

XXXXX
(Sub Code)

DISCRETE MATHEMATICS
(III SEM FOR CSE,AIDS,CSBS,AI ML, IT,
CYBER SECURITY)

L T P C
3 1 0 4

COURSE OBJECTIVES:

To make the student conversant with the

- ✓ Knowledge of the concepts needed to test the logic of a program.
- ✓ Concept of combinations and permutations.
- ✓ Concept of recurrence relations and counting principles.
- ✓ Terminology of graph and special types of graphs.
- ✓ Concepts and properties of algebraic structures such as groups, rings and fields.
- ✓ Real-world case studies on discrete mathematics.

UNIT - 1 LOGIC AND PROOFS

10

***Applications:** Linguistics, evidence evaluation, philosophical reasoning, automated theorem proving, epistemology.*

Propositional logic - Propositional equivalences - Predicates and quantifiers - Nested quantifiers - Rules of inference - Introduction to proofs - Proof methods and strategy.

UNIT - 2 COMBINATORICS

10

***Applications:** Fractal generation, genetic algorithms, investment growth models, signal processing, solving difference equations.*

Mathematical induction - Strong induction and well ordering - The basics of counting – The (C6) pigeonhole principle - Permutations and combinations. Recurrence relations - Solving linear recurrence relations - Generating functions - Inclusion and exclusion principle

UNIT - 3 GRAPHS

10

***Applications:** Project management (PERT/CPM), signal flow graphs, protein interaction networks.*

Graphs - Graph terminology and special types of graphs - Matrix representation of graphs and (C7) graph isomorphism - Connectivity - Euler and Hamilton graphs.

UNIT - 4 ALGEBRAIC STRUCTURES

10

***Applications:** Musical composition, communication networks, graph theory, rotations.*

Algebraic systems - Semi groups and monoids- Groups - Subgroups - Homomorphism's Normal (C8) subgroup and cosets - Lagrange's theorem - Definitions and examples of Rings and Fields.

UNIT - 5 LATTICES AND BOOLEAN ALGEBRA

10

Applications: *Musical composition, communication networks, graph theory, rotations.*

Partial ordering - Posets - Lattices as posets - Properties of lattices - Lattices as algebraic systems - Sub lattices - Direct product and homomorphism - Some special lattices - Boolean algebra - Sub Boolean Algebra - Boolean Homomorphism.

**UNIT - 6 APPLICATIONS OF DISCRETE MATHEMATICS IN (C1)
REAL LIFE SCENARIO**

10

Apply the recurrence relations in solving CAGR (Compound annual growth rate)- Analyze the shortest path algorithm on tracking material costs impact in final product - Estimate the discount strategies using combinatorics - Analyze the group theory for efficient warehouse logistics and package delivery routes [Amazon, DHL & FedEx] - Apply Boolean logic in SQL queries for effective big data analysis and database management in ISI [Indian Statistical Institute].

TOTAL: 60 PERIODS**OUTCOMES:**

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

1. Utilize mathematical logic concepts, such as inference theory and quantifiers, to effectively solve problems.
2. Solve problems involving recurrence relations, including linear recurrence relations, and utilize generating functions.
3. Represent real-life situations using graph theory, apply principles such as Eulerian and Hamiltonian paths, and interpret various graph representations.
4. Examine the core mathematical principles behind algebraic structures such as groups, rings, and fields.
5. Utilize the concepts of lattices and Boolean algebra to solve logical problems effectively.
6. Apply the basic ideas of algebraic structure, discrete mathematics, Boolean to simulate real-life events.

TEXT BOOKS:

1. Rosen. K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017.
2. Tremblay. J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
3. Strang. G., "Linear Algebra and its applications", Thomson (Brooks/Cole), New Delhi, 2005.

REFERENCES:

1. Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2013.
2. Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

CO -PO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	-	-	-	-	-	-	1	-	-	1	-	-	-
2	3	3	-	-	-	-	-	-	1	-	-	1	-	-	-
3	3	3	-	-	-	-	-	-	1	-	-	1	-	-	-
4	3	3	-	-	-	-	-	-	1	-	-	1	-	-	-
5	3	3	-	-	-	-	-	-	1	-	-	1	-	-	-
6	3	3	-	-	-	-	-	-	1	-	-	1	-	-	-
LOW (1) ; MEDIUM (2) ; HIGH (3)															

COURSE OBJECTIVES:

- ✓ To learn how to design object-oriented programs with Python classes.
- ✓ To understand threading concept and multithreading on Python.
- ✓ To learn about lambda function and regular expression.
- ✓ To develop GUI based applications and Graphics using python.
- ✓ To use Numpy, Pandas and Matplotlib packages.
- ✓ To know about real time applications of python.

UNIT - 1 OBJECT ORIENTED PROGRAMMING IN PYTHON 8

Applications: OOPs concepts in Client Server Systems, OO Databases, Simulation and modeling.

OOPs in python: Features of Object Oriented Programming system (OOPs) - classes and objects - Creating a class - the self variable, types of variables, namespaces – inheritance in python, types of inheritance – polymorphism – overloading – overriding – data hiding.

UNIT - 2 THREADS AND ADVANCED FILE OPERATIONS 8

Applications: Multiprocessing, better resource utilization, rendering graphics.

Threads in python: Difference between process and thread - types of threads - benefits of threads - creating threads – multithreading – starting a thread - thread synchronization. File operations – modes of opening a file – seek() and tell() - working with text file , binary file and CSV file – preparing a pdf file after data processing.

UNIT - 3 LAMBDA FUNCTION AND REGULAR EXPRESSION 8

Applications: Quick data manipulation, less number of lines in coding, flexibility, pattern matching, word (or) character searching.

Lambda function – syntax - advantages over normal function – difference between lambda and def - Regular expression - sequence characters in regular expressions - quantifiers in regular expressions - special characters in regular expressions - using regular expression on files - retrieving information from a file.

UNIT - 4 GRAPHICAL USER INTERFACE & GRAPHICS IN PYTHON 8

Applications: Self ticket booking system, Video games, Designing Web pages.

Graphical user interface: Creating a GUI in python - widget classes - working with Fonts and Colors, working with Frames, Layout manager, Event handling – Graphics in python - Turtle Graphics – turtle attributes and methods - Creating drawings and animations – simple shapes – working with colors and pen size – Using loops and functions – creating designs.

UNIT - 5**PACKAGES IN PYTHON**

8

Applications: *Data Analysis and Visualization, real time numerical calculations, image processing, AIML model predictions.*

Introduction to Numpy -Creation of vectors and matrices - Matrix manipulation - Pandas - Pandas data structures – Series and Data Frame - Data wrangling using pandas – Matplotlib - Scatter plot - Line plot - Bar chart.

UNIT - 6**REAL TIME APPLICATIONS**

5

Python in Web Development, Data Science , Artificial Intelligence and Machine Learning, Deep Learning, 3D game development, Web Scrap applications, Search Engine optimization. Familiar companies uses python – Netflix, Facebook, Spotify, Google, AWS uses Django and Flask.

TOTAL: 45 PERIODS**OUTCOMES:**

At the end of the course the students would be able to

1. able to understand OOP concepts in Python including inheritance and polymorphism.
2. able to work with files and perform operations on it using Python
3. able to implement regular expression and concept of threads for developing efficient program
4. Designing GUI based applications using Python
5. Knowledge of using Numpy, Pandas and Matplotlib packages.
6. Know the real time applications and familiar companies using python

PRACTICAL EXERCISES:

1. Write a Python class named Person with attributes name, age, weight (kgs), height (ft) and display the details of a person.
2. Write a python program to demonstrate operator overloading
3. Write a Program to demonstrate concept of threading and multitasking in Python.
4. Write a program to Python program to implement various file operations. (text file, binary file and CSV file)
5. Write a program to Python program to demonstrate use of regular expression for the following :
Check the validity of a password given by the user. The password should satisfy the following criteria:
 - i) Contain at least 1 letter between a and z
 - ii) Contain at least 1 number between 0 and 9
 - iii) Contain at least 1 letter between A and Z
 - iv) Contain at least 1 character from \$, #, @
 - v) Minimum length of password: 6
Maximum length of password: 12
6. Write a python program to create a module and import the module in another python program.
7. Write a Python program to demonstrate working of OS Module and Calendar Module
 - a) Write a python program to find min, max, sum, cumulative sum of array

- b) Write a python program to implement Pandas Series with labels.
- 8. Write a GUI Program in Python to design application that demonstrates
 - a. Different fonts and colors
 - b. Different Layout Managers
- Event Handling
- 9. Write a python program to create different shapes / objects using turtle package.

TOTAL: 30 PERIODS

TEXT BOOKS:

- 1. Paul Gries , Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 3rd Edition, 2018.
- 2. Programming through Python, M. T Savaliya, R. K. Maurya, G M Magar, Revised Edition, Sybgen Learning India, 2020.

REFERENCES:

- 1. Advanced Python Programming, Dr. Gabriele Lanaro, Quan Nguyen, Sakis Kasampalis, Packet Publishing, 2019.
- 2. Programming in Python 3, Mark Summerfield, Pearson Education, 2nd Ed, 2018.
- 3. Python: The Complete Reference, Martin C. Brown, McGraw Hill, 2018.
- 4. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress, 2017.

COURSE OBJECTIVES:

- ✓ To impart artificial intelligence principles, techniques and its history.
- ✓ To assess the applicability of problem solving and heuristic search.
- ✓ To understand the strengths and weaknesses of the basic knowledge representation in solving engineering problems.
- ✓ To apply probabilistic approach for uncertainty in problem solving.
- ✓ To understand learning methods and develop intelligent systems by assembling solutions to concrete computational problems.
- ✓ To create an awareness about the Future of AI.

UNIT – 1 ARTIFICIAL INTELLIGENCE AND ITS ISSUES 7

Applications: *Digital Assistance- Siri (Apple) Alexa (Amazon) Cortana (Microsoft) Google Assistant (Google) Bixby (Samsung)-disaster response-education & game playing.*

Definitions - Importance of AI, Evolution of AI - Applications of AI, Classification of AI systems with respect to environment, Knowledge Inferring systems and Planning, Uncertainty and towards Learning Systems.

UNIT – 2 PROBLEM SOLVING & HEURISTIC SEARCH 7

Applications: *Chess playing AI like Deep Blue, Go playing AI like AlphaGo, Real-time strategy (RTS) game AI in StarCraft II*

Problem solving by Search, Problem space - State space, Blind Search - Types, Performance measurement. Types, Game playing mini-max algorithm, Alpha-Beta Pruning.

UNIT – 3 KNOWLEDGE REPRESENTATION AND REASONING 8

Applications: *smart home automation, trouble shooting s/w issues-complex game AI-ontological representation -semantic search-E-commerce product categorization-NLP*

Logical systems Knowledge Based systems, Propositional Logic Constraints, Predicate Logic First Order Logic, Inference in First Order Logic, Ontological Representations and applications.

UNIT – 4 UNCERTAINTY AND KNOWLEDGE REASONING 8

Applications: *Medical diagnosis, Spam filtering, Weather Forecasting, Fault diagnosis.*

Overview Definition of uncertainty, Bayes Rule Inference, Belief Network, Utility Based System, Decision Network.

UNIT – 5 TOOLS FOR DEVELOPING AI

9

Applications: Copilot , GitHub, ChatGPT

Programming Languages – Machine Learning Frame works – AI powered Coding assistants - Integrated Development Environments (IDE's) - Version Control Systems – Other AI tools.

UNIT - 6 AI IN SHAPING OUR WORLD

6

Revolutionizing Patient Care with AI (IBM Watson Health)- Transforming Supply Chain Management through AI(Amazon)- Driving the Future of Transportation (Tesla's Autonomous Vehicles)- Fashioning the Future with AI in Retail (Zara)- Breaking Language Barriers with Voice Recognition(Baidu)- Sowing the Seeds of AI in Agriculture(Blue River Technology). Innovating Drug Discovery with AI(Roche).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

- CO1: Evaluate Artificial Intelligence (AI) methods and describe their foundations.
- CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
- CO3: Demonstrate knowledge of reasoning and knowledge representation for solving real world problems.
- CO4: Analyze and illustrate how search algorithms play vital role in problem solving.
- CO5: Illustrate the construction of learning and expert system.
- CO6: Gain knowledge about current scope and limitations of AI and societal implications.

TEXT BOOKS:

1. Russell, S. and Norvig, P,” Artificial Intelligence - A Modern Approach”, 3rd edition, Prentice Hall ,2020.
2. Poole, D. and Mackworth, A.,” Artificial Intelligence: Foundations of Computational Agents”, Cambridge University Press, 2023.

REFERENCES:

1. Ric, E., Knight, K and Shankar, B, “Artificial Intelligence”, 3rd edition, Tata McGraw Hill, 2009.
2. Luger, G.F, “Artificial Intelligence -Structures and Strategies for Complex Problem Solving”, 6th edition, Pearson, 2008

- | CO – PO MAPPING | | | | | | | | | | | | | | |
|---------------------------------|----|---|---|---|---|---|---|---|---|----|----|-----|---|---|
| CO | PO | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 1 | 3 | 2 | 1 | 2 | 2 | - | - | - | 1 | - | - | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | - | - | - | 2 | - | - | 3 | 3 | 3 |
| 3 | 3 | 3 | 2 | 3 | 3 | 1 | - | - | 2 | - | - | 3 | 3 | 3 |
| 4 | 3 | 3 | 2 | 3 | 3 | - | - | - | 3 | - | - | 3 | 3 | 3 |
| 5 | 3 | 2 | 2 | 2 | 3 | - | - | - | 2 | - | - | 3 | 3 | 3 |
| 6 | 3 | 2 | 3 | 3 | 3 | - | - | - | 2 | - | - | 2 | 3 | 3 |
| LOW (1) ; MEDIUM (2) ; HIGH (3) | | | | | | | | | | | | | | |

LOW (1); MEDIUM (2); HIGH (3)

COURSE OBJECTIVES:

- ✓ To learn the basic structure of computer, operation and instructions.
- ✓ To compute simple arithmetic operations for fixed point and floating point.
- ✓ To understand the basics of pipelining and multicore processing.
- ✓ To learn parallelism processor architecture
- ✓ To synthesize and learn various memory system and I/O communication
- ✓ To introduce the recent trends in Computer Architecture

UNIT I - BASIC STRUCTURE OF A COMPUTER SYSTEM**7*****Applications: Everyday Computing***

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing– Bus structure – Bus operation.

UNIT II - ARITHMETIC FOR COMPUTERS**8*****Applications: Everyday Computing***

ALU – Addition and subtraction – Multiplication – Division – Floating Point Representation and operation - Subword parallelism.

UNIT III – PROCESSOR AND CONTROL UNIT**8*****Applications: Embedded Systems***

A Basic MIPS implementation – Building a Data path – Simple Implementation Scheme – Overview of Pipelining – Pipelined Datapath and Control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT IV - MEMORY HIERARCHY AND I/O SYSTEMS**8*****Applications: Graphics Processing Unit (GPU)***

Memory Hierarchy – Types and characteristics of memories- Memory Technologies – Basics of Cache memory – Measuring and Improving Cache performance –Virtual Machines -Virtual Memory. Overview of DMA -Accessing I/O: Parallel and Serial Interface- Interrupts – Interrupt I/O – Interconnection Standards: USB, SATA

UNIT V - PARALLELISM**9*****Applications: Online search engines , Data Centers***

Parallel processing challenges – Flynn’s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multicore processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

UNIT VI :RECENT TRENDS IN COMPUTER ARCHITECTURE**5**

Quantum Computing- AI Integration of hardware design- Edge Computing- Neuromorphic computing.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

CO1: Define the basic structure of computer, operation and instructions.

CO2 : Compute simple arithmetic operations for fixed point and floating point.

CO3: Differentiate pipelining, parallel processing, multithreading and multicore processing

CO4: Illustrate parallel processor architecture

CO5: Synthesize and learn various memory system and I/O communication

CO6: Be aware of Recent trends in computer architecture

TEXT BOOK

1. David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, Sixth Edition, Morgan Kaufmann/Elsevier, 2020.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw Hill, 2012.

REFERENCES

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Tenth Edition, Pearson Education, 2016

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1								
CO2	3	2	3	2	2						
CO3	3	3	2							1	1
CO4	3	3	3	2						1	1
CO5	3	2	2	2	1					1	1

COURSE OBJECTIVES:

- ✓ To introduce basic concepts of Data types, Algorithms and linear data structures.
- ✓ To perform operations on linear data structures Stack and Queues.
- ✓ To apply suitable non-linear data structure operations to solve specific problems.
- ✓ To utilize relevant graph algorithms for various graph-based applications.
- ✓ To evaluate different searching, sorting and hashing algorithms.
- ✓ To apply the data structure concepts in different domains.

UNIT- I INTRODUCTION TO DATA STRUCTURE AND LIST**8**

Applications: *Linked list- image viewer, Music player, previous & next pages in web browser, GPS navigation, undo redo functionality.*

Introduction to DS – Types of Data Structures- Introduction to analysis of algorithms - Asymptotic Notations -Recursive, Non-Recursive Algorithm - Abstract Data Types (ADTs) -List ADT -Array-based implementation -Linked list implementation - Singly linked lists -Circularly linked lists -Doubly-linked lists -Applications of lists - Polynomial ADT- Polynomial Manipulation.

UNIT- II LINEAR DATA STRUCTURES–STACKS, QUEUES**9**

Applications: *Stack-back & forward buttons in a web browser, recursive programs-Queue- call centers, printer management, traffic systems, task scheduling*

Stack ADT -Stack Model - Implementations: Array and Linked list - Operations - Applications - Balancing Symbols -Evaluating arithmetic expressions- Infix to Postfix conversion -Function Calls - Queue ADT - Operations - Circular Queue - DeQueue - Applications of Queues.

UNIT- III NON-LINEAR DATA STRUCTURES–TREES**9**

Applications: *BST- dictionary, phone contacts, online store system, File system. AVL trees-indexing databases-Heaps-resource allocation, directory structures in file systems.*

Tree ADT -Tree Traversals -Binary Tree ADT- Expression trees- Binary Search Tree ADT- AVL Trees -Priority Queue (Heaps) - Binary Heap- Multi way Search Trees: B-Tree-B+ Tree.

UNIT -IV NON-LINEAR DATA STRUCTURES -GRAPHS**7**

Applications: *Social Networks, Transportation, Computer networks, Web crawling, GPS Navigation, Network routing. Telecommunication Networks-route planning for postal delivery, road trips*

Graph Definition-Representation of Graphs-Types of Graph- Breadth-first traversal -Depth-first traversal -Bi-connectivity-Euler circuits-Topological Sort-Shortest Path Algorithm: Dijkstra's algorithm- Minimum Spanning Tree: Prim's algorithm, Kruskal's Algorithm.

Applications: *E-commerce Applications, Social Media, Search Engines, Text Editors and IDE ,Accident Detection, Online shopping- **Hashing** : Bloom Filtering, Data base indexing, Password storage.*

Searching: Linear Search-Binary Search. Sorting: Bubble sort -Selection sort -Insertion sort -Quick sort. Hashing: Hash Functions -Collision Resolution Strategies: Separate Chaining -Open Addressing -Rehashing.

UNIT- VI RECENT TRENDS AND DS APPLICATION IN DIFFERENT DOMAINS 6

Introduction - Cache-Oblivious Data Structures, Sketch Data Structures ,Geometric Data Structures, Self-Organizing Data Structures. Applications- AI & ML- Decision Trees for Predictions, Graphs in Neural Networks-Block chain Technology-Merkle trees, Hash tables. Healthcare and Bioinformatics-suffix trees, hash tables and Graphs. IoT- Circular buffer, Graphs & BST.

TOTAL:45 PERIODS**PRACTICAL EXERCISES:**

1. Array implementation of Stack, Queue and Circular Queue ADTs
2. Implementation of Singly Linked List
3. Linked list implementation of Stack and Linear Queue ADTs
4. Implementation of Polynomial Manipulation using Linked list
5. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues
9. Implementation of Dijkstra's Algorithm
10. Implementation of Prim's Algorithm
11. Implementation of Linear Search and Binary Search
12. Implementation of Insertion Sort and Selection Sort
13. Implementation of Open Addressing (Linear Probing and Quadratic Probing)

TOTAL:30 PERIODS**COURSE OUTCOMES:**

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

- CO1: define basic concepts in algorithms and data structures.
- CO2: implement linear data structure operations.
- CO3; choose appropriate linear/non-linear data structure operations for solving a given problem.
- CO4: apply appropriate graph algorithms for graph applications.
- CO5: analyze the various searching, sorting and hashing algorithms.
- CO6: apply the data structure concepts in different domains.

TOTAL:75 PERIODS

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2017.
2. Kamthane, "Introduction to Data Structures in C", 1st Edition, Pearson Education, 2007
3. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Silicon paper publications, 2008.

1. “SCHAM’S outlines Data Structures With C”, Seymour Lipschutz, Adopted in India by Arrangement with The Tata McGraw-Hill companies, Lnc., New York.
2. Langsam, Augenstein and Tanenbaum, “Data Structures Using C and C++”, 2nd Edition, Pearson Education, 2015.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, Fourth Edition, McGraw Hill/ MIT Press, 2022.
4. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, “Data Structures and Algorithms”, 1st edition, Pearson, 2002.
5. Kruse, “Data Structures and Program Design in C”, 2nd Edition, Pearson Education, 2006.
6. Rajesh K. Shukla, “Data Structures using C and C++”, Wiley India Publications, 2009.

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
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2	2	1		1	1	-	-	-	2	1	1	3	3	3
3	2	2	2	2	2	1	1	-	2	2	1	3	3	3
4	2	2	1	1	2	-	-	-	3	1	2	3	3	3
5	2	2	2	2	2	-	-	-	2	1	1	3	3	3
6	2	2	3	3	2	1	1	-	2	1	1	2	3	3
LOW (1); MEDIUM (2); HIGH (3)														

COURSE OBJECTIVES:

- ✓ To Understand the basic concepts of Data Analysis
- ✓ To acquire skills in data preparatory and preprocessing steps
- ✓ To understand the mathematical skills in statistics
- ✓ To learn the tools and packages in Python for data science
- ✓ To acquire knowledge in data interpretation and visualization techniques
- ✓ Will gain Knowledge about recent trends in Data Science

UNIT- I INTRODUCTION

8

Applications: Search engines, Image recognition

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications

UNIT- II DESCRIBING DATA

9

Applications: Speech recognition, Recommendation systems

Frequency distributions –Outliers –relative frequency distributions –cumulative frequency distributions – frequency distributions for nominal data –interpreting distributions –graphs –averages –normal distributions –z scores –normal curve problems –finding proportions –finding scores –more about z– interpretation of r^2 –multiple regression equations –regression toward the mean- statistical metrics with python.

UNIT- III INTRODUCTION TO NUMPY

8

Applications: Machine Learning, Scientific Computing

Data types in Python -basics of Numpy arrays - computations on Numpy Arrays-universal functions- aggregations: min, max and Everything in between-computation on arrays: broadcasting - comparisons, masks, and Boolean logic - fancy indexing -sorting values in Numpy array-fast sorting-sorting along rows or columns-partial sorts-K nearest neighbors- Numpy's structured arrays

UNIT- IV DATA MANIPULATION WITH PANDAS

8

Applications: Financial Analysis, Data Visualization

Pandas objects - data indexing and selection - operating on data in pandas -handling missing data - hierarchical indexing - combining datasets: concat and append - combining datasets: merge and join- aggregation and grouping- pivot tables-vectorized string operations - working with time Series - high-performance pandas: eval()and query().

UNIT -V PYTHON FOR DATA VISUALIZATION

7

Applications : Climate Change Analysis, Sports data Analysis

Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density –three dimensional plotting – geographic data – data analysis using statmodels and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh

UNIT -VI RECENT TRENDS IN DATA SCIENCE

5

Healthcare- Drug development, Virtual healthcare assistance- Finance- Fraud detection- Marketing- Targeted advertising, Customer interactions- Transportation - Driverless cars, Airline routing.

TOTAL: 45 PERIODS

PRACTICAL EXERCISES:

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
 - a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
 - b. Bivariate analysis: Linear and logistic regression modeling
 - c. Multiple Regression analysis
 - d. Also compare the results of the above analysis for the two data sets.
6. Apply and explore various plotting functions on UCI data sets.
 - a. Normal curves
 - b. Density and contour plots
 - c. Correlation and scatter plots
 - d. Histograms
 - e. Three dimensional plotting
7. Visualizing Geographic Data with Basemap
8. Importing Data from External Source Using Python

SOFTWARE REQUIREMENTS

Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

TOTAL : 30 PERIODS

TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

- CO1: Apply the skills of data inspecting and cleansing.
- CO2: Determine the relationship between data dependencies using statistics
- CO3: Represent the useful information using mathematical skills
- CO4: Handle data using primary tools used for data science in Python
- CO5: Apply the knowledge for data describing and visualization using tools
- CO6: Aware of the current scope and limitations of DS and societal implications

TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (first two chapters for Unit I)
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. (Chapters 1–7 for Units II)
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016. (Parts of chapters 2–4 for Units III, IV and V)

REFERENCES

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014
2. Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, “Fundamentals of Data Science”, CRC Press, 2022
3. Chirag Shah, “A Hands-On Introduction to Data Science”, Cambridge University Press

CO’s & PO’s MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	2	2	-	-	-	1	1	1
CO2	2	1	-	1	1	-	-	-	2	1	1
CO3	2	2	1	2	2	1	1	-	1	2	1
CO4	3	2	2	1	2	-	-	-	1	1	2
CO5	2	2	1	2	2	-	-	-	1	1	1
CO6	2	2	1	2	2	-	-	-	1	1	1

(XXXXX)	HOLISTIC PERSONALITY DEVELOPMENT AND	L T P C
Subject	BEHAVIORAL SKILLS	2 0 0 1
Code		

COURSE OBJECTIVES:

- ✓ To enable students to gain a comprehensive understanding of the self and its key components, including self-identity, self-image, self-concept, and self-confidence.
- ✓ To provide insights into the nature and types of fear, emphasizing its impact on both personal and academic spheres.
- ✓ To equip students with effective tools and strategies to assess and enhance self-esteem, while fostering a growth mindset and cultivating a positive attitude.
- ✓ To introduce the concept and dimensions of Emotional Intelligence (EQ) and differentiate it from Intelligence Quotient (IQ) and Spiritual Quotient (SQ).
- ✓ To develop students' communication proficiency and impression management skills for fostering healthy interpersonal relationships.
- ✓ To strengthen students' interpersonal competence for success in both social and professional environments.

UNIT – I SELF AWARENESS 2

Understanding Self (Self-Identity, Self-Concept, Self-Confidence, Self-Image) Techniques of Self Awareness (Johari Window, Self-Characteristics, Stages of Self Awareness)

UNIT – II FEAR MANAGEMENT 2

Understanding Fear (e.g., fear of failure, public speaking, exams, job interviews) - The science behind fear (Fight or Flight response) - Changing negative thoughts into positive ones - Facing fears step by step

UNIT – III SELF ESTEEM 2

Self Esteem & Effectiveness (Importance, High & Low Self-Esteem, Measurement, Steps to Improve) Adopting a growth mindset for continuous improvement. Building Positive Attitude (Types & Importance of Attitude)

UNIT – IV EMOTIONAL INTELLIGENCE 2

Emotional Intelligence (Difference Between IQ, EQ, and SQ) Managing Emotions & Building Emotional Competence - Power of Now

UNIT – V RELATIONSHIP MANAGEMENT 2

Understanding Relationships (Roles, Healthy Relationships) - Bridging Individual Differences (TA & Communication Styles) - Impression Management

UNIT – VI INTERPERSONAL RELATIONSHIP 2

Interpersonal Relationship Development (Skills & Types) - Theories of Interpersonal Relationships (Social Exchange, Uncertainty Reduction) - Building Interpersonal Competence.

TOTAL: 12 PERIODS

COURSE OUTCOMES:

1. Students will be able to identify and analyze their self-concept, self-image, and self-confidence, while recognizing their individual strengths and areas for improvement.
2. Students will demonstrate an understanding of the biological and psychological foundations of fear and apply techniques to transform negative thought patterns into positive affirmations.
3. Students will implement evidence-based strategies to enhance self-esteem and adopt a growth-oriented approach to personal and professional development.
4. Students will effectively regulate and manage emotions by applying practical Emotional Intelligence (EQ) frameworks.
5. Students will articulate various roles within relationships, identify traits of healthy relationships, and utilize communication skills to foster meaningful connections.
6. Students will examine the development, theoretical foundations, and essential skills required for cultivating effective interpersonal relationships.

TEXT BOOKS:

1. “Emotional Intelligence: Why It Can Matter More Than IQ” by Goleman and Daniel, 10th Anniversary Edition 2006, Bantam Books.
2. “The 7 Habits of Highly Effective People” by Covey and Stephen R, 30th Anniversary Edition 2020, Simon & Schuster Publisher.
3. “Personality Development and Soft Skills” by Mitra, Barun K, 2nd Edition 2011, Oxford University Press.
4. “You Can Win: A Step by Step Tool for Top Achievers” by Khera, Shiv, Revised and Updated Edition 2014, Bloomsbury India Publisher.

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2. “Personality Development and Soft Skills” by Mitra, Barun K, 2nd Edition 2016, Oxford University Press.
3. “The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change” by Covey and Stephen R, 30th Anniversary Edition 2020.
4. “Emotional Intelligence: Why It Can Matter More Than IQ” by Goleman, Daniel, 10th Anniversary Edition 2006.

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LIFE SKILL III – BASIC CONVERSATION SKILLS

L T P C
2 0 0 1

COURSE OBJECTIVES:

- ✓ To develop effective professional communication skills, including greetings, polite conversations, and intervening in dialogues.
- ✓ To introduce and practice framing questions using model auxiliaries (can, could, would) and WH questions in a technical environment.
- ✓ To apply tone, intonation, and voice modulation effectively in two-way conversations to enhance communication clarity and impact.
- ✓ To practice essential one-on-one conversation techniques to communicate effectively in interview settings.
- ✓ To practice various discussion activities.
- ✓ To understand the do's and don'ts of group discussions and perform group discussions.

UNIT – I PROFESSIONAL COMMUNICATION

2

Creating conversation - Professional greetings and courtesies - Introduction to polite conversation techniques – Intervening when two people are conversing - Polite disagreement

Practice: Initial greeting, Transitioning between conversations, Practicing professional greetings using conversation and Courtesy vocabularies in different scenarios (C 17)

Role-play: Conducting professional conversations

UNIT – II FRAMING QUESTIONS

2

Basics of framing questions using model auxiliaries (can, could, would, etc.) - WH questions and Yes/No questions in technical environment

Practice: Role - play exercises in question framing, Conducting Q&A sessions based on conversations, Effective questioning techniques in various settings

UNIT – III LISTENING TWO-WAY CONVERSATION

2

Understanding tone and intonation in conversations - Responding appropriately in two - way conversations, practicing real - life two - way conversations

Practices: Practicing two - way conversation with tone and intonation - Voice modulation

UNIT – IV TWO -WAY CONVERSATION – BASICS

2

“Basic one and one techniques in interview”

Practice: Conversation tips for effective two-way dialogue - Common conversation pit falls (how to avoid monotones, Long sentences and Breath control during conversation).

Techniques of discussion – Brainstorming questions, debate and argumentation, panel discussion

Practice: Asking brainstorming questions

UNIT – VI BASICS OF GROUP DISCUSSION**2**

Dos and Don'ts of group discussion – Evaluation process

Practice: Three group discussions

TOTAL: 12 PERIODS

OUTCOMES:

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

1. Initiate and manage professional conversations with correct greetings and courtesies.
2. Demonstrate proficiency in asking clear and appropriate questions in professional and technical conversations.
3. Adjust their tone and intonation based on the context of the conversation.
4. Confidently navigate one-on-one interviews and other personal conversations.
5. Formulate and ask open-ended brainstorming questions.
6. Understand the importance and purpose of group discussions in professional and academic settings.

REFERENCES:

1. “Advanced Communication Skills” by Mathew Richardson, Charlie Creative Lab, 2020.
2. Andy Gillett, Using English for Academic purposes for students in higher Education.
<https://www.uefap.org/reading/>
3. R. K. Agnihotri and A. L. Khanna. *English for Academic and Professional Purposes*. Macmillan India, 2008
4. **Swales, John M., and Christine B. Feak.** *Academic Writing for Graduate Students: Essential Tasks and Skills*. University of Michigan Press, 2012

CO – PO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
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5	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
6	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
LOW (1) ; MEDIUM (2) ; HIGH (3)															