**Department of Data Science (PG)**

**Programme Specific Outcomes (PSOs)**

On the successful completion of the Postgraduate programme, the students will be able to

| | |
|---|---|
| **PSO1 Disciplinary Knowledge** | apply advanced theoretical concepts, analytical frameworks, and methodologies in data science to encourage deep and nuanced comprehension essential for scholarly and professional endeavors. |
| **PSO2 Communication Skills** | nurture collaborative environments and enhance professional relationships in various academic and professional contexts through proficient verbal, written, and non-verbal communication skills. |
| **PSO 3 Problem Solving & Analytical Reasoning** | apply problem-solving methodologies and analytical reasoning to address complex challenges in data science across diverse contexts. Demonstrate the capacity to effectively analyze information, identify innovative solutions, and make decisions contributing effectively in the field of data science. |
| **PSO 4 Critical Thinking** | exhibit advanced critical thinking skills by effectively analyzing complex problems, synthesizing diverse information, and generating innovative solutions in data science |
| **PSO 5 Research Skills** | contribute to advancing knowledge in the field of data science through critical thinking, scholarly integrity, and innovative research. |
| **PSO 6 Digital Literacy** | excel in diverse professional environments through proficient use of digital tools and technologies. |
| **PSO 7 Professional competencies** | navigate dynamic professional environments and achieve organizational goals through innovative thinking and collaboration in data science projects |
| **PSO 8 Moral and Ethical Awareness/Reasoning** | integrate ethical principles into professional practice and foster integrity, accountability, and responsible decision-making. |
| **PSO 9 Multicultural Competence** | communicate, collaborate, and lead effectively in multicultural environments in data science projects, embracing the richness of cultural diversity. |
| **PSO 10 Self-directed & Lifelong Learning** | continuously assess learning needs, expand expertise, and adapt to complex and dynamic data science contexts, fostering a commitment to lifelong learning and growth. |

**Department of Data Science (PG)**

**Learning Outcome - Based Curriculum Framework (LOCF)**

**(w.e.f 2024-2025)**

| Sem | Category | Course Code | Course Title | Hours/ Wk. | Credits | Marks |
|---|---|---|---|---|---|---|
| 1 | CC | 24PDS4401 | Python Programming | 6 | 4 | 80 |
| 1 | CC | 24PDS4403 | Fundamentals of Data Science | 5 | 4 | 80 |
| 1 | CC | 24PDS4405 | Mathematics for Data Science | 5 | 4 | 80 |
| 1 | CC | 24PDS4407 | Python Programming – Lab | 5 | 4 | 80 |
| 1 | *DSE* | 24XXXNNNN | *Discipline Specific Elective - I* | 5 | 4 | 80 |
| 1 | *GE* | 24XXXNNNN | *Generic Elective – I* | 4 | 3 | 60 |
| | **Total** | | | **30** | **23** | **460** |
| 2 | CC | 24PDS4402 | Big Data Analytics | 6 | 4 | 80 |
| 2 | CC | 24PDS4404 | Artificial Intelligence | 5 | 4 | 80 |
| 2 | CC | 24PDS4406 | Statistics – I | 5 | 4 | 80 |
| 2 | CC | 24PDS4408 | Big Data Analytics - Lab | 5 | 4 | 80 |
| 2 | *DSE* | 24XXXNNNN | *Discipline Specific Elective -II* | 5 | 4 | 80 |
| 2 | *GE* | 24XXXNNNN | *Generic Elective – II* | 4 | 3 | 60 |
| | **Total** | | | **30** | **23** | **460** |
| 3 | CC | 24PDS5401 | Machine Learning | 5 | 4 | 80 |
| 3 | CC | 24PDS5403 | Machine Learning – Lab | 5 | 4 | 80 |
| 3 | CC | 24PDS5405 | Databases for Data Science (TcL) | 5 | 4 | 80 |
| 3 | CC | 24PDS5407 | Statistics – II | 5 | 4 | 80 |
| 3 | CC | 24PDS5409 | Data Mining & Warehousing | 5 | 4 | 80 |
| 3 | *DSE* | 24XXXNNNN | *Discipline Specific Elective-III* | 5 | 3 | 60 |
| 3 | IS | 24XXX5233 | Internship* | - | 2 | 40 |
| | **Total** | | | **30** | **25** | **500** |
| 4 | CC | 24PDS5402 | Data Visualization(TcL) | 5 | 4 | 80 |
| 4 | CC | 24PDS5404 | Cloud Computing | 5 | 4 | 80 |
| 4 | CC | 24PDS5406 | Deep Learning | 5 | 4 | 80 |
| 4 | CC | 24PDS5302 | Deep Learning - Lab | 4 | 3 | 60 |
| 4 | CC | 24PDS5502 | Project | 6 | 5 | 100 |
| 4 | *DSE* | 24XXXNNNN | *Discipline Specific Elective-IV* | 5 | 3 | 60 |
| 4 | *SEC* | 24XXX5244 | *Professional Competency Skill* | - | 2 | 40 |
| | **Total** | | | **30** | **25** | **500** |
| **Grand Total** | | | | **120** | **96** | **1920** |

* Internship - First Year Vacation (30 Hrs.)

## Part III

### Discipline Specific Elective (DSE)

| Sem | Part | Course Code | Course Title | Hours /Wk. | Credits | Marks |
|---|---|---|---|---|---|---|
| 1 | III | 24PDS4409 | Internet of Things (TcL) | 5 | 4 | 80 |
| | | 24PDS4411 | Data structures and Algorithms (TcL) | | | |
| 2 | III | 24PDS4410 | Software Engineering for Data Science | 5 | 4 | 80 |
| | | 24PDS4412 | Information Security & Ethics | | | |
| 3 | III | 24PDS5301 | Natural Language Processing (TcL) | 5 | 3 | 60 |
| | | 24PDS5303 | Reinforcement Learning (TcL) | | | |
| 4 | III | 24PDS5304 | Web Analytics | 5 | 3 | 60 |
| | | 24PDS5306 | Social Media Analytics | | | |

### Generic Elective (GE)

| Sem | Part | Course Code | Course Title | Hours/Wk. | Credits | Marks |
|---|---|---|---|---|---|---|
| 1 | III | 24PDS4301 | Data Analytics using Excel (TcL) | 4 | 3 | 60 |
| | | 24PDS4303 | Web Programming (TcL) | | | |
| 2 | III | 24PDS4302 | Data Analysis using Tableau (TcL) | 4 | 3 | 60 |
| | | 24PDS4304 | Multimedia Analytics (TcL) | | | |

## Mapping with POs

| PDS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |

## Mapping of Courses with PSOs

| Courses | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 24PDS4401 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| 24PDS4403 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| 24PDS4405 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |
| 24PDS4407 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| 24PDS4409/ 24PDS4411 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| 24PDS4402 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| 24PDS4404 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| 24PDS4406 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |
| 24PDS4408 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| 24PDS4410/ 24PDS4412 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| 24PDS5401 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| 24PDS5403 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| 24PDS5405 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| 24PDS5407 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| 24PDS5409 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 |
| 24PDS5301/ 24PDS5303 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| 24PDS5233 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 |
| 24PDS5402 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 |
| 24PDS5404 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| 24PDS5406 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| 24PDS5302 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| 24PDS5502 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 |
| 24PDS5304/ 24PDS5306 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 |
| 24PDS5244 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 |
| **Average** | **2.9** | **2.8** | **2.7** | **2.5** | **2.2** | **2.1** | **1.7** | **1.4** | **1.1** | **1.1** |

## Mapping of Courses with POs

| Courses | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 24PDS4301/ 24PDS4303 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| 24PDS4302/ 24PDS4304 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **3** | **2.5** | **2** | **2** | **2** | **2** | **1** | **1** | **1** |

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4401 | Python programming | Core | 6 | 4 |

To be able to think logically and develop interactive programs using the python constructs functions, data structures, classes and objects, files.

**Course Outcomes**

At the end of the course, students will be able to

**CO1:** to assess the fundamentals of Python and Mathematical Functions

**CO2:** design the basic concepts of Python Strings and Functions

**CO3:** formulate the fundamental Classes, Objects and GUI techniques

**CO4:** support to generate the information on List and File handling

**CO5**: to examine Tuple, dictionary and Database concepts

**UNIT-I** **18 Hours**

**Introduction -** Computer and its components - Programming Languages - Operating Systems - The history of Python - Introduction to python programming - Programming Style and Documentation - Programming Errors - Introduction to Graphics Programming**Elementary Programming** - Input - Output - Identifiers - Variables, Assignment Statements and Expressions - Numeric Data Types and Operators - Evaluating Expressions and Operator Precedence - Type Conversion - Different forms of if statements.**Mathematical Functions** - Introduction - Common Python Functions – Mathematical functions.

**UNIT-II** **18 Hours**

**Loops** - Introduction - while, for, Nested Loops - break and Continue **Functions** - Introduction - Defining and calling a function - Return single and multiple values - Positional, Keyword and Default Arguments - Passing Arguments by Reference Values - Modularizing Code – Function

**Strings:** Strings: A string is a sequence, Getting the length of a string using len, Traversal through a string with a loop, String slices, Strings are immutable, Searching, Looping and counting, The in operator, String comparison, String methods, Format operator

**UNIT-III** **18 Hours**

**Objects and Classes** - Introduction - Defining Classes for Objects - Immutable vs Mutable Objects - Hiding Data Fields - Class Abstraction and Encapsulation **Inheritance and Polymorphism** - Super classes and Subclasses - Overriding methods - Operator Overloading - Object class. **GUI** - Buttons and Callbacks, Canvas Widgets, Coordinate Sequence, More Widgets, Packing Widgets, Menus and Callbacks, Binding

**UNIT-IV** **18 Hours**

Lists - Basics - Copying Lists - Passing Lists to Functions - Returning a List from a Function - Searching, Sorting Lists - List Comprehension, List arguments, Passing List to a function, List Processing.Files and Exception Handling – Files: Persistence, Opening files, Reading and Writing files, Format Operator, File names and Paths, Searching through a file, Letting the user choose the file name -Retrieving Data from Web - Exception Handling - Raising Exceptions.

**UNIT-V** **18 Hours**

**Tuples, Sets and Dictionaries** – Introduction - Tuples - Sets - Comparing the Performance of Sets and Lists – Dictionaries,**Python's Database Connectivity** - Types of Databases Used with Python, Working with MySQL Database, Using MySQL from Python, Retrieving All Rows from a Table, Inserting Rows into a Table, Deleting Rows from a Table, Updating Rows in a Table, Creating Database Tables through Python

**Learning Resources**

**Text Books**

1.Y. Daniel Lang, Introduction to Programming using Python, 2nd Edition, Pearson Education Inc., 2013.

**Reference Books**

1. Allen B. Downey. Think Python. How to Think Like a Computer Scientist, 2nd Edition, O 'Reilly Publishers, 2016.

2. Corey Wade, et al: The Python Workshop, 2nd Edition, Packt, 2022.

3. David Beazley, Brian K. Jones. Python Cookbook: Recipes for Mastering Python 3, 3rd Edition, 2013 Harsh Bhasin. Python for Beginners. New Age International Publishers, 2018.

4.Martin C. Brown. Python: The Complete Reference. McGraw Hill Education; Fourth Edition, 2018.

**Websites**

1.https://realpython.com, http://docs.python.org, http://diveintopython.org/,

2.https://www.w3schools.com/python/,

3. https://www.tutorialspoint.com/python/index.html

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO2** | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **CO4** | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **CO5** | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **2.4** | **2.2** | **2** | **1.8** | **1.6** | **1.6** | **1** | **1** | **1** |

Strong – 3 Medium – 2 Low – 1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4403 | Fundamentals of data science | Core | 5 | 4 |

The course on foundations of data science provides students with a comprehensive understanding of the fundamental principles and techniques used in analyzing and interpreting data. Students gain practical skills and theoretical knowledge essential for exploring and extracting valuable insights from complex data sets.

**Course Outcomes:**

At the end of the course, students will be able to

**CO 1:** formulate the types of data and analytics, data science process, and its life cycle.

**CO 2:** design math in data science

**CO 3:** examine the various data intensive operations and tools

**CO 4:** assess the tools and methods for analyzing the data

**CO 5:** examine the recent potential applications and development of data science with realtime case studies

**UNIT-I** **15 Hours**

Introduction of data science: Data Science – Data science Venn diagram - Basic terminology – Types of data – levels ofdata- Types of data analytics - Descriptive analytics-Diagnostic analytics- Predictive analytics- Prescriptive analytics

**UNIT-II** **15 Hours**

Mathematical preliminaries: Basic Maths – basic symbols and terminology-Linear Algebra Basic Probability – definitions- probability – compound events – conditional probability

**UNIT-III** **15 Hours**

Data mining and data warehousing: Introduction to Data warehousing – Design consideration of data warehouse - Data loading process– Data mining – Data mining techniques – Tools and platforms – case study

**UNIT-IV** **15 Hours**

Visualizing data: Exploratory Data Analysis – Developing the visual aesthetic – chart types – Greatvisualizations – Reading graphs – Interactive visualizations

**UNIT-V** **15 Hours**

Data science – recent trends : Applications of Data Science, recent trends in various data collection and analysis techniques, various visualization techniques.

**Learning Resources**

**Text Books**

1. Ozdemir, Sinan. Principles of data science. Packt Publishing Ltd, 2016.
(Unit 1- Chapter1,2,3 Unit 2.1 – Chapter 4, Unit 2.2 – Chapter 5 )

2. Maheshwari, Anil. "Data analytics made accessible." Seattle: Amazon Digital Services, 2nd edition (2023)(Unit 3 – Chapter 3 and 4)

3. Skiena, Steven S. The data science design manual. Springer, 2017.
(Unit 4- chapter 6)

**Reference Books**

1. Hadrien Jean.Education, C. (2023). Data Science. Certybox Education.

2. Pierson, Lillian. Data science for dummies. John Wiley & Sons, 2021.

3. Grus, Joel. Data science from scratch: first principles with python. O'Reilly Media, 2019.

4. Blum, Avrim, John Hopcroft, and Ravindran Kannan. Foundations of data science. Cambridge University Press, 2020.

**Websites**

1 .https://www.analyticsvidhya.com/

2.https://www.simplilearn.com

3.https://www.ibm.com/in-en/topics/data-science

4. https://www.mygreatlearning.com/blog/what-is-data-science/

## CO – PSO Mapping

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **2.6** | **2.4** | **2.2** | **2** | **1.6** | **1.4** | **1.2** | **1.2** | **1** |

Strong – 3 Medium – 2 Low – 1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4405 | Mathematics for Data Science | Core | 5 | 4 |

This course aims to learn the concept in building the mathematical background necessary to understand and implement in data science practical/research work.

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO1:** demonstrate understanding of basic mathematical concepts in data science, relating to linear algebra.

**CO2:** describe properties of linear systems using vectors, perform and interpret matrix Operations.

**CO3:** describe and compute orthogonality and determinants.

**CO4:** solve linear differential equations.

**CO5:** understand and apply the concept of linear transformations.

**UNIT-I** **15 Hours**

Matrices and Solving Linear Equations Ax = b:Matrices and Their Column Spaces-Matrix Multiplication AB and CR-Elimination and Back Substitution-Elimination Matrices and Inverse Matrices-Matrix Computations and A = LU

**UNIT-II** **15 Hours**

Vectors Spaces: Vectors and Linear Combinations-Lengths and Angles from Dot Products-Vector Spaces and Subspaces-Computing the Nullspace by Elimination: A = CR-The Complete Solution to Ax = b-Independence, Basis, and Dimension-Dimensions of the Four Subspaces

**UNIT-III** **15 Hours**

Orthogonality and Determinants : Orthogonality of Vectors and Subspaces-Projections onto Lines and Subspaces-Least Squares Approximations - 3 by 3 Determinants and Cofactors-Computing and Using Determinants-Areas and Volumes by Determinants

**UNIT-IV** **15 Hours**

Eigen values and Eigenvectors: Introduction to Eigen values : $Ax = \lambda x$ - Diagonalizing a Matrix-Symmetric Positive Definite Matrices-Complex Numbers and Vectors and Matrices

**UNIT-V** **15 Hours**

Linear Transformations : The Idea of a Linear Transformation-The Matrix of a Linear Transformation-The Search for a Good Basis

**Learning Resources**

**Text Book**

1.Gilbert Strang, Introduction to Linear Algebra, Wellesley - Cambridge Press, Sixth Edition, 2023

**Unit 1:** Chapter 1: sections: 1.3, 1.4, Chapter 2: section: 2.1- 2.3

**Unit 2:** Chapter 1: sections: 1.1, 1.2, Chapter 3: section: 3.1-3.5

**Unit 3:** Chapter 4: section: 4.1 - 4.3, chapter 5: section 5.1 - 5.3

**Unit 4:** Chapter 6: section: 6.1- 6.4

**Unit 5:** Chapter 8: section: 8.1 - 8.3

**Reference Books**

1. David Lay, Steven Lay, Judi McDonald, Linear Algebra and Its Applications 5th Edition, Pearson's

2. Sheldon Axler, Linear Algebra Done Right (Undergraduate Texts in Mathematics) 3rd ed., Springer, 2015 Edition

3. Jim Jefferson, Linear Algebra, Fourth edition

4. Jeff M Philips, Mathematical Foundations for Data Analysis

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 |
| **CO 2** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 |
| **CO 3** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **CO 4** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **CO 5** | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 2 | 2 |
| **Average** | **3** | **3** | **3** | **3** | **2.8** | **2** | **2** | **2.2** | **2.4** | **2** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4407 | Python programming – Lab | Core | 5 | 4 |

To be able to apply appropriately the python programming knowledge gained and develop computer based solutions for a given problem

**Course Outcomes:**

At the end of the course, students will be able to

**CO 1:** Recall the components of a computer; demonstrate the appropriate use of data types, mathematical functions and strings in a program

**CO 2:** State the use of selection and looping constructs, compare and choose an appropriate construct for a given problem

**CO 3:** Develop modular programming using functions, Design program using OO constructs

**CO 4:** Demonstrate Strings and Lists, implement Lists and Strings appropriately, design new problems using appropriate data structures

**CO 5:** Demonstrate Tuples, sets, dictionaries and files, compare programs with and without files, develop applications using different data structures

**UNIT-I** **15 Hours**

1. Installation of the required software
2. Programs using basic data types and operators
3. Programs involving Mathematical functions
4. Program in String Manipulations

**UNIT-II** **15 Hours**

1. Programs using different forms of if statement
2. Drawing various shapes using turtle
3. Programs involving repeated execution of a set of statements
4. Programs using break and continue
5. Programs using random

**UNIT-III** **15 Hours**

1. Modular programming using functions
2. Programs using classes and objects
3. Programs using Inheritance

**UNIT-IV** **15 Hours**

1. Programs on Files and Exception handling
2. Programs using Lists and List manipulation

**UNIT-V** **15 Hours**

1. Programs using Tuple and its methods
2. Programs with Set and Set manipulation
3. Programs using Dictionaries
4. Program comparing the performance of Sets and Lists

**Learning Resources**

**Text Book**

1. Y. Daniel Lang, Introduction to Programming using Python, 2nd Edition, Pearson Education Inc., 2013.

**References Books**

1. Allen B. Downey. Think Python. How to Think Like a Computer Scientist, 2ndedition, O'Reilly Publishers, 2016.
2. Corey Wade, et al : The Python Workshop, 2nd Edition, Packt, 2022.
3. David Beazley, Brian K. Jones. Python Cookbook: Recipes for Mastering Python 3, 3rd Edition, 2013 Harsh Bhasin. Python for Beginners. New Age International Publishers, 2018.
4. Martin C. Brown. Python: The Complete Reference. McGraw Hill Education; Fourth edition, 2018.

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO5** | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.8** | **2.4** | **2.4** | **2.2** | **2** | **1.8** | **1.4** | **1.2** | **1.2** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4409 | Internet of things | DSE | 5 | 4 |

The course on the Internet of Things(IoT) explores the interconnected world of devices, sensors and systems that communicate and exchange data. This course equips students with the knowledge and skills to harness the power of IoT technologies and leverage data from connected devices to drive innovation and improve efficiency in the digital era.

**Course Outcomes:**

At the end of the course, students will be able to on successful completion of the course, the student will be able:

**CO1**: examine the concepts of IoT

**CO 2**: construct the essentials IOT data and framework

**CO 3**: categorize different types of IOT protocols

**CO 4**: design a basic IOT system

**CO 5**: examine the reliability, security and privacy of an IOT system

**UNIT-I** **15 Hours**

Introduction – IoT definition and evolution – IoT Architectures - OpenIoT Architecture for IoT/Cloud Convergence - Resource Management – IoT Data Management and Analytics - Communication Protocols – Internet of Things Applications-Scheduling Process and IoT Services

**UNIT-II** **15 Hours**

IoT Data and Framework Essentials - Introduction - Programming framework for IoT– The foundation of Stream processing in IoT - Continuous Logic processing system – Challenges and Future directions – Anomaly detection – Problem statement and definitions – Efficient incremental local modelling – IoT Governance.

**UNIT-III** **15 Hours**

RF Protocols RFID, NFC; IEEE 802.15.4**:**ZigBee - ZWAVE, THREAD - Bluetooth Low Energy (BLE) - IPv6 for Low Power and Lossy Networks (6LoWPAN) - Routing Protocol for Low power and lossy networks (RPL) - CoAP - XMPP - Web Socket- AMQP – MQTT – WebRTC - PuSH Architectural Considerations in Smart Object Networking - TinyTO Protocol.

**UNIT-IV** **15 Hours**

Developing Internet of Things: Introduction – IoT Design Methodology – Case study on IoT system for Weather monitoring – IoT Device - IoT physical devices and endpoints - Exemplary Device: Raspberry Pi - Linux on Raspberry Pi - Raspberry Pi interfaces – Programming Raspberry Pi and with python – Other IoT devices.

**UNIT-V** **15 Hours**

IoT Reliability, Security and Privacy: Introduction - Concepts - IoT Security Overview – Security Frameworks for IoT – Privacy in IoT networks – IoT characteristics and reliability issues - Addressing reliability

**Learning Resources**

**Text Books**

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things, A Hands -on Approach", 1st Edition 2015, University Press, ISBN: 978-81-7371- 954-7
2. Buyya, Rajkumar, and Amir VahidDastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.
3. Hersent, Olivier, David Boswarthick, and Omar Elloumi. The internet of things: Key applications and protocols. John Wiley & Sons, 2011.

**References Books**

1.Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer

2.Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

3.Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI

**Websites**

1.https://thingsee.com/blog/quality-hardware-list-for-your-iot-projects
2.https://tools.ietf.org/html/rfc7452. http://dret.net/lectures/iot-spring15/protocols
3.http://iot.intersog.com/blog/overview-of-iot-development-standards-and frameworks

## CO – PSO Mapping

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO5** | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.8** | **2.8** | **2.6** | **2.2** | **2** | **1.8** | **1.4** | **1.2** | **1.2** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4411 | Data structures & algorithms | DSE | 5 | 4 |

The course on data structures and algorithms delves into the fundamental concepts and techniques used in organizing and manipulating data efficiently. This course equips students with essential problem – solving skills and computational thinking, enabling them to develop optimized and scalable solutions for a wide range of programming challenges.

**Course Outcomes:**

At the end of the course, students will be able to

**CO1:** setup the design of algorithms and analysis techniques

**CO2:** analyze the time and space complexity of algorithms

**CO3**: compare different data structures

**CO4:** measure the kinds of problems that uses the data structures and the algorithms for solving them

**CO5:** inspect appropriate data structures for real time applications

**UNIT-I** **15 Hours**

Basic Concepts**:** Basic steps in complete development of Algorithm – Analysis and complexity of Algorithm – Asymptotic notations - Problem Solving techniques and examples**ADT:** List ADT, Stacks ADT, Queue ADT

**UNIT-II** **15 Hours**

Algorithm Design Model: **Greedy** Method - Divide and Conquer - Dynamic Programming – Backtracking – Branch and Bound **Trees:** Preliminaries Binary Tree, Binary Search Trees

**UNIT-III** **15 Hours**

Heap: General Idea, Priority Queues, Model, Simple Implementations, Binary Heap, Applications

**UNIT-IV** **15 Hours**

Sorting: Sorting - Preliminaries, Insertion Sort, Shell Sort, Heap Sort, Merge Sort, QuickSort, External Sorting

**UNIT-V** **15 Hours**

Graphs: Definitions, Topological Sort, Shortest Path Algorithm, Minimum panning Tree, Application of Depth First Search, **Theory of NP-Completeness:** Formal language framework, Complexity classes – P, NP -NP Reducibility and NP-Complete, NP-Hard

**Learning Resources**

**Text Books**

1.Aho, J. E. Hopcroft and J. D. Ullman. Design and Analysis of Computer Algorithms. 1sted. Addison-Wesley, 2009.

2.Horowitz and Sahani. Fundamentals of Computer Algorithms. 2nd ed. Galgotia, 2008.

3.Weiss, M. A. Data Structure and Algorithm analysis in C. 2nd ed. Pearson Education Asia,2002.

**References**

1.Baase, S. and Allen Van Gelder. Computer Algorithms-Introduction to Design and Analysis.New Delhi: Pearson Education, 2008

2.Goodrich, M.T. and R. Tamassia. Algorithm Design: Foundations, Analysis, and Internet Examples. New Delhi: Wiley, 2006.

**Websites**

1.https://thingsee.com/blog/quality-hardware-list-for-your-iot-projects

2.https://tools.ietf.org/html/rfc7452. http://dret.net/lectures/iot-spring15/protocols

3.http://iot.intersog.com/blog/overview-of-iot-development-standards-and frameworks

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 |
| **CO4** | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 1 |
| **CO5** | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **3** | **2.8** | **2.2** | **1.8** | **1.8** | **1.6** | **1.2** | **1.2** | **1** |

Strong – 3 Medium - 2 Low -1

| Cours | Name of the Course | Cate | Hours | Cre |
|---|---|---|---|---|
| 24PDS4301 | Data analytics using excel | GE | 4 | 3 |

The aim of this course is to understand the basic of Data Analytics. It enables to apply Analytics using Excel Advance Formulas, Functions, Macros PivotTables, Visualize Data using various types of data representations.

**Course Outcomes**

At the end of the course, the students will be able to

**CO1:** examine the purpose of Data Analytics

**CO2:** gain knowledge about basic Formulas and Functions, in Excel

**CO3:** examine the Advance Formula for data analytics.

**CO4:** analyze data using Pivot table for Data Validation

**CO5:** collect the various types of Charts in Excel

**Unit I** **12 Hours**

Introduction: Introduction to Data Analytics –Need of Analytics-Phases of Data Analytics-Exploring Data- Probability and Decision Making under Uncertainty.

**Unit II** **12 Hours**

Excel Function**:** Analytics Using Excel- Basic formula-If Conditions-If combined with Andand Or -SumIf Common Functions- Date and Time- Text functions-Functionality Using Ranges**.**

**Unit III** **12 Hours**

Advance Formula and Macros: Advance Formulas – Vlookup-Hlookup- Countif-Financial Functions- Sorting- Filter- Text to Column- Data Validation-Macros-Working with Macros - Recording a Macro - Playing and Deleting a Macro - Adding a Macro to the Quick Access Toolbar

**Unit IV** **12 Hours**

Pivot Table: Pivot Table- Creating PivotTables- Manipulating a PivotTable- Using the PivotTable Toolbar- Changing Data Field- Properties-Displaying a PivotChart-Setting PivotTable Options- Adding Subtotals to PivotTables

**Unit V** **12 Hours**

Data Visualization: Data Visualization- Different types of chart, Formatting Chart Objects, Changing the Chart Type. Case study-Time sheet preparation-Sales Analysis-Customer service- Budget preparation chart.

**Learning Resources**

**Text Books**

1.S. Christian Albright and Wayne L. Winston, Analytics: "Data Analysis and Decision Making", Sixth Edition, 2014.

2. John Walkenbach, Michael Alexander, and Richard Kusleika, "Excel 2019 Bible", John Wiley & Sons, 2019.

**Websites**

1.https://www.excel-easy.com/data-analysis.html

2.https://www.makeuseof.com/tag/data-analysis-excel/

## CO – PSO Mapping

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **CO5** | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **2.8** | **2.6** | **2.4** | **2.2** | **1.8** | **1.6** | **1.2** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4303 | Web programming | GE | 4 | 3 |

The course on web programming introduces students to the fundamental concepts and tools used in developing dynamic and interactive websites. Through this course, students gain practical skills and understanding of web development principles, empowering them to build engaging and functional websites for diverse purposes.

**Course Outcomes**

At the end of the course, students will be able to

**CO1:** examine .NET Framework and Windows Application

**CO2:** inspect presentation controls and namespaces.

**CO3:** prepare with backend using ADO.NET

**CO4:** value about web application and state management

**CO5:** score knowledge on connecting XML, LINQ and AJAX

**UNIT-I** **12 Hours**

Overview of .NET Framework: CLR-CTS- Metadata and Assemblies-.NET Framework Class Library – BCL- Windows Forms – ASP.NET– Toolsin the .NET Framework- New Features of .NET Framework: Portable Class Libraries.

Introducing Windows Application: Introduction – Creating Windows Forms- Customizinga Form Collecting User Input in windows Forms and Events : Buttons-Text Boxes- Check Boxes-Radio Buttons –Combo Boxes –Date and Time Picker – Calendar-List Boxes –Checked List Box –List View – Tree View

**UNIT-II** **12 Hours**

Presentation and Informational Controls in Windows Forms and Events: Labeling- Link Label-Status Bar- Picture Box-Image List-Progress Bar-Tool Tip –Introducing to ADO.net: Under standing ADO.NET- Creating Connection Strings –Creating a Connection to a Database-Creating a Command Object- Working with Data Adapters – Using Data Reader work with Database.

**UNIT-III** **12 Hours**

ASP.NET : Life cycle- Specifying a Location for a Web Application - Adding controls to web form. Web Server Controls: The Control Class - The Web Control Class - The Button Control - The Text Box Control -The Label Control - The Hyper Link Control -The Link Button Control -The Place Holder Control -The Hidden Field Control - The Check Box Control -The Radio Button Control -The List Box Control -The Drop Down List Control -The Image Control -The Image Button Control - The Table Control - Menus - Validation Server Controls - Master Page.

**UNIT-IV** **12 Hours**

State Management: Understanding the session object Sessions and the Event Model, Configuring, In-Process Session State, Out-of-Process Session state Application Object, Query strings, Cookies, View State, Global .asax. XML and .NET: Basics of XML, Create XML Document - The Role of the Animation class types-The To, From and by properties – The Role of the Timeline Base Class – Authoring and Animation– Controlling the pace of an animation – Reversing and Looping an Animation – The Role of Story Boards

**UNIT-V** **12 Hours**

LINQ: Introducing LINQ Queries- Standard Query Operators- Introducing LINQ to Dataset, SQL and XML- The Linq Data Source Control. Data Binding – Grid View, Details view, Forms view.ASP. NET.

**Learning Resources**

**Text Books**

1. C# 2012 Programming Covers .NET 4.5 Black Book. Dream tech press, Kogent Learning Solutions, 2013.(Unit 1.1,Unit 2.2,Unit 2.3,Unit 2.4, Unit 3,Unit 4, Unit 5)

2. Liberty, Jesse, and Dan Hurwitz. Programming. NET Windows Applications. “O’Reilly Media, Inc.", 2004. (Unit 1.2,1.3, 2.1)

3. Troelsen, Andrew, and Philip Japikse, C# 6.0 and the .NET 4.6 Framework. press,2015.(Unit 4.3)

**References Books**

1. Albahan Joseph, and Ben Albahari. C# 5.0 in a Nut Shell: The Definitive Reference. “Orielly Media Inc”, 2012

2. Anne Boehm . Joel. Murach’s C# 2015. United States of America: Murach's, 2016.

3. Delamater. Mary. Anne Boehm. ASP.NET 4.5 Web Programming with C# 2012.United States of America: Murach's, 2013.

4. John Sharp. Microsoft Visual C# Step by Step. United States of America: Pearson Edition, 2018.

5. Price, Jason, and Mike Gunderlov. Mastering Visual C#.Net. John Wiley & Sons,2006

**Websites**

1.http://www.w3schools.com/aspnet/aspnet.asp

2.http://csharp.net-tutorials.com/xml/introduction/

3.http://ajax.net-tutorials.com/basics/introduction/

4.http://www.c-sharpcorner.com/

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 |
| **CO4** | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **CO5** | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.8** | **2.8** | **2.4** | **2.4** | **2.2** | **2** | **1.8** | **1.6** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk | Credits |
|---|---|---|---|---|
| 24PDS4402 | Big data analytics | Core | 6 | 4 |

To introduce the concepts of big data analytics and developing a real time applications

**Course Outcomes**

Students will be able to

**CO 1:** revise basic concepts of big data analytics and technologies

**CO 2:** propose the concept of HDFS, Map reduce for storing and processing of Big data

**CO 3:** analyze and perform different operations on data using Pig, Hive, and Hbase

**CO 4:** evaluate the tools and methods for analyzing Big data analytics model

**CO 5:** formulate real time big data analytics applications

**UNIT-I** **18 Hours**

Introduction to big data analytics: Classification of Digital Data, Structured and Unstructured Data - Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Why Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop Environment Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments.

**UNIT-II** **18 Hours**

Big data technology landscape: NoSQL, Comparison of SQL and NoSQL, Hadoop -RDBMS Versus Hadoop - Distributed Computing Challenges – Hadoop Overview - Hadoop Distributed File System - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem

**UNIT-III** **18 Hours**

HADOOP AND HDFS**:**Introduction to Hadoop – RDBMS vs Hadoop- distributed computing challenges - A Brief History of Hadoop- The Hadoop Distributed Filesystem- Processing Data with Hadoop - Anatomy of a MapReduce Works - Anatomy of a MapReduce Job Run- Job Scheduling- Shuffle and Sort- Task Execution

**UNIT-IV** **18 Hours**

Hadoop eco system: Hive: Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub- Query – Joins – Aggregations - Group by and Having - RCFile Implementation - Hive User Defined Function - Serialization and Deserialization. Pig: Introduction - Anatomy – Features – Philosophy - Use Case for Pig - Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig -

HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions

**UNIT-V** **18 Hours**

Case Studies: Hadoop Usage at Last.fm - Hadoop and Hive at Facebook- Nutch Search Engine- Log Processing at Rackspace – Cascading - TeraByte Sort on Apache Hadoop 601 - Using Pig and Wukong to Explore Billion-edge Network Graphs - Recent Trends in Big Data Analytics

**Learning Resources**

**Recommended Text**

1. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, First Edition, 2015,Wiley.

2. Tom White, Hadoop: The Definitive Guide, O'Reilly Media Inc., 2015.

**Reference Books**

1. Lublinsky, Boris, Kevin T. Smith, and Alexey Yakubovich. Professional hadoop solutions. John Wiley & Sons, 2013.

2. Big Data Analytics, RadhaShankarmani, M Vijayalakshmi, Second Edition, 2017, Wiley

3. Hadoop Essentials: A Quantitative Approach, Henry H. Liu, First Edition, 2012, PerfMath Publishers

**Websites**

1.https://www.ibm.com/analytics/big-data-analytics

2.https://www.simplilearn.com/what-is-big-data-analytics-article

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO5** | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.8** | **2.8** | **2.6** | **2.2** | **2** | **1.8** | **1.4** | **1.2** | **1.2** | **1** |

Strong – 3 Medium - 2 Low -1

| Course | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4404 | Artificial Intelligence | Core | 5 | 4 |

This course aims to give an overview of artificial intelligence (AI) principles and develop a basic understanding of the building blocks of AI. It acquires the knowledge about the Search, Knowledge representation, inference, logic, reasoning and learning.

**Course Outcomes**

At the end of the course students should be able to:

**CO1:** analyze the key characteristics of intelligent agents

**CO2:** create the pre-processing methods for Information Retrieval

**CO3:** examine the suitable search strategy to solve the search problems

**CO4:** assemble adversarial search to find the optimal move for a given game

**CO5:** design a plan graph for the given problem like Constraints satisfaction problems and STRIPS problems - Apply

**Unit 1** **15 Hours**

Introduction:The foundations of AI - The History of AI- Intelligent agents- Agent based system. PROBLEM SOLVING: Searching for solution- Uninformed/Blind search - Informed/ Heuristic search - A* search - Hill-climbing search -Constraint satisfaction problem.

**Unit 2** **15 Hours**

Knowledge representation and planning Logics – First order logic, Inference in first order logic, Knowledge representation. PLANNING: The planning problem - Planning with state space search - Partial order search - Planning with proportional logic - Planning and acting in the real world. Adversarial planning.

**Unit 3** **15 Hours**

Uncertain knowledge and probabilistic reasoning Uncertainty- Probabilistic reasoning - Semantics of Bayesian network -Approximate inference in Bayesian network, exact inference in Bayesian network - Probabilistic reasoning over time.

**Unit 4** **15 Hours**

Learning:Learning from observation - Knowledge in learning -Statistical learning methods - Reinforcement learning

**Unit 5** **15 Hours**

Decision-making: Basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications. ROBOTICS: Introduction

**Learning Resources**

**Reference Books**

1. Stuart Russell and Peter Norvig, ―Artificial Intelligence: A Modern Approach‖, Pearson Education, 2018.

2. David Pool, Alan Mackworth, ―Artificial Intelligence: Foundations of Computational agents, Cambridge University, 2015.

3. Nils J. Nilsson, ―The Quest for Artificial Intelligence: A History of Ideas and achievements, Cambridge University Press, 2010.

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO5** | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **2.8** | **2.6** | **2.2** | **2** | **1.8** | **1.6** | **1.6** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk | Credits |
|---|---|---|---|---|
| 24PDS4406 | Statistics - I | Core | 5 | 4 |

This course aims to develop knowledge and understand fundamental concepts in probability and statistics.

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO1:** organize, manage and present data.

**CO2:** understand, describe, and calculate the measures of data and correlation.

**CO3:** recognize and understand various probability distribution functions, calculate and interpret expected results.

**CO4:** apply the methods of estimating a parameter.

**CO5:** understand the concept of probability and apply for simple events.

**UNIT-I** **15 Hours**

Introduction to Statistics: Introduction-Data Collection and Descriptive Statistics-Inferential Statistics and Probability Models-Populations and Samples-A Brief History of Statistics -Origin and development of Statistics, Scope, limitation and misuse of statistics. Types of data: Types of Measurement. Presentation of data by tables: construction of frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions

**UNIT-II** **15 Hours**

Descriptive statistics and Correlation: Introduction-Describing Data Sets-Frequency Tables and Graphs-Relative Frequency Tables and Graphs-Grouped Data, Histograms, Ogives, and Stem and Leaf Plots-Summarizing Data Sets-Sample Mean, Sample Median, and Sample Mode-Sample Variance and Sample Standard Deviation-Sample Percentiles and Box Plots-Chebyshev's Inequality-Normal Data Sets-Paired Data Sets and the Sample Correlation Coefficient -Scatter plot, Karl Pearson coefficient of correlation, Spearman's rank correlation coefficient, multiple and partial correlations (for 3 variates only).

**UNIT-III** **15 Hours**

Random distribution – Discrete: Random Variables-Types of Random Variables-Jointly Distributed Random Variables-Independent Random Variables-Conditional Distributions-Expectation-Properties of the Expected Value-Variance-Covariance -Moment Generating Functions-Chebyshev's Inequality -The Bernoulli and Binomial Random Variables-Computing the Binomial Distribution Function- The Poisson Random Variable-Computing the Poisson Distribution Function

**UNIT – IV** **15 Hours**

Random distribution – Continuous: The Hypergeometric Random Variable-The Uniform Random Variable- Normal Random Variables-Exponential Random Variables-The Poisson Process-The Gamma Distribution-Distributions Arising from the Normal-The Chi-Square Distribution-The t-Distribution-The F Distribution-The Logistics Distribution

**UNIT-V:** **15 Hours**

Distributions of sampling statistics: Introduction-The Sample Mean-The Central Limit Theorem-Approximate Distribution of the Sample Mean, How Large a Sample Is Needed?-The Sample Variance-Sampling Distributions from a Normal Population-Distribution of the Sample Mean, Joint Distribution of X and S-Sampling from a Finite Population

**Learning Resources**

**Text Books**

1.Sheldon M. Ross, Introduction to Probability and Statistics for Engineers And Scientists, Elsevier Academic Press, UK, Fifth Edition, 2023

Unit 1: Chapter 1: section: 1-4

Unit 2: Chapter 2: section: 1-6

Unit 3: Chapter 4: section: 1-8, chapter 5: section 1-8

Unit 4: Chapter 6: section: 1-6

Unit 5: Chapter 7: section: 1-7

2. Rohatgi V.K and Saleh E, An Introduction to Probability and Statistics, 3rd edition, John Wiley & Sons Inc., New Jersey, 2015.

3. Gupta S.C and Kapoor V.K, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand & Sons, New Delhi, 2014Gilbert Strang, Introduction to Linear Algebra, Wellesley - Cambridge Press, Sixth Edition, 2023

**Reference Books**

1.Jim Frost, Introduction to Statistics: An Intuitive Guide for Analyzing Data and Unlocking Discoveries

## CO – PSO Mapping

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| **CO 2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |
| **CO 4** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **CO 5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **Average** | **3** | **3** | **3** | **3** | **2.6** | **2.4** | **2.4** | **2** | **2** | **2** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4408 | Big data analytics lab | Core | 5 | 4 |

To introduce the concepts of big data analytics and developing a real time applications

**Course Outcomes**

Students will be able to

**CO 1:** configure Hadoop and perform File Management

**CO 2:** apply Map Reduce program to real time issues.

**CO 3:** critically analyze huge data set using Hadoop distributed file systems and Map Reduce

**CO 4:** experimenting different data processing tools like Pig, Hive.

**CO 5:** develop real time big data analytics applications

**UNIT-I** **15 Hours**

Install Apache Hadoop

Perform setting up and Installing Hadoop in its three operating modes: Standalone

Pseudo, Distributed, Fully Distributed

To use Web Based Tools to Manage Hadoop Set-up

Implement the following file management tasks in Hadoop:Adding files and directories

Retrieving files, Deleting Files

**UNIT-II** **15 Hours**

Develop a Map Reduce program to calculate the frequency of a given word in a given file.

Develop a Map Reduce program to find the maximum temperature in each year.

Develop a Map Reduce program to find the grades of student's.

Develop a Map Reduce program to implement Matrix Multiplication.

Develop a Map Reduce to find the maximum electrical consumption in each year given electrical consumption for each month in each year.

**UNIT-III** **15 Hours**

Develop a Map Reduce to analyze weather data set and print whether the day is shinny or cool day. (National Climatic Data Centre (NCDC) Data set)

Develop a Map Reduce program to find the number of products sold in each country by considering sales data containing fields like Tranction Date Product Price Payment Type Name City\State Country Account Created Last Login Latitude Longitude

Data sets from different sources as Input

Develop a Map Reduce program to find the tags associated with each movie by analyzing movie lens data. (https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset)

**UNIT-IV** **15 Hours**

Install and Run Pig then write Pig Latin scripts to sort, group, join, project and filter the data.

Install and Run Hive then use Hive to Create, alter and drop databases, tables, views, functions and Indexes.

Develop a program to calculate the maximum recorded temperature by year wise for the weather dataset in Pig Latin

Develop a program to calculate the maximum recorded temperature by year wise for the weather dataset in Pig Latin

Write queries to sort and aggregate the data in a table using Hive QL

Develop a Map Reduce to find the maximum electrical consumption in each year given electrical consumption for each month in each year.

Write a program to implement combining and partitioning in hadoop to implement a custom partitioner and Combiner

**UNIT-V** **15 Hours**

Analyze the sentiment for product reviews; this work proposes a Map Reduce technique provided by Apache Hadoop

Trend Analysis based on Access Pattern over Web Logs using Hadoop.

Implementation of decision tree algorithms using Map Reduce.

Implementation of K-means Clustering using Map Reduce.

Generation of Frequent Item set using Map Reduce.

**Learning Resources**

**Text Books**

1. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, First Edition, 2015,Wiley.

2. Tom White, Hadoop: The Definitive Guide, O'Reilly Media Inc., 2015.

**Reference Books**

1. Lublinsky, Boris, Kevin T. Smith, and Alexey Yakubovich. Professional hadoop solutions. John Wiley & Sons, 2013.

2. Big Data Analytics, RadhaShankarmani, M Vijayalakshmi, Second Edition, 2017, Wiley

3. Hadoop Essentials: A Quantitative Approach, Henry H. Liu, First Edition, 2012, PerfMath Publishers

**Websites**

1.https://www.ibm.com/analytics/big-data-analytics

2.https://www.simplilearn.com/what-is-big-data-analytics-article

3.https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-big-data-analytics

## CO – PSO Mapping

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO5** | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.8** | **2.4** | **2.4** | **2.2** | **2** | **1.8** | **1.4** | **1.2** | **1.2** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4410 | Software Engineering for Data Science | DSE | 5 | 4 |

To understand the software engineering principles and ensure software quality

**Course Outcomes**

**At the end of the course, students will be able to**

**CO1:** demonstrate the Software Engineering Principle

**CO2:** examine Software Life Cycle Models for Software Development

**CO3:** setup the Requirements Engineering skills and gather Requirements

**CO4:** to design a quality Software

**CO5:** practice the appropriate testing methodologies

**UNIT-I** **15 Hours**

Software and Software Engineering**:** The nature of software - Software Engineering - The Software Process - Software Engineering Practice - Software Myths

Process Models: A Generic Process Model - Process Assessment and Improvement - Prescriptive Process Models - Product and Process

**UNIT-II** **15 Hours**

Recommended Process Model: Requirements Definition - Preliminary Architectural Design - Resource Estimation - First Prototype Construction - Prototype Evaluation - Prototype Evolution - Prototype Release - Maintain Release Software

Human Aspects of Software Engineering: Characteristics of a Software Engineer - The Psychology of Software Engineer - The Software Team - Team Structures - The impact of Social Media - Global Teams

Principles that guide practice : Core Principles - Principles that guide each Framework Activity - Communication Principles - Planning Principles - Modeling Principles - Construction Principles - Deployment Principles

**UNIT-III** **15 Hours**

Understanding Requirements: Requirements Engineering - Building the Analysis Model - Requirements Monitoring - Requirements Modeling - A Recommended Approach: Requirements Analysis - Scenario- Based Modeling - Class-Based Modeling - Functional Modeling - Behavioural Modeling

**UNIT-IV** **15 Hours**

Design Concepts: Design within the context of Software Engineering - The Design Process - Design Concepts - The Design Model Quality and Security : Introduction - Software Quality - The Software Quality Dilemma - Software Quality Assurance: Background Issues - Elements of Software Quality Assurance ,SQA Process and Product Characteristics - SQA Tasks, Goals and Metrics - Formal Approaches - Statistical SQA - Software Reliability.

**UNIT-V** **15 Hours**

Software Testing -Component Level: A Strategic Approach to Software Testing - Planning and Record Keeping - Test-Case Design - White-box Testing - Black-Box Testing - Object- oriented Testing, Software Testing - Integration Level**:** Software Testing Fundamentals - Integration Testing, Artificial Intelligence and Regression Testing.

**Learning Resources**

**Text Book**

1.Pressman, Roger S., and Bruce R. Maxim. Software Engineering: A Practitioner'sApproach, Ninth Edition, 2020

**Reference Books**

1.Martin, Robert C. Agile software development: principles, patterns, and practices.Prentice Hall, 2002.

2.Schach, Stephen R. Object-oriented software engineering. McGraw-Hill, 2008.

3.Sommerville, Ian. "Software engineering 9th Edition." ISBN-10 137035152 (2011).

**Websites**

1. https://www.d.umn.edu/~gshute/softeng/principles.html

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO5** | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.8** | **2.6** | **2.6** | **2.2** | **2** | **1.8** | **1.4** | **1.2** | **1.2** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4412 | Information security and ethics | DSE | 5 | 4 |

To introduce and familiarize the students to security issues in computing, core concepts and vocabulary of computer security

**Course Outcomes**

At the end of the course, students will be able to

**CO1:** create computer security, including users, software, devices, operating systems, networks, law, and ethics

**CO2:** debate cryptography an essential tool that is critical to computer security

**CO3:** analyse the different aspects of computer security and privacy

**CO4:** evaluate the aspects of computer security

**CO5:** design a system that uses user authentication, prevents malicious code execution, encrypts the data, protects privacy, implements firewall, detects intrusion, and more.

**UNIT-I** **15 Hours**

Security Problem in Computing: Meaning of "Secure" – Attacks – Meaning of Computer and information Security - Computer Criminals - Methods of Defense Cryptography : Terminology and Background - Principles of Cryptography - Cryptography tools - Substitution Ciphers - Transpositions (Permutations) – Making "Good" Encryption Algorithms - The Data Encryption Standard (DES) – The AES Encryption Algorithm - PublicKey Encryption - The Uses of Encryption - Digital Signatures and Certificates - Hybrid Cryptography Systems - Protocols for secure Acceptable Use Policies - Reasons for social media being hazardous to the corporate network Balancing Security and Social Networking in business.

**UNIT-I** **15 Hours**

Program Security: Secure Programs - Nonmalicious Program Errors - Viruses and Other Malicious Code -Targeted Malicious Code - Controls against Program Threats, Security Issues in Social Networking

**UNIT-III** **15 Hours**

**Database and Data Mining Security**

Introduction to Databases - Security Requirements - Reliability and Integrity – Sensitive Data Inference - Multilevel Databases - Proposals for Multilevel Security – Data Mining, Security in Networks, Network Concepts - Threats in Networks - Network Security Controls - Firewalls – IntrusionDetection Systems - Secure E-Mail

**UNIT-IV** **15 Hours**

**Administering Security**

Security Planning - Risk Analysis - Organisational Security Policies - Physical Security. The Economics of Cyber security

**Making a Business Case - Quantifying Security - Modeling Cyber security**

**UNIT-V** **15 Hours**

**Privacy in Computing**

Privacy Concepts - Privacy Principles and Policies - Authentication and Privacy – Data Mining - Privacy on The Web - E-Mail Security - Impacts on Emerging Technologies Legal and Ethical Issues in Computer Security Protecting Programs and Data - Information and the Law - Rights of Employees and Employers - Redress for Software Failures - Computer Crime - Ethical Issues in Computer Security - Case Studies of Ethics

**Learning Resources**

**Text Books**

1.Pfleeger ,Charles P and Shari Lawrence Pfleeger. Security in Computing, Released January2015, Pearson, ISBN: 9780134085074

2.Bahadur ,Gary. Securing the Clicks Network Security in the Age of Social Media. 1st ed. McGraw-Hill, 2012.

**Reference Books**

1.Daswani, Neil, Christoph Kern and Anita Kesavan. Foundations of Security: What Every Programming Needs to Know. Apress, 2007

**Websites**

1.http://www.trendmicro.fr/media/wp/securityguide-social-networks-whitepaper-en.pdf

2.http://paper.ijcsns.org/07_book/201306/20130619.pdf

## CO – PSO Mapping

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 2 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **CO5** | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.6** | **2.6** | **2.6** | **2** | **2** | **1.6** | **1.6** | **1.2** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4302 | Data analysis using tableau | GE | 4 | 3 |

This course aims to learn how to become a master at communicating business-relevant implications efficiently using data visualizations in Tableau, the most popular visualization program in the business world. Tableau is a data visualization tool or business intelligence tool which analyzes and shows data in a chart or report fast. Data visualization and predictive analytics is a norm in every industry today.

**Course Outcomes**

At the end of the course students should be able to: Understand data visualization

**CO1:** create all the various data sources

**CO2:** justify complex calculations, share and publish visualizations

**CO3: a**nalyze various types of functions in tableau.

**CO4:** inspect the filtering and groups.

**CO5: c**ompare the variety of basic charts.

**Unit I** **12 Hours**

Introduction: Introducing Visualization and Tableau - data visualization - expectations for a data visualization tool - reasons to make a switch to Tableau - positioning of Tableau - Tableau product line - file types in Tableau Tableau Workbook (twb) - Tableau Packaged Workbook (twbx) Tableau Data Source (tds) file - Tableau Packaged Data Source (tdsx) file

**Unit II** **12 Hours**

Connecting with Tableau**:** Working with Single and Multiple Data Sources Desktop architecture - Data layer - Data connectors - Tableau environment To open – To close - Start page - Data Source Page Workspace - Workbooks and Sheets Visual Cues and Icons in Tableau - Connect to a File -Connect to a Text File - Connect to MS Access

**Unit III`** **12 Hours**

Function in Tableau: Table Calculations - Profitability as Percent of Total - Moving average - Types of moving average - Rank - LOD (Level of Detail) - Percentile -Number functions - String functions - Logical Functions - Date functions

**Unit IV** **12 Hours**

Filtering and Groups: Simplifying and Sorting Your Data Filtering – filtering - Sorting - Discrete and Continuous Data - Groups - create a group - editing an existing group - creating hierarchies sets Contents - Difference between a set and group - Group Set Creating parameters

**Unit V** **12 Hours**

Statistics and Charts: Statistics - number summary - Spread of data - Box plot - Pie chart - Line Graph - Scatter plot – Histogram - Word Cloud - Waterfall charts - Bump charts - Bullet graph

**Learning Resources**

**Textbook**

1.Joshua N.Milligan, "Learning Tableau 2019", Packt Publishing, 2019

**Reference Books**

1.Seema Acharya, Subhashini Chellappan, "Pro Tableau", A step by step guide, A Press 2017.

2.Daniel G.Murray, with the InterWorks team "Tableau Your Data", Wiley, 2013

**Websites**

1.https://www.tutorialspoint.com/tableau/tableau_quick_guide.htm

2.https://www.javatpoint.com/tableau

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **CO5** | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **2.8** | **2.4** | **2.4** | **2.4** | **1.6** | **1.6** | **1.2** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS4304 | Multimedia analytics | GE | 4 | 3 |

This course aims to learn how to become a master at a solid understanding of multimedia data types, including images, videos, audio, and other forms of rich media. Students will learn techniques for collecting, preprocessing, and cleaning multimedia data for analysis, including handling large datasets and managing data quality issues. Methods for extracting meaningful features from multimedia data and representing them in a format suitable for analysis, such as feature vectors or other numerical representations.

**Course Outcomes**

At the end of the course students should be able to: Understand data visualization

**CO1:** create various perception of multimedia

**CO2:** design the model for experiment to interpret the results of multimedia analysis.

**CO3:** analyze various types of evaluating the quality

**CO4:** manage the scaling up multimedia analytics.

**CO5:** support a variety of charts for visualizations

**Unit I** **12 Hours**

Introduction: Introduction - A Multimedia Analytics Model : Introduction – Human Perception of Multimedia – Machine Perception of Multimedia – Multimedia Analytics.

**Unit II** **12 Hours**

Instantiating the Model: Data Collection – Topical Analysis of Users and Venues – Experimental Setup – Experimental Results

**Unit III** **12 Hours**

Evaluating Analytic Quality: Introduction – Method: Evaluating analytic tasks – Artificial actors – Evaluation Pipeline - Evaluation Measures – Interpretation.

**Unit IV** **12 Hours**

Scaling Up Multimedia Analytics: Data Representation: Feature Selection – Compression and Decompression – The Ratio-64 Representation – Interactive Learning – Experimental Setup – Result and Discussions.

**Unit V** **12 Hours**

Visualization Concepts: Statistics - number summary - Spread of data - Box plot - Pie chart - Line Graph - Scatter plot – Histogram - Word Cloud - Waterfall charts - Bump charts - Bullet graph

**Learning Resources**

**Textbook**

1.Jan Zahalka, “The Machine in Multimedia Analytics”, Packet Publishing, 2019

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **CO5** | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **2.8** | **2.4** | **2.4** | **2.2** | **1.6** | **1.6** | **1** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5401 | Machine learning | Core | 5 | 4 |

To understand the different types, steps and algorithms involved in Machine Learning Process

**Course Outcomes**

At the end of the course, students will be able to

**CO1:** describe the data, essential steps for creating a typical ML model and the fundamentals of pattern classification

**CO2:** able to analyze different ML algorithms and unprocessed data and features

**CO3:** implement the essential techniques to reduce the number of features in a dataset and test the performance of predictive models

**CO4:** discuss multiple algorithms, combine and produce ensembles, discuss the essential techniques for modeling linear relations

**CO5:** experiment the clustering algorithms; develop a Web application embedding a ML model

**UNIT-I** **15 Hours**

Data Analytics with pandas and NumPy: NumPy and basic stats - Matrices - pandas library - Working with data - Null Values - Creating statistical graphs

Book 1, Chapter -10

Giving Computers the ability to learn from data - Introduction - Building intelligent systems to transform data into knowledge - The three different types of Machine Learning(ML) - Introduction to basic terminology and notations - A roadmap for building ML systems - Using Python for ML

Book 2, Chapter - 1

Training Simple ML Algorithms for Classification - Early History of ML - Implementing a Perceptron learning algorithm.

Book 2, Chapter – 2

**UNIT-II :** **15 Hours**

ML Classifiers using sckikit-learn: Choosing a classification algorithm - Training a perceptron - Modeling class probabilities via logistic regression - Maximum margin classification with support vector machines(SVM) - Solving nonlinear problems using a kernel SVM - Decision tree learning.

Book 2 , Chapter 3

Data Preprocessing - Missing data - Categorical data - Partitioning a dataset into separate training and test datasets - Bringing features onto the same scale - Selecting meaningful features - Assessing feature importance with random forests

Book 2, Chapter – 4

**UNIT-III** **15 Hours**

Compressing Data via Dimensionality Reduction - Unsupervised dimensionality reduction via principal component analysis - Supervised data compression via linear discriminant analysis - Using kernel principal component analysis for nonlinear mappings

Book 2, Chapter - 5

Learning Best Practices for Model Evaluation and Hyperparameter Tuning - Streamlining workflows with pipelines - Using k-fold cross-validation to assess model performance.

Book 2, Chapter – 6

**UNIT-IV** **15 Hours**

Combining different models for ensemble learning - Learning with ensembles - Combining classifiers via majority vote - Bagging: building an ensemble of classifiers from bootstrap samples - Leveraging weak learners via adaptive boosting

Book 2, Chapter - 7

Predicting Continuous Target Variables with Regression Analysis - Introducing Linear regression - Implementing an ordinary least squares linear regression model - urning a linear regression model into a curve -polynomial regression - Dealing with nonlinear relationships using random forests

Book 2, Chapter – 10

**UNIT-V** **15 Hours**

Working with Unlabelled Data – Grouping objects by similarity using k-means - Organising clusters as a hierarchical tree.

Book 2, Chapter - 11

Introduction to Embedding a ML model into a Web Application - Serialising fitted scikit-learn estimators - Setting up an SQLite database for data storage.

Book 2, Chapter – 9

**Learning Resources**

**Text Books**

1. Corey Wade et al, Vahid Mirjalili, The Python Workshop, 2nd Edition, packs publishing, 2022

2. Sebastian Raschka and Vahid Mirjalili, Python Machine Learning, 3rd Edition, packt publishing, 2019

**Reference Books**

1. Andreas C. Mueller, Sarah Guido. Introduction to Machine Learning with Python. O'Reilly Media, Inc., 2016.
2. Ethem Alpaydin, Introduction to Machine Learning, 2nd Edition, http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=12012, 2010
3. Wes McKinney. Python for Data Analysis. O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, second edition, 2018

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO2** | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **CO4** | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **CO5** | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **2.6** | **2.2** | **2** | **1.8** | **1.6** | **1.6** | **1** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5403 | Machine learning lab | Core | 5 | 4 |

To preprocess the data and build ML models using appropriate techniques and evaluate the model

**Course Outcomes**

Upon completion of the course, the student will be able to

**CO1:** recall the concepts pandas, NumPy and Matplotlib to read in , process and visualise data, implement linear classification algorithms

**CO2:** compare classifiers with linear and non-linear decision boundaries, select relevant features for the model construction

**CO3:** apply data compression and best practices for model evaluation and hyper parameter tuning

**CO4:** select appropriate algorithms and ensemble

**CO5:** inspect the clustering algorithms on unlabelled data, construct a web application embedding a ML model

**UNIT-I :** **15 Hours**

1. Programs using NumPy and pandas
2. Visualising using graphs
3. Perceptron learning algorithm

**UNIT-II :** **15 Hours**

4. Training a perceptron
5. Modeling logistic regression
6. Support vector machines(SVM)
7. Solving nonlinear problems using a kernel SVM
8. Decision tree

**UNIT-III :** **15 Hours**

9. Unsupervised dimensionality reduction via principal component analysis
10. Supervised data compression via linear discriminant analysis
11. Using k-fold cross-validation to assess model performance

**UNIT-IV :** **15 Hours**

12. Debugging algorithms with learning and validation curves
13. Fine-tuning ML models via grid search
14. Implementing different performance evaluation metrics
15. Regularised methods for regression

16. Nonlinear relationships using random forests

**UNIT-V:** **15 Hours**

17. Grouping objects by similarity using k-means

18. Organising clusters as a hierarchical tree

19. Embedding a ML model into a Web Application

## CO – PSO Mapping

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **CO5** | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.8** | **2.6** | **2.6** | **2.2** | **2** | **1.8** | **1.6** | **1.2** | **1.2** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5405 | Databases for data science | Core | 5 | 4 |

To provide fundamentals of database design, modeling systems, data storage, world of data warehousing and NoSQL

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO1:** describe the importance of relational data modeling and conceptual modelling

**CO2:** experiment with various database and compose effective queries

**CO3**: analyse the process of OLAP system construction

**CO4:** explain the use of NOSQL and its approach to the database

**CO5:** interpret the applications using Relational and NoSQL databases

**Unit I** **15 Hours**

Fundamental Concepts of Database Management: Applications of Database Technology - Key Definitions - File versus Database Approach to Data Management - Elements of a Database System - Advantages of Database Systems and Database Management - Architecture and Categorization of DBMSs

Conceptual Data Modeling using the ER Model and UML Class Diagram: Phases of Database Design - The Entity Relationship Model - UML Class Diagram

**Unit II** **15 Hours**

Types of Database Systems: Legacy Databases - Relational Databases: The Relational Model – Normalization Relational Databases: Structured Query Language - SQL Data Definition Language - SQL Data Manipulation Language

Lab: SQL DDL and DML

**Unit III** **15 Hours**

Data Warehousing and Business Intelligence: Operational versus Tactical/Strategic Decision-Making - Data Warehouse Definition - Data Warehouse Schemas - The Extraction, Transformation, and Loading (ETL) Process - Data Marts.

**Unit IV** **15 Hours**

Key Value Data Stores: Document Databases, Document oriented Database Features, Consistency, Transactions, Content Management Systems, E-Commerce Applications.

**Unit V** **15 Hours**

Document Oriented Database: Column- oriented NoSQL databases, Column-oriented NoSQL databases, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling,

**Learning Resources**

**Text Book**

1.Lemahieu, W., Broucke, S.vanden and Baesens, B. (2018) Principles of database management: The Practical Guide to storing, managing and analyzing big and small data. Cambridge, United Kingdom: Cambridge University Press.

2.Sadalage, P. & Fowler,NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition,2022

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO5** | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.8** | **2.8** | **2.6** | **2.4** | **2** | **1.8** | **1.4** | **1.2** | **1.2** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5407 | Statistics -II | Core | 5 | 4 |

To develop knowledge and understand fundamental concepts in probability and statistics

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO1:** identify the four steps of hypothesis testing.

**CO2:** gain a thorough understanding of applied principles of statistics.

**CO3**: to develop knowledge and skills in theoretical, computational and application-oriented statistics

**CO4:** apply the methods of analysis of variance

**CO5:** understand and apply the concept of non-parametric tests

**UNIT-I** **15 Hours**

Hypothesis testing –Large Samples: Population and Statistics – Finite and Infinite population – Parameter and Statistics – Types of sampling - Sampling Distribution – Sampling Error - Standard Error – Test of significance –concept of hypothesis – types of hypothesis – Errors in hypothesis-testing – Critical region – level of significance - Power of the test – p-value -Introduction-Significance Levels-Tests Concerning the Mean of a Normal Population-Case of Known Variance-Case of Unknown Variance: The t-Test-Testing the Equality of Means of Two Normal Populations-Case of Known Variances-Case of Unknown Variances-Case of Unknown and Unequal Variances-The Paired t-Test- Hypothesis Tests Concerning the Variance of a Normal Population-Testing for the Equality of Variances of Two Normal Populations

**UNIT-II** **15 Hours**

Hypothesis Testing- Small Samples: Students t-distribution and its properties (without proofs) – Single sample mean test – Independent sample mean test – Paired sample mean test – Tests of proportion (based on t distribution) – F distribution and its properties (without proofs) – Tests of equality of two variances using F-test – Chi-square distribution and its properties (without proofs) – chisquare test for independence of attributes – Chi-square test for goodness of fit.

**UNIT-III** **15 Hours**

Regression: Introduction-Least Squares Estimators of the Regression Parameters-Distribution of the Estimators-Statistical Inferences About the Regression Parameters-Inferences Concerning $\beta$ - Inferences Concerning $\alpha$- Inferences Concerning the Mean Response $\alpha+\beta$ x 0 - Prediction Interval of a Future Response-Summary of Distributional Results

**UNIT-IV** **15 Hours**

Analysis of variance: Introduction-An Overview-One-Way Analysis of Variance-Multiple Comparisons of Sample Means-One-Way Analysis of Variance with Unequal Sample Sizes-Two-Factor Analysis of Variance: Introduction and ParameterEstimation-Two-Factor Analysis of Variance: Testing Hypotheses-Two-Way Analysis of Variance with Interaction

**UNIT-V** **15 Hours**

Distributions of sampling statistics: Introduction-The Sample Mean-The Central Limit Theorem-Approximate Distribution of the Sample Mean, How Large a Sample Is Needed?-The Sample Variance-Sampling Distributions from a Normal Population-Distribution of the Sample Mean, Joint Distribution of X and S-Sampling from a Finite Population

**Learning Resources**

**Text Books**

1.Sheldon M. Ross, *Introduction to Probability and Statistics for Engineers And Scientists, Elsevier Academic Press, UK*, Fifth Edition, 2023

**Unit 1:** Chapter 2: section: 2-4

**Unit 2:**Chapter 2: section: 2-6

**Unit 3:** Chapter 4: section: 2-8, chapter 5: section 2-8

**Unit 4:** Chapter 6: section: 2-6

**Unit 5:** Chapter 7: section: 2-7

2. Gupta S.C and Kapoor V.K, Fundamentals of Mathematical Statistics, 22th edition, Sultan Chand & Sons, New Delhi, 2020.

3. Brian Caffo, Statistical Inference for Data Science, Learnpub, 2026.

**Reference Books**

1. Allen B. Downey,Think Stats- Exploratory data analysis,O'reilly, 2nd Edition

2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Publications, Tenth Edition

3. Jim Frost, Introduction to Statistics: An Intuitive Guide for Analyzing Data and Unlocking Discoveries

## CO – PSO Mapping

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **CO 2** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **CO 3** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **CO 4** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **CO 5** | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 2 | 2 |
| **Average** | **3** | **3** | **3** | **3** | **1.8** | **2** | **2** | **2** | **2** | **2** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5409 | Data mining and warehousing | Core | 5 | 4 |

To present an introduction to data mining and warehousing, with an emphasis on how to organize, maintain and retrieve effective information from a warehouse.

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO1 :** describe the fundamental Concepts of Data mining and warehousing.

**CO2 :** analyze the Preprocessing, data cleaning, Data integration and Transformation techniques.

**CO3:** comprehend the concepts of Association Rule Mining

**CO4 :** understand the implementation of Classification and Prediction Accuracy.

**CO5 :** design data models to represent Data mining Applications.

**Unit I** **15 Hours**

Introduction to Data mining & Data warehousing: Introduction – Data mining – Data mining functionalities – kinds of patterns can be mined – classification – major issues. Data warehouse – A multidimensional data model – Data warehouse architecture – Data warehouse implementation – From data warehouse to data mining

**Unit II** **15 Hours**

Data pre-processing – Data cleaning – Data Integration and Transformation – Data Reduction – Discretization and concept hierarchy generation – Data mining primitives – Data mining Task.

**Unit III** **15 Hours**

Association Rule Mining – Mining single dimensional Boolean association rules from transactional databases – mining multilevel association rules from transaction databases-

**Unit IV** **15 Hours**

Classification and prediction – Issues regarding classification and prediction – classification by decision Tree Induction – Bayesian Classification – Classification by Back propagation – classification based on concepts from association rule mining – prediction – classifier accuracy

**Unit V** **15 Hours**

Clustering & Trends in Data Mining : Clustering – Introduction to types of Clustering - Applications and Trends in Data Mining – Data mining system products and Research prototypes– Social Impacts of Data Mining – Trends in Data mining

**Learning Resources**

**Textbook**

1.Jiawei Han, Michelien Kamber, “Data Mining Concepts and Techniques”, 3rd Edition, 2014.

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO5** | 3 | 3 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **2.8** | **2.6** | **2.6** | **2** | **1.8** | **1.4** | **1.2** | **1.2** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5301 | Natural language processing | DSE | 5 | 3 |

To explore the concepts and fundamentals of Natural Language Programming

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO1:** explain the challenges of empirical methods for natural language processing (NLP) applications.

**CO2:** to introduce basic models and methods used in NLP applications to formulate computational solutions.

**CO3:** comprehend the Syntactic Analysis of NLP.

**CO4:** to Design the Semantics and Pragmatics concepts.

**CO5:** overview of the major applications in NLP

**UNIT-I** **15 Hours**

Knowledge in Speech and Language Processing – Ambiguity - Models and Algorithms- Language, Thought, and Understanding - The State of the Art - History - Applications – Basic NLP

Book1 : Chapter 1, Book 2: Chapter 1

**UNIT-II** **15 Hours**

Word analysis: Regular Expressions - Words & Transducers- Survey of English Morphology- Finite-State Morphological Parsing - Word and Sentence Tokenization- N-grams- Counting Words in Corpora- Simple (Unsmoothed) N-grams- Training and Test Sets- Part-of-Speech Tagging- English Word Classes- Tagsets for English- Part-of-Speech Tagging- Rule-Based Part-of-Speech Tagging- Evaluation and Error Analysis

Book1 : Chapter 2, 3,4,5

**UNIT-III:** **15 Hours**

Syntactic analysis: Formal Grammars of English- Constituency- Context-Free Grammars- Grammar Rules for English - Treebanks - Finite-State and Context-Free Grammars - Dependency Grammars - Parsing with Context-Free Grammars - Parsing as Search- Dynamic Programming Parsing Methods- Statistical Parsing- Probabilistic Context-Free Grammars- Probabilistic CKY Parsing of PCFGs- Learning PCFG Rule Probabilities

Book1 : Chapter 12, 13, 14

**UNIT-IV** **15 Hours**

Semantics and pragmatics: Computational Desiderata for Representations- First-Order Logic, Computational Semantics –Syntax Driven Semantic analysis, Semantic attachments Semantic Attachments for a Fragment of English, Lexical Semantics- Word Senses, Relations between Senses, WordNet: A Database of Lexical Relations- Event Participants: Semantic Roles and Selectional Restriction

Book1: Chapter 17, 18,19

**UNIT-V** **15 Hours**

Applications - Information Extraction, Question Answering and Summarization, Dialogue and Conversational Agents

Book1 : Chapter 22, 23,24

**Learning Resources**

**Text Books**

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.

2. Patel, Ankur A., and Ajay Uppili Arasanipalai. Applied Natural Language Processing in the Enterprise. " O'Reilly Media, Inc.", 2021.

**Reference Books**

1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.

2. Richard M Reese, —Natural Language Processing with Java‖, O_Reilly Media, 2015.

3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.

4. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval‖, Oxford University Press, 2008.

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO5** | 3 | 3 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **2.8** | **2.6** | **2.6** | **2** | **1.8** | **1.6** | **1.6** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5303 | Reinforcement learning | DSE | 5 | 3 |

To introduce the concepts and fundamentals of reinforcement learning and methods

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO1:** describe the Concepts of Reinforcement Learning.

**CO2:** analyze the essential Programming and methods in reinforcement learning

**CO3:** explain the Temporal Difference learning and Deep Q networks to explore the essentials of Reinforcement learning.

**CO4:** define On Policy prediction methods

**CO5:** implement reinforcement learning in various applications

**UNIT-I** **15 Hours**

Introduction and basics of reinforcement learning: The Reinforcement Learning Problem - Reinforcement Learning- Examples- Elements of Reinforcement Learning- Limitations and Scope - An extended example – History of Reinforcement Learning - Applications - Ethics in RL- Applying RL for real-world problems- Multi-Agent Reinforcement Learning

Book 1- Chapter 1

**UNIT-II** **15 Hours**

Markov decision process & dynamic programming: Finite Markov Decision Processes - Dynamic Programming – Policy Evaluation – Policy Improvement – Value Iteration – Efficiency of DP

Book 1- Chapter 3,

**UNIT-III** **15 Hours**

Monte carlo method & planning and learning Monte Carlo Methods - Model Based Learning and Planning – Integrated Planning – Acting and Learning – Prioritized Sweeping – Heuristic Search

Book 1- Chapter 5,

**UNIT-IV** **15 Hours**

Psychology and Neuroscience: Prediction and control - Classical conditioning – neuroscience – basics- reward and prediction

Book 1- Chapter 14,15

**UNIT-IV** **15 Hours**

Applications and case studies: TD – Gammon – Samuel's Checkers Player – Personalized Web Services.

Book 1- Chapter 16

**Learning Resources**

**Textbook**

1.Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. MIT press, 2018.

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 2 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO5** | 2 | 3 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.8** | **2.6** | **2.6** | **2.6** | **2** | **1.8** | **1.6** | **1.6** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5233 | Internship | IS | | 2 |

To apply theoretical and practical knowledge to design and develop a project in their chosen domain.

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO 1:** gain hands-on experience in a real-world professional environment.

**CO 2:** develop workplace skills, including teamwork, time management, and professional communication.

**CO 3:** gain insight into industry standards, practices, and expectations.

**CO 4:** apply technical skills and knowledge to solve real-world problems.

**CO 5:** engage in reflective learning to assess experiences and set future career goals.

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| **Average** | **3** | **3** | **3** | **3** | **2.8** | **2.8** | **2** | **1.6** | **1.2** | **1.2** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5402 | Data visualization | Core | 5 | 4 |

To explore the fundamental concepts, importance of data analysis and design the visualization.

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO1:** design and create data visualizations.

**CO2:** gain the knowledge about D3.

**CO3:** use knowledge of chart library, generate chart and animate the graphs.

**CO4:** apply the various operations on data source.

**CO5:** understand and apply principles of data visualization.

**UNIT –I** **15 Hours**

Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets,data visualization tools. Mapping - Time series -Connections and correlations - Scatter plot maps - Trees, Hierarchies and Recursion – Networks and Graphs, Info graphics.

**UNIT- II** **15 Hours**

Introduction to D3 - Fundamental Technology -Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity - Layouts –Geomapping – Exporting- Data to create Visualizationwith SVG - SVG – Styling CSS –Shapes – SVG Properties – SVG Text - Drawing – Transformations.

**UNIT- III** **15 Hours**

D3-based reusable chart library: Introduction to D3 – Setup and Deployment – Generate Chart – Customize Chart – How to Use APIs – Customize Style – Building Real time and Live Updating animated graphs with C3.

**UNIT- IV** **15 Hours**

Tableau introduction: Environment Setup – Navigation – File & Data Types. DATA SOURCE: Custom Data View – Extracting Data – Fields Operations – Editing Meta Data – Data Joining – Data Blending. Worksheets

**UNIT –V** **15 Hours**

Tableaue charts: Bar Chart – Line Chart – Pie Chart – Scatter Plot – Bubble Chart –Gantt Chart – Histograms - Waterfall Charts. ADVANCED: Dashboard – Formatting –Forecasting – Trend Lines

**Learning Resources**

**Textbook**

1.Ben Fry, “Visualizing Data”, O‟Reilly Media, Inc., 2007.

**Reference Books**

1. Scott Murray, “Interactive data visualization for the web”, O‟Reilly Media, Inc., 2013.

2. Ritchie S. King - Visual Storytelling with D3 – An Introduction to Data Visualization with D3,Addison-Wesley-Data Analytic Series,ISBN 10: 0321933176.

3. Elijah Meeks , D3.js in Action, Second Edition: Data visualization with JavaScript, Publisher: Manning Publications, 2017, ISBN: 9781617294488

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 |
| **CO5** | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **2.8** | **2.6** | **2.6** | **2.2** | **1.8** | **1.6** | **1.2** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5404 | Cloud computing | Core | 5 | 4 |

To provide an understanding of how cloud computing evoloved, its acceptance world – wide and integral part of several organization.

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO1:** explain the models, principles, and benefits of Cloud Computing

**CO2:** describe virtualization foundations to cater the needs of elasticity, portability and resilience by cloud service providers.

**CO3:** identify the applications of Cloud Computing

**CO4:** analyse the security aspects of Cloud Computing

**CO5:** discuss the importance of message passing and map reduce in Cloud Computing

**Unit I** **15 Hours**

Introduction to Cloud Computing: Introduction – History – Fundamentals of Cloud Computing – Characteristics – Advantages and Disadvantages – Comparison of Traditional and Cloud Computing paradigms – Evaluating the impact and economics - Business Drivers – Future of Cloud.

**Unit II** **15 Hours**

Cloud Computing Architecture: Cloude computing architecture – Design principle – Life cycle(CCLC) – Reference architecture – Load balancing approach – Mobile cloud computing(MCC) – Case study of oracle cloud management

**Unit III** **15 Hours**

Service Oriented Architecture: Objectives - SOA foundation - Web services and SOA - SOA communication - SOA components - SOA Infrastructure - Need of SOA - Business Process Management (BPM) – Services of BPM

Cloud Computing Applications: Introduction – Google App Engine – Google Apps – Google Cloud – Data Store - Dropbox Cloud – Apple iCloud – Microsoft Windows Azure Cloud – Amazon Web Services(AWS)

**Unit IV** **15 Hours**

Cloud Security and Privacy: Cloud Security – Cloud CIA security model – Cloud Computing Security Architecture – Service provideder security issues – Data Security in cloud – Data privacy risks –Cloud service level agreements(SLA): Components – Types – Cloud Vendors – Quality of Cloud Services – Techniques – Migration – Trust management.

**Unit V** **15 Hours**

Cloud Computing Technologies: Cloud Computing Technologies - High performance Computing - Message Passing Interface(MPI) - MapReduce programming model -Dryad and Dryad LINQ - Eucalyptus cloud platform: Components. Adoption of Cloud Computing: Factors affecting the adoption - Existing areas of application - Case studies -Certifications.

**Learning Resources**

**Textbook**

1.Kant Hiran, Kamal, Ruchi Doshi, Temitayo Fagbola, Mehul Mahrishi, Cloud Computing: Master the Concepts, Architecture and Applications with Real-world examples and Case studies, BPB Publishers, 2019

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 |
| **CO4** | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **CO5** | 2 | 2 | 3 | 3 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.8** | **2.8** | **2.6** | **2.6** | **2.2** | **2** | **1.8** | **1.6** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5406 | Deep learning | Core | 5 | 4 |

To provide fundamental knowledge of neural networks and deep learning

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO1:** describe the concepts simulating human brain.

**CO2:** inspect the Supervised Learning Networks.

**CO3:** explain the essentials of Convolution Neural Network and Network architectures.

**CO4:** define, train and use a Deep Neural Network for solving real world problems that require artificial Intelligence based solutions.

**CO5**: discuss deep learning in various applications

**UNIT-I** **15Hours**

Introduction to Artificial Neural Networks: Neural Networks-Application Scope of Neural Networks- Fundamental Concept of ANN: The Artificial Neural Network-Biological Neural Network-Comparison between Biological Neuron and Artificial Neuron-Evolution of Neural Network. Basic models of ANN-Learning Methods-Activation Functions-Importance Terminologies of ANN.

**UNIT-II** **15Hours**

Supervised Learning Network: Perceptron Networks-Theory-Perceptron Learning ruleArchitecture-Flowchart for training Process-Perceptron Training Algorithm for Single and Multiple Output Classes. Back Propagation Network- Theory-Architecture-Flowchart for training process -Training Algorithm-Learning Factors for Back-Propagation Network. Radial Basis Function Network RBFN: Theory, Architecture, Flowchart and Algorithm.

**UNIT-III** **15Hours**

Convolutional Neural Network**:**Introduction - Components of CNN Architecture - Rectified Linear Unit (ReLU) Layer - Exponential Linear Unit (ELU, or SELU) - Unique Properties of CNN -Architectures of CNN -Applications of CNN.

**UNIT-IV** **15Hours**

Recurrent Neural Network: Introduction- The Architecture of Recurrent Neural Network- The Challenges of Training Recurrent Networks- Echo-State Networks- Long Short-Term Memory (LSTM) - Applications of RNN.

**UNIT-V** **15Hours**

Auto Encoder and Restricted Boltzmann Machine: Introduction - Features of Auto encoder Types of Autoencoder Restricted Boltzmann Machine- Boltzmann Machine - RBM Architecture - Example - Types of RBM

**Learning Resources**

**Text Books**

1.S.N.Sivanandam, S. N. Deepa, Principles of Soft Computing, Wiley-India, 3rd Edition, 2018.

2.Dr. S Lovelyn Rose, Dr. L Ashok Kumar, Dr. D Karthika Renuka, Deep Learning using Python, Wiley-India, 1st Edition, 2019.

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 2 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO5** | 2 | 3 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.8** | **2.6** | **2.6** | **2.6** | **2** | **1.8** | **1.6** | **1.6** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5302 | Deep learning lab | Core | 4 | 3 |

To acquire knowledge on the basics of neural networks using computational tools for variety of problems and to explore various deep learning algorithms.

**Course Outcomes:**

Students will be able to:

**CO1**:develop algorithms simulating human brain.

**CO2**: implement Neural Networks in Tensor Flow for solving problems.

**CO3**:explore the essentials of Deep Learning and Deep Network architectures.

**CO4**:define, train and use a Deep Neural Network for solving real world problems GAN

**CO5**: implement deep learning in Transfer Learning

**UNIT –I** **12 Hours**

Image Classification

- Experiment using peceptron
- Use a deep learning framework to train a Convolutional Neural Network on the MNIST dataset.
- Implement data augumentation techniques(eg. Rotation, flipping) to increase the size of the training set
- Experiment with different architectures (eg. AlexNet, ResNet ) and hyperparameters (eg. Learning rate, batch size)

**UNIT – II** **12 Hours**

Natural Language Processing

- Use a deep learning framework to train a recurrent neural network (RNN) on a text classification task (e.g. sentiment analysis).
- Implement word embeddings (e.g. Word2Vec, GloVe) to convert text data into numerical representations.
- Experiment with different architectures (e.g. LSTM, GRU) and hyperparameters (e.g. sequence length, embedding size).

**UNIT – III** **12 Hours**

Object Detection

- Use a deep learning framework to train a CNN on an object detection task (e.g. COCO dataset).
- Implement techniques for bounding box regression and non-maximum supprmession.

- Experiment with different architectures (e.g. YOLO, SSD) and hyperparameters (e.g. anchor box sizes, confidence threshold).

**UNIT – IV** **12 Hours**

Generative Adversarial Networks

- Use a deep learning framework to train a GAN on an image generation task (e.g. generating faces).
- Implement techniques for training GANs (e.g. batch normalization, Adam optimizer).
- Experiment with different architectures (e.g. DCGAN, WGAN) and hyperparameters (e.g. learning rate, batch size).

**UNIT – V** **12 Hours**

Transfer Learning

- Use a pre-trained deep learning model (e.g. VGG16, ResNet50) and fine-tune it on a new task (e.g. image classification on a different dataset).
- Experiment with different architectures and hyperparameters (e.g. learning rate, number of fine-tuned layers).

**Learning Resources**

**Text Book**

1.Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning" MIT Press, 2016

2.Francois Chollet, " Deep Learning with Python", Manning Publications, 2017.

3.Aurelien Geron, " Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow", O'Reilly Media, 2019.

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO5** | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **2.8** | **2.4** | **2.4** | **2.2** | **2** | **1.8** | **1.4** | **1.2** | **1.2** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5502 | Project | CORE | 6 | 5 |

To Apply theoretical and practical knowledge to design and develop a project in their chosen domain.

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO 1:** gain hands-on experience in a real-world professional environment.

**CO 2:** develop workplace skills, including teamwork, time management, and professional communication.

**CO 3:** gain insight into industry standards, practices, and expectations.

**CO 4:** apply technical skills and knowledge to solve real-world problems.

**CO 5:** engage in reflective learning to assess experiences and set future career goals.

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| **Average** | **3** | **3** | **3** | **3** | **2.8** | **2.8** | **2** | **1.6** | **1.2** | **1.2** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5304 | Web analytics | DSE | 5 | 3 |

To impart the fundamental knowledge of web analytics which are essential in business world.

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO1:** examine the basic concepts of Web Analytics

**CO2:** describe the Data methods for Web Analytics

**CO3:** identify the web analytics strategies and webanalytics tools

**CO4:** analyse the Web intelligence to improve the outcomes of business plan

**CO5:** design and implement search log analytics process a make a business decision making.

**Unit I** **15 Hours**

Introduction: The foundation of web analytics Theory and methods : Introduction-Behaviorism-Behaviors-Trace Data-Unobtrusive methods-Web analytics as Unobtrusive methods-The history of Web Analytics:Single web sities-Library Systems-Search Engines

**Unit II** **15 Hours**

Data Collection for Web Analytics: Web server log files-page tagging-Visitor Type-Visit length-Demographic and system statistics-Internal search-Visitor path-Top pages-Referres and knowledge Analysis-

**Unit III** **15 Hours**

Web analytics Strategies: Performance indicator-Web Analytics process-Identify key stake holders-Define goal for web site- Identify the most important site visitor-Determine the key performance Indicators-Identify and implement the solution-Use multiple technologies and methods-Makes improvement iteratively-Hire and empower a full time Analysist-Choosing a web Analytics tool

**Unit IV** **15 Hours**

Web Analytics as Intelligence: Determining a key performance-Commerce-Lead Generation-Content/Media-Support/Self Service- Supplementary methods for Augmenting web analytics-Review of appropriate Survey Literature- Planning and conducting survey-Design a survey instrument.

**Unit V** **15 Hours**

Search log Analytics: Introduction-Review of search log analytics-Search log Analysis Process- Data Analysis

**Learning Resources**

**Textbook**

1.Bernard J. Jansen, "Understanding User-Web Interactions via Web analytics", Morgan and Claypool, 2009.

**Reference Books**

1. Brian Clifton, "Advanced web metrics with Google analytics", John Wiley & Sons, 2012.
2. Jerri L. Ledford, Joe Teixeira and Mary E. Tyler, "Google Analytics", John Wiley & Sons, 2013.
3 Avinash Kaushik, "Web Analytics2.0", John Wiley & Sons, 2010.

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **CO5** | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **2.8** | **2.6** | **2.6** | **2.2** | **1.6** | **1.6** | **1** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5306 | Social media analytics | DSE | 5 | 3 |

This course aims to foundation of social media analytics and deal with any social media network strategy or campaign and learn to integrate social media analytics with other areas of business.

Course Outcomes

**CO1:** explain the data in social media and its various forms.

**CO2:** different types of social media analytics tools that draw data from different sources, are based in different search patterns, and also deliver different results

**CO3:** describe the Metrics as a part of tactics and applying metrics towards strategic goals and learn to repeat such tactics when successful

**CO4:** defining what strategy is, its elements, and learn the niceties on how to build a good analytics strategy.

**CO5:** applications of Social Media Analytics and its future.

**Unit I** **15 Hours**

Social Media Data : A look into the evolution of Data and the Digital Gap – Social Media Data Sources – Offline and Online - Defining Social Media Data – Data Sources in Social Media Channels – Estimated Vs Factual Data Sources – Public and Private Data – Data gathering in Social Media Analytics – API – Web Crawling or Scraping. From Data to Insights - Shaping data to work for us – Creating a plan to shape Data into insights.

**Unit II** **15 Hours**

Analytics in Social Media and Types of Analytic Tools: Defining Analytics in Social Media as a Broad Term – Types of Analytics in Social Media - Analytics, Listening, Advertising Analytics - The Analytics Process - Elements to shape data insights – Analysis is Comparison – Shaping method – Analysis Cycle – Community activity – Resources - Attention span for reports – Dynamic cycles – short and long periods – Understand the audience – case study.

**Unit III** **15 Hours**

Metrics, Dashboards and Reports Metrics: Default and Custom metrics – Metric Categories – Divide and conquer – Metric Capabilities – examples – Metrics and Strategy – Estimated Metrics – Given by the social networks – calculated by third party technology – Metrics and Tactics - Dashboards – purpose – defining objectives – example – default vs custom dash boards – Linearity and order of Metrics – Reports - Elements of Reporting - Good Qualities for Each Element of Reporting - Elements in Chain - Reporting Approaches.

**Unit IV** **15 Hours**

Strategy **and** Tactics: Success Strategy in Social Analytics - Strategic Planning in Social Media Analytics - Data Availability and Data Sources - Knowledge beyond Social Media - Tools and Technology Preparation - Team Preparation Goals and Objectives - Reporting Cycles and Timelines - Contingency Plans - Application of a Social Media Analytics Strategy - Evaluation of a Strategic Analytics Cycle - Detecting a Hidden Strategy - Building a Good Social Analytics Strategy - Tactics - Practical Elements to Include in Social Analytics – Strategies - Goals and success rates - Competitive bench marking – Discovery - Case study.

**Unit V** **15 Hours**

The Future : The Final Stage for Analytics Applications - Three Stages of Analytics - Descriptive Analytics Predictive Analytics - Prescriptive Analytics - Competitive Advantage as a Goal - Prescriptive Analytics - The Future of Social Media Analytics .

**Learning Resources**

**Reference Books**

1.Social Media Analytics Strategy, Alex Gonclaves, 2017, Apress

2.Social Media Analytics, Marshall Sponder, 2012, The Mc-Graw-Hill Publisher.

3.Social Media Analytics, Mathew Ganis – Avinash Kohirkar, IBM Press.

**CO – PSO Mapping**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 | PSO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **CO5** | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| **Average** | **3** | **2.8** | **2.4** | **2.6** | **2.2** | **1.6** | **1.6** | **1** | **1** | **1** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS5244 | Professional competency skill | SEC | - | 2 |

To Apply theoretical and practical knowledge to design and develop a project in their chosen domain.

**Course Outcomes:**

On the successful completion of the course, Students will be able to

**CO 1**: enhance problem-solving skills through rigorous practice of quantitative, logical reasoning, and verbal ability questions.

**CO 2**: improve time management skills to efficiently allocate time during the exam and maximize performance.

**CO 3**: develop the ability to work collaboratively in multidisciplinary teams, integrating data science expertise with domain-specific

**CO 4**: cultivate strong communication skills to articulate data insights and recommendations to diverse audiences, including technical and non-technical stakeholders.

**CO 5**: engage in continuous self-assessment and feedback to identify strengths and areas for improvement, setting clear goals for success.

**CO – PO Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| **Average** | **3** | **3** | **3** | **3** | **2.8** | **2.8** | **2** | **1.6** | **1.2** | **1.2** |

Strong – 3 Medium - 2 Low -1

# Value Added Course

| Sem | Category | Course Code | Course Title | Hours/ Wk. | Credits | Marks |
|---|---|---|---|---|---|---|
| 2 | VAC | 24PDS422V | Metaheuristic Algorithms | 2 | 2 | 30 |
| 3 | VAC | 24PDS521V | Microsoft Power BI | 2 | 2 | 30 |

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS422V | Metaheuristic Algorithms | VAC | 2 | 2 |

**Objective:**

The course is intended to provide an introduction to algorithms and nature inspired algorithms.

**Course Outcomes:**

**CO 1:** describe the fundamental principles and goals of metaheuristic algorithms for optimization.

**CO 2:** interpret Image Segmentation methods

**CO 3:** apply metaheuristic algorithms to perform edge-based and region-based image segmentation.

**CO 4:** analyze and interpret the results of multilevel thresholding based on metaheuristic algorithms for image segmentation.

**CO 5:** compare and contrast the strengths and limitations of different clustering methods in the context of image segmentation

**Unit I** **6 Hours**

Introduction – Metaheuristic Algorithms for Optimization – Image Segmentation – Optimization – Gradient Based Optimization – Other Classical Approaches.

**Unit – II** **6 Hours**

Image Segmentation Using Metaheuristics – Edge Based Image Segmentation – Region Based Image Segmentation – Data Clustering – Based Image Segmentation – Comparison between the Traditional Image Segmentation Methods

**Unit – III** **6 Hours**

Multilevel Thresholding for Image Segmentation Based on Methaheuristic Algortithms – Multilevel Thresholding – Metaheuristic Algorithms for Segmentation (Cuckoo Search Algorithm, Bat Algorithm, Aritical Bee Colony, Firefly Algorithm, Social – spider Algorithm, Whale Optimization Algorithm, Moth Flame Optimization, Grey Wolf Optimization, Partical Swarm Optimization) .

**Unit- IV** **6 Hours**

Image Segmentation using Kapur's Entropy and a Hybrid Optimization Algorithm – Background – Proposed Approach – Experimental and Results.

**Unit – V** **6 Hours**

Introduction – Clustering methods for Image Segmentation ( Hierarchical Clustering, Partitional Clustering, K- Means Clustering, Fuzzy Clustering)

**Learning Resource**

**Text Book**

1. Diego Oliva, Mohamed Abd Elaziz, Salvador Hinojosa, "Metaheuristics algorithms for Image Segmentation : Theory and Applications",Springer.

## CO – PO Mapping

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **CO2** | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 |
| **CO5** | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| **Average** | **3** | **2.4** | **2.4** | **3** | **2.6** | **2** | **2** | **1.8** | **1.2** | **1.2** |

Strong – 3 Medium - 2 Low -1

| Course Code | Name of the Course | Category | Hours/Wk. | Credits |
|---|---|---|---|---|
| 24PDS521V | Microsoft power BI | VAC | 2 | 2 |

**Objective:**

The course is intended to Learn to integrate Power BI with other Microsoft tools, such as Excel and SharePoint, for seamless data analysis and collaboration

**Course Outcomes:**

**CO 1:** describe the various options of PowerBI and to generate the report.

**CO 2:** design various dashboards in workspace.

**CO 3:** formulate the PowerBI architechture and Publishing methods

**CO 4:** learn to connect the Database and loading from multiple sources.

**CO 5:** assess and integrate the Power BI in various platforms.

**Unit I** **6 Hours**

**Introducing POWER BI:** Getting started with Power BI – Uploading data to Power BI – Introducing to natural language queries – Introduction to reports – Introducing Visual Interactions – Decorating the Report – Saving the Report – Pinning the report.

**Unit II** **6 Hours**

**Sharing the Dashboard :** Creating a group workspace in Power BI - Viewing Reports and Dashboards on mobile devices.

**Unit III** **6 Hours**

**Understanding Data Refresh:** Introducing data refresh – Introducing the Power BI refresh architecture – Introducing Power BI Desktop – Publishing to Power BI.

**Unit IV** **6 Hours**

**Using PowerBI Desktop:** Connecting to database – Loading from multiple sources – Using Query Editor – Hiding or removing tables – Handling seasonality and sorting months.

**Unit V** **6 Hours**

**Getting data from services and content packs :** Cosuming a service content pack – Creating a custom dataset from a service. Creating a content pack for your organization – Consuming an Orgaizational Content Pack – Updating an Organizational Content Pack.

**Learning Resources**

**Text Books**

1. Alberto Ferrari and Marco Russo, " Introducing Microsoft Power BI", Microsoft Corporation, 2016.

**References Books**

1. Holden, “Guide to firewalls and Network security”, Vijay Nicole Publications,2005

2. Christopher M King, Curtis E. Dalton, T.Ertem Osmanoglu, “Security Architecture Design, Deployment & Operations”, Osborne/McGraw-Hill,2001

## CO – PO Mapping

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 |
| **CO4** | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| **Average** | **3** | **2.8** | **2.2** | **3** | **2.4** | **2** | **2** | **1.6** | **1.2** | **1.2** |

Strong – 3 Medium - 2 Low -1