ul style="list-style-type: none">• Introduction, Terminology, data science process, data science toolkit, Types of data, Example Application• Data science needs and features• Importance of data science in modern business• Current trends in data science• Analytical techniques• Jobs in data science | 25% |
| 2. | Basic factors for Data <ul style="list-style-type: none">• What is data? Types of digital data• Working with structured and unstructured data• Natural language and Machine generated data• Graph based or Network data• Audio, Image and Video data, Data streaming | 25% |

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| 3. | Data science process <ul style="list-style-type: none">• Setting the research goal• Retrieving or Collecting Data• Data preparation, Validating• Data exploration and modeling• Resulting analysis, Presentation and Automation• Benefits of data science process | 25% |
| 4. | Advanced Data Science management <ul style="list-style-type: none">• Data Aggregation, Integration• Data warehouse, Data mining• Transactional Data – Biological Data – Spatial Data – Social Network Data – Data Evolution• Advance data management and analysis• Data Visualizations | 25% |

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| Teaching-Learning Methodology | Material for this course will be presented using multiple teaching approach: lecture and discussion, exploration and inquiry, cooperative group work, demonstrations, and presentations |
|--------------------------------------|---|

| EvaluationPattern | | |
|--------------------------|--|------------|
| Sr. No. | Details of the Evaluation | Weightage |
| 1. | Internal Written | 30% |
| 2. | Internal Continuous Assessment in the form of Quizzes, Seminars, Assignments, Attendance | |
| 3. | External Examination | 70% |

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| Suggested References: | |
|------------------------------|---|
| S r .No. | References |
| 1 | Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016 |
| 2 | Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018 |
| 3 | Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015 |
| 4 | Online Sources: https://www.javatpoint.com/data-science https://www.heavy.ai/learn/data-science |

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**Master of Science (Data Science)
Semester –1**

| | | | |
|-----------------------------|-------------------|---------------------|----------------------------|
| Course Code | PG01CMDS05 | Title of the Course | Applied Mathematics |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives | <ul style="list-style-type: none">• To some basic mathematical ideas and tools which are at the core of any engineering course.• A brief course in Linear Algebra familiarizes students with some basic techniques in matrix theory, which are essential for analyzing linear systems.• The course is a brief overview of the basic tools from Linear Algebra and Multivariable Calculus that will be needed in subsequent course of the program. |
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| Course Outcomes | <ul style="list-style-type: none">• Fundamental properties of matrices, their norms, and their applications.• Basic properties of optimization problems involving matrices and functions of multiple variables. |
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| Course Content | | |
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| Unit | Description | Weight age (%) |
| 1. | Matrices <ul style="list-style-type: none">• Matrices and Basic Operations, Special structures Matrices and Basic Operations. Interpretation of matrices as linear mappings and some examples.• Rank of a matrix, Echelon form, consistency of linear System of equations, Linear dependence of vectors, Eigen values, Eigenvectors.• Square Matrices, Determinants, Properties of determinants, singular and non-singular matrices, examples, finding an inverse matrix. | 25% |

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| 2. | <p>Correlation and Regression</p> <ul style="list-style-type: none"> Correlation: Covariance, Calculation of covariance, correlation analysis and Correlation Coefficient calculated from ungrouped data. Regression: Simple linear Regressions analysis, regression coefficients, Linear regression line or equation.. | 25% |
| 3. | <p>Boolean Algebra</p> <ul style="list-style-type: none"> Boolean Function Law of Boolean Algebra, Complement law of Boolean Algebra Properties and use of Boolean Algebra. | 25% |
| 4. | <p>Transportation Problem</p> <ul style="list-style-type: none"> Transportation Problem - N-W corner rule, matrix Minima Method, Vogel's Approximation Method (Including unbalanced). | 25% |

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| EvaluationPattern | | |
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| Sr. No. | Details of the Evaluation | Weightage |
| 1. | Internal Written | 30% |
| 2. | Internal Continuous Assessment in the form of Quizzes, Seminars, Assignments, Attendance | |
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| Suggested References: | |
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| S r .No. | References |
| 1 | Sastry, S.S, Engineering Mathema[cs", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014. |
| 2 | Gilbert Strang, Linear Algebra and its Applications. Thomson /Brooks Cole (Available in a Greek Translation). |
| 3 | A.J. Patel, H.S. Doshi: Operations Research, Himalaya Publishing House. |
| 4 | Sancheti & Kapoor: Statistic: Theory, Methods and Applications, Sultan Chand & Sons, New Delhi |
| 5 | Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2010 |

C P PATEL AND F H SHAH COMMERCE (AUTONOMOUS) COLLEGE, ANAND

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GUJARAT INSTITUTIONAL RATING FRAMEWORK (4 STAR)

AAA Reaccredited CGPA 3.56 – GRADE **A⁺** KCG-Dept of Edu. Got of Gujarat-April 2017

NAAC Reaccredited - CGPA 3.30 - GRADE **'A⁺'** UGC – MHRD, Govt of India – June 2022

Effective from the Academic Year 2024-2025

| Suggested References: | |
|------------------------------|--|
| S r .No. | References |
| 1 | Sastry, S.S (2014) Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi |
| 2 | Gilbert Strang, Linear Algebra and its Applications. Thomson /Brooks Cole. |
| 3 | Wylie, R.C. and Barre, L.C (2012): Advanced Engineering Mathematics —Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi |
| 4 | B.S. Grewal (2017): Higher Engineering Mathematics, Khanna Publishers, 44th Edition, |
| 5 | Erwin Kreyszig (2010): Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, |

Master of Science (Data Science)**Semester –1**

| | | | |
|------------------------------------|-------------------|----------------------------|---|
| Course Code | PG01CMDS06 | Title of the Course | Practical's of Python and Advance Office Tools |
| Total Credits of the Course | 05 | Hours per Week | 10 |

| | |
|--------------------------|---|
| Course Objectives | <ul style="list-style-type: none"> To provide practical experience of Python programming To provide practical experience off working with Office Tools. To familiarize students with Data Science Libraries in Python. Financial applications in Office Tools. Data science application in python. |
|--------------------------|---|

| | |
|------------------------|---|
| Course Outcomes | <ul style="list-style-type: none"> Gain knowledge of developing Python programs and applications. Create and manipulate Office Tools functionality for data analysis. |
|------------------------|---|

| Course Content | | |
|-----------------------|--|-----------------------|
| | Description | Weight age (%) |
| | Part-1 : Practical based on PG01CMDS01 | 50% |
| | Part-2 : Practical based on PG01CMDS03 | 50% |

| | |
|--------------------------------------|---|
| Teaching-Learning Methodology | Blended learning approach incorporating traditional classroom teaching as well as online / ICT-based teaching practices |
|--------------------------------------|---|

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Effective from the Academic Year 2024-2025

| EvaluationPattern | |
|--|------------|
| Details of the Evaluation | Weightage |
| Internal Written / Practical Examination (As per CBCS R.6.8.3) | 15% |
| Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3) | 15% |
| External Examination | 70% |