



Karmaveer Bhaurao Patil University, Satara

Syllabus for

B. Sc. I (Data Science)

Under

Faculty of Science and Technology

(As per NEP 2020)

With effect from Academic Year 2024-2025

Preamble:

The Data Science Department serves as a vital hub of innovation, inquiry, and applied learning in the rapidly evolving fields of data analytics, machine learning, and artificial intelligence. Our mission is to advance the frontiers of knowledge through rigorous research, collaborative problem-solving, and the development of cutting-edge methodologies that empower organizations and individuals to make data-driven decisions.

Rooted in a multidisciplinary approach, the department integrates statistical analysis, computational techniques, and domain-specific expertise to provide students and researchers with the tools needed to tackle complex challenges. We are committed to fostering an inclusive and intellectually stimulating environment where students, faculty, and industry partners collaborate to explore, discover, and implement data solutions that drive societal impact.

In a world increasingly shaped by data, the Data Science Department strives to equip future leaders with the skills and ethical insights necessary to harness the power of information responsibly and effectively. Our dedication to excellence in education, research, and service reflects our vision of becoming a global leader in data science, fostering innovation that transforms industries, economies, and lives.

General Objectives of the Programme:

1. To nurture academicians with focus and commitment to their subject.
2. To shape good and informed citizens from the students entering into the Programme.
3. To create skilled workforce to match their requirement of the society.
4. To impart knowledge of the science is the basic objective of this Programme.
5. To develop a scientific attitude is the major objective so as to make the students open - minded, critical and curious.
6. To develop skills in practical work and experiment along with the collection and interpretation of scientific data to contribute to science.

General Program Outcomes:

1. The student will graduate with proficiency in the subject of their choice.
2. The student will be eligible to continue higher studies in their subject.
3. The student will be eligible to pursue higher studies abroad.
4. The student will be eligible to appear for the examinations for jobs in Visual Art department, government organizations as well as IT Industry and Entertainment Industry.

Program Specific Objectives:

1. Graduates will be proficient in applying statistical, mathematical, and computational techniques to analyze, interpret, and visualize complex data sets, enabling informed decision-making in various industries.
2. To provide advanced and in-depth knowledge of data science and specialization in one or two subjects of the new era of technology.
3. To prepare Graduates who will achieve peer-recognition, as an individual or in a team, through demonstration of good analytical, design, programming, and implementation skills.
4. To enable students, pursue a professional career in Data Science in related industry, business and research.
5. To develop the ability among students to formulate, analyze and solve real life problems faced in Data Science industry. To produce computer science professionals who can be directly employed or start his/her own work as
 - Data Scientist.
 - Business Analyst.
 - Data Analytics Manager.
 - Data Architect.
 - Data Administrator.
 - Business Intelligence Manager.
 - Entrepreneur in Computer Science industry.
6. To Develop designing, analyzing and critical thinking skill among students.

Program Specific outcomes:

After successful completion of B.Sc. Animation science Course student will be able to:

1. Avail Current trends in IT Industries and new Technologies.
2. Apply knowledge of programming platforms in Data Science and AI in real life.
3. Avail detailed knowledge of Data Science, Artificial Intelligence, Machine Learning, and Big Data etc.
4. Demonstrate their ability of advanced programming to design and develop innovative applications.
5. Access, evaluate, understand, and compare digital information from various sources and apply it for scientific knowledge acquisition as well as scientific data analysis and presentation.
6. Critically evaluate, analyze, and comprehend a scientific problem. Think creatively, experiment and mic research into innovation and creatively design scientific solutions to problems.
7. Exemplify generate a solution independently, check and validate it and modify if necessary.
8. Translate project plans, use management skills, and lead a team for planning and execution of a task.
9. Start his own business or start up.

Department of Data Science
According to NEP 2.0 (2020)
B.Sc. I SEM - I

| Sr. No. | Course | Components | Course code | Name of the Course | Credits |
|--------------|---------------|------------|-------------|-------------------------------|-----------|
| 1 | Course 1 | DSC-I | BDST 111 | Fundamental of Data Science | 2 |
| | | DSC-II | BDST 112 | Database Management System | 2 |
| | | DSP(P) - I | BDSP 113 | Based on DSC I and DSC II | 2 |
| 2 | Course 2 | DSC-I | BDST 114 | Fundamental of Computer | 2 |
| | | DSC-II | BDST 115 | Computer Programming with C | 2 |
| | | DSP(P) - I | BDSP 116 | Based on DSC I and DSC II | 2 |
| 3 | Course 3 | DSC-I | BDST 117 | Computational Mathematics -I | 2 |
| | | DSC-II | BDST 118 | Computational Mathematics -II | 2 |
| | | DSP(P) - I | BDSP 119 | Based on DSC I and DSC II | 2 |
| 4 | Open Elective | OE-1 | BDSTOE-1 | Music Studies | 2 |
| 5 | IKS-I | Generic | BDSTIKS-1 | BDST IKS-1 | 2 |
| Total | | | | | 22 |

According to NEP 2.0 (2020)
B.Sc. I SEM - II

| Sr. No. | Course | Name of the Course | Paper code | Name of the Paper | Credits |
|--------------|----------|--------------------|------------|---|-----------|
| 1 | Course 1 | DSC-III | BDST 121 | Data Storage Technology | 2 |
| | | DSC-IV | BDST 122 | Relational Database Management System | 2 |
| | | DSP(P) - II | BDSP 123 | Based on DSC I and DSC II | 2 |
| 2 | Course 2 | DSC-III | BDST 124 | Web Development | 2 |
| | | DSC-IV | BDST 125 | Operating System Concept | 2 |
| | | DSP(P) - II | BDSP 126 | Based on DSC I and DSC II | 2 |
| 3 | Course 3 | DSC-III | BDST 127 | Computational Mathematics III | 2 |
| | | DSC-IV | BDST 128 | Computational Mathematics IV | 2 |
| | | DSP(P) - II | BDSP 129 | Based on DSC I and DSC II | 2 |
| 5 | VEC-I | VEC-I | BDSTVEC-I | Democracy, Election and Indian Constitution | 2 |
| 6 | SEC-I | SEC-I | BDSTSEC-I | Data Analytic Skills for Data Scientist | 2 |
| Total | | | | | 22 |

Semester-I**BDST 111: Fundamental of Data Science****Course Objectives:** - Student should be able to learn...

1. Fundamental concepts of Data Science.
2. Study basic principles of Data Science.
3. Develop skills for Data Management.
4. Think through the ethics surrounding privacy, data sharing.

| Credits=2 | BDST 111: Fundamental of Data Science | No. of hours Per unit/ credits |
|-----------------|---|---|
| UNIT I | Data Science Concepts | (7) |
| | Defining data science and big data, Recognizing the different types of data, Gaining insight into the data science process, Data Science Process: Overview, Different steps, Machine Learning Definition and Relation with Data Science. | |
| UNIT II | Data management and Analysis | (9) |
| | Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources. Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes | |
| UNIT III | Data visualization | (7) |
| | Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings. | |
| UNIT IV | Applications of Data Science | (7) |
| | Technologies for visualization, Python, recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science. | |

Course Outcomes: - Student will be able to ...

1. Explore the fundamental concepts of data science.
2. Understand data analysis techniques for applications handling large data.
3. Understand various machine learning algorithms used in data science process.
4. Visualize and present the inference using various tools.
5. Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making.

Reference Books: –

1. Mittal Gautam, Data Science Simplified: A Hands-on Guide for Beginners, Notion Press, 2021
2. .Raghunathan, Foundations of Data Science, CRC Press,2020
3. Patil Prashant, Big Data Analytics: A Comprehensive Guide, McGraw-Hill Education, 2019
4. Ian H. Witten, Frank, Eibe, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann,2016
5. Grus Joel, O'Reilly, Data Science from Scratch: First Principles with Python, 1st edition, 2015.
6. Jeffrey David, Leskovec, Anand Rajaraman, Ullman, Cambridge, Mining of Massive Datasets, J20 University Press, 2nd edition, 2014.
7. Jure Leskovek, Anand Rajaraman, Jeffrey Ullman, Mining of Massive Datasets. v2.1, Cambridge University Press, 2014.
8. O'Neil Cathy, Schutt Rachel, O' Reilly, Doing Data Science, Straight Talk from the Frontline,1st edition, New York, O'Reilly Media,2013.

BDST 112: Database Management System

Course Objectives: Student should be able to ...

1. Understand the fundamental concepts of data.
2. Understand principles of databases.
3. Identify the database management operation.
4. Discuss the concept of procedure oriented, object-oriented programming languages, Database Management.

| Credits=2 | BDST 112: Database management system | No. of hours per unit/credits |
|-----------------|--|--------------------------------------|
| UNIT I | Database Management System | (7) |
| | DBMS (Database Management System), Key Features of DBMS, File System, Difference between File System and DBMS, Types of Database Systems Centralized, Distributed, Cloud, DBMS Architecture: Single-tier, Two-tier, Three-tier. | |
| UNIT II | Basic of Structured Query Language | (9) |
| | Introduction to SQL, Basic Data Type in SQL: Binary Data types, Numeric Datatype Character String Datatype, Date and time Data types, SQL Operator: Arithmetic Operators, Comparison Operators Logical Operators, SQL DDL Commands, SQL DML Commands, Type of Constraints | |
| UNIT III | Data Models and Storage Fundamentals | (7) |
| | Overview of Data Models: Hierarchical, Network, Object-oriented, Entities, Attributes, Relationships, Object-Based Data Models: Concepts, Features, Advantages, ER Modeling Basics, Primary and Secondary Storage, Primary key, foreign key, candidate key, super key, unique key Normalization: Concept of normalization, advantages, First NF, Second NF, Third NF, Examples of normalizations | |
| UNIT IV | Advance Database Concepts | (7) |
| | Importance of Database Security, Introduction to NoSQL, Concepts of Big Data, Introduction to Warehouse, Introduction to Data Center, Case Study: Design Database System for- Library management system | |

Course Outcomes: - Students will be able to...

1. Apply the basics of data, information, system and Database.
2. Evaluate basics of different database models for software development.
3. Design the basics of Relational algebra operations and Relational Calculus.
4. Demonstrate SQL basics and write queries to perform different operations on real world data.

Reference Books:

1. R. Elmasri, S.B. Navathe, (2010), Fundamentals of Database Systems 6th Edition, Pearson Education
2. R. Ramakrishanan, J. Gehrke, (2002), Database Management Systems 3rd Edition, McGraw-Hill,
3. Silberschatz, H.F. Korth, S. Sudarshan, (2010), Database System Concepts 6th Edition, McGraw Hill
4. Silberschatz Abraham, Database System Concepts, Mc Graw Hill, 2021
5. Chan Ben, SQL Programming: Learn the Ultimate Coding, Basic Rules of the Structure Query Language, Notion Press, 2020
6. Teorey Toby, Database Modeling and Design: Logical Design, Morgan Kaufmann, 2010
7. SQL, PL/SQL The Programming Language of ORACLE – Ivan Bayross. BPB publication ,2021

BDSP 113: Lab I – Based on

(BDST 111: Fundamental of Data Science and BDST 112: Distributive Data base management system)

Course Objectives: - Student should be able to...

1. Learn Fundamental concepts of Data Science.
2. Understand Basic principles of Data Science.
3. Identify programming skills using the fundamentals and basics of C Language.
4. Understand Algorithms and flowchart of programs in C and to solve the problems.

| | | |
|-------------------------------------|--|---|
| Credit :2 Group A- | BDST 111:Fundamental of Data Science 1. Identify relevant data sources and collect the required data. 2. Clean and pre-process the data to ensure its quality and integrity. 3. Convert the data into a suitable format for analysis, such as CSV, Excel, or a database format. 4. Create a bar chart to compare categorical variables or display counts or frequencies. 5. Customize the chart with labels, colors, and legends to enhance readability. 6. Construct a histogram to display the distribution of a single variable. 7. Adjust the bin sizes to reveal different levels of granularity in the data. 8. Case study on Applications of Data Science 9. Case Study on Data Center 10. Case Study on Healthcare | No. of hours per unit (60) |
| Group B: - | BDST 112: Distributive Data base management system 1. Installation of MySQL Database 2. Create Database Company. 3. Create a table named Employees with columns for EmployeeID, FirstName, LastName, Position, and Salary. 4. Insert five records into the Employees table. 5. Select the FirstName and LastName of all employees. 6. Select all information for employees who are Data Scientist. 7. Select all employees whose first name starts with 'J'. 8. Select all employees whose salaries are between 60,000 and 70,000. 9. Select all employees who are either Developers or Testers. 10. Select all unique positions from the Employees table. 11. Use Constraints in the Employee Table 12. Increase the salary of all developers by 10%. 13. Delete the record of the employee with EmployeeID 14. Count the number of employees. 15. Calculate the total salary of all employees. | |

Course Outcomes: Student will be able to ...

1. Explore the fundamental concepts of data science.
2. Perform data analysis techniques, various machine learning algorithms and applications handling large data.
3. Apply software's are available for C Programming and how to use the Editor for writing Program and how to execute it.
4. Improve to write algorithms, flowcharts and programs on operators, Conditional Branching, Looping, Functions and Arrays.

Reference Books:

1. Mittal Gautam, Data Science Simplified: A Hands-on Guide for Beginners, Notion Press, 2021
2. Raghunathan, Foundations of Data Science, CRC Press, 2020
3. Patil Prashant, Big Data Analytics: A Comprehensive Guide, McGraw-Hill Education, 2019
4. Ian H. Witten, Frank, Eibe, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann, 2016
5. Guy Hart-Davis (2023) "The ABCs of Microsoft Office 97 Professional edition", BPB Publications.
6. Yashwant Kanetkar (2018) Let Us C, BPB Publications, Edition 18
7. Peter Prinz and Tony Crawford (2016) C in a Nutshell (2nd Ed.)
8. Jeri R. Hanly and Elliot B. Koffman (2009) Problem Solving and Program Design in C (6th Edition)
9. E. Balagurusamy (2008) Programming in ANSI C, McGraw Hill Education Edition

BDST 114: Fundamentals of Computer

Course Objectives: Student should be able to ...

1. Understand how to operate desktop computers to carry out computational tasks.
2. Learn working of Hardware and Software and the importance of operating systems.
3. Identify programming languages, number systems, peripheral devices, networking.
4. Understand concepts of multimedia, and internet concepts.

| Credits=2 | BDST114: Fundamentals of Computer | No. of hours per unit/ credits |
|-----------------|---|---|
| UNIT I | Computers Concepts | (8) |
| | Introduction, Definition, Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification of Computers, Applications of Computer, Capabilities and limitations of computer | |
| UNIT II | Basic Computer Organization | (8) |
| | Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, and Output Units: Monitors and its types. Printers: Impact Printers and its types. Non-Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers. | |
| UNIT III | Software's and Operating System | (7) |
| | Software and its needs, types of S/W. System Software: Operating System, utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Functions, Measuring System Performance, Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi-tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux | |
| UNIT IV | Computer Arithmetic and Data Communication | (7) |
| | Binary, Binary Arithmetic, Number System: Positional & Non-Positional, Binary, Octal, Decimal, Hexadecimal, converting from one number system to another, converting from one number system to another, Converting from one number system to another, Communication Process, Data Transmission speed, Communication Types (modes), Data Transmission Medias, Modem and its working, characteristics, Types of Networks, LAN Topologies, Computer Protocols, Concepts relating to networking | |

Course Outcomes: Students will be able to...

1. Describe basic concepts and terminology of information technology.
2. Evaluate the fundamentals of personal computers and their operations.
3. Maintain their small account using the computers and enjoy in the world of Information Technology
4. Use the computer for basic purposes of preparing his personnel/business letters, viewing information on internet (the web), sending mails, preparing his business presentations, playing games etc.

Reference Books:

1. Guy Hart-Davis (2023) "The ABCs of Microsoft Office 97 Professional edition", BPB Publications.
2. Karl Schwartz (1998), "Microsoft Windows 98 Training Guide" BPB Publications.
3. C.S. French (1998) "Data Processing and Information Technology", BPB Publications
4. P.K Sinha (1992) `Computer Fundamentals`, BPB Publications
5. Sinha P, Computer Fundamentals, BPB ,2004
6. Jain Satish, Computer Organization and operating System, BPB, 2021
7. Tanenbaum Andrew, Operating System Design and Implementation, Pearson,20

BDST 115: Computer Programming with C

Course Objectives: Student should be able to ...

1. Adequate knowledge on the need of programming languages.
2. Study the need of problem-solving techniques.
3. Understand programming skills using the fundamentals and basics of C Language.
4. Algorithms and flowchart of programs in C and to solve the problems.

| Credits=2 | BDST 115: Computer Programming with C | No. of hours perunit/credits |
|-----------------|---|------------------------------|
| UNIT I | Fundamentals of C language | (8) |
| | Problem Solving definition, Step involving in problem solving, Algorithm, Characteristics, Flowcharts, Definition, Symbol, features. History of 'C' language, Structure of 'C' programs, 'C' Tokens, Character set and keywords, Constant and its type, Variable and its type Data types, Operators and its types, Precedence rules, Input/output using standard functions. | |
| UNIT II | Branching, Looping and Functions | (8) |
| | Conditional branching, if, if else, else if ladder, switch, Nested statements. Looping for, while do-while statements. Unconditional control statements- go to, break and continue. Definition, types & parts of functions, Local and global variable, Library functions and User defined functions. | |
| UNIT III | Array | (7) |
| | Understanding the Array and its types, , Array of structures, Arrays within Structures, structure and function, Nested structure, Pointer to structure, Array definition and declaration, initialization of arrays, types of arrays, String handling functions, Arrays and functions. | |
| UNIT IV | Pointer and Union | (7) |
| | Understanding the pointers, Definition and declaration, Operations on pointer, Pointer initialization, Pointer and function, Definition and declaration, Structure initialization, Difference between structure and union | |

Course Outcomes: students will be able to...

1. Develop algorithm writing and flowchart drawing.
2. Evaluate the compilation process and execution of any C Program.
3. Analyze the use of Functions and Arrays to solve in real life applications.
4. Apply the use of Arrays to solve in real life applications.

Reference Books:

1. Yashwant Kanetkar (2018) Let Us C, BPB Publications, Edition 18
2. Peter Prinz and Tony Crawford (2016) C in a Nutshell (2nd Ed.)
3. Jeri R. Hanly and Elliot B. Koffman (2009) Problem Solving and Program Design in C (6th Edition)
4. E. Balagurusamy (2008) Programming in ANSI C, McGraw Hill Education Edition 6
5. Peter van der Linden (1994) Expert C Programming: Deep C Secrets
6. Brian Kernighan and Dennis Ritchie (1988) The C Programming Language –, Pearson Education India
7. P. Kamal, Learn Arrays in c with example, Kindle edition, 2013

BDSP 116: Lab II – Based on

(BDST 114: Fundamental of Computer and BDST 115: Computer Programming with C)

Course Objectives: - Student should be able to...

1. Learn Fundamental concepts of Data Science.
2. Understand Basic principles of Data Science.
3. Identify programming skills using the fundamentals and basics of C Language.
4. Understand Algorithms and flowchart of programs in C and to solve the problems.

| Credit :2 | Fundamentals of Computer | No. of hours per unit (60) |
|-------------------|--|---|
| Group A- | <p>Identification of the peripherals of a computer, components in a CPU and their functions.</p> <ol style="list-style-type: none">1. Assembling and disassembling the system hardware components of personal computer.2. Basic Computer Hardware Trouble shooting.3. Study of LAN and Wi-Fi Basics.4. Basic Computer Proficiency-<ol style="list-style-type: none">1. Familiarization of Computer Hardware Parts2. Basic Computer Operations and Maintenance.5. Dos and Don'ts, Safety Guidelines in Computer Lab6. Familiarization of Basic Software – Operating System, Word Processors, Internet Browsers, Integrated Development Environment (IDE) with Examples.7. Verify the components of a typical computer system.8. Explore, maintain files, and customize the Windows operating system.9. Integrate Word, Excel, and PowerPoint to prepare business documents.10. Study of basics of computer networks | |
| Group B: - | <p style="text-align: center;">Computer Programming with C</p> <ol style="list-style-type: none">1. Write a program to accept 5 subject marks and calculate total marks, percentage, and grade of student.2. Write a program to perform arithmetic operations.3. Write a program to input n numbers and find the Odd and Even numbers.4. Write a program to find the age of a person (Input birth date and today date).5. Write a program to find the sum of first n natural numbers.6. Write a program to accept the range and generate Fibonacci Series.7. Write a program to calculate sum of numbers using simple function.8. Write a program to calculate factorial of number using Recursion.9. Write a program to enter array elements and perform arithmetic operations.10. Write a program to sort the numbers in ascending and descending order using array. | |

Course Outcomes: Student will be able to ...

1. Explore the fundamental concepts of data science.
2. Perform data analysis techniques for applications handling large data.
3. Perform various machine learning algorithms used in data science process.
4. Apply software's are available for C Programming and how to use the Editor for writing Program and how to execute it.
5. Improve to write algorithms, flowcharts and programs on operators, Conditional Branching, Looping, Functions and Arrays.

Reference Books:

1. Mittal Gautam, Data Science Simplified: A Hands-on Guide for Beginners, Notion Press,2021
2. Raghunathan, Foundations of Data Science, CRC Press,2020
3. Patil Prashant, Big Data Analytics: A Comprehensive Guide, McGraw-Hill Education,2019
4. Ian H. Witten, Frank, Eibe, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann,2016
5. Guy Hart-Davis (2023) "The ABCs of Microsoft Office 97 Professional edition", BPBPublications.
6. Yashwant Kanetkar (2018) Let Us C, BPB Publications, Edition 18
7. Peter Prinz and Tony Crawford (2016) C in a Nutshell (2nd Ed.)
8. Jeri R. Hanly and Elliot B. Koffman (2009)Problem Solving and Program Design in C (6thEdition)
9. E. Balagurusamy (2008) Programming in ANSI C, McGraw Hill Education Edition 6

BDST 117: Computational Mathematics – I

Course Objectives: -Student should be able to...

1. Understand Fundamental properties of matrices and their applications.
2. Learn classical notations of logic.
3. Know different number systems and their conversion.
4. Study the concept of graph and trees to tackle real situations.

| Credits=2 | BDST 117: Computational Mathematics I | No. of hours per unit/credits |
|-----------------|---|--------------------------------------|
| Unit-I | Matrices | (7) |
| | Definition and properties of determinants, Definition and types of matrices, Basic Operations of matrices, Inverse and Transpose of a matrix, Characteristic Polynomial, Definition and examples of Eigenvalues and Eigenvectors, Caley's-Hamilton theorem, Singular Value Decomposition. | |
| Unit-II | Number Systems | (9) |
| | Decimal, Binary, and hexadecimal Number systems and their inter conversion, Binary addition, subtraction, multiplication and division, signed and unsigned binary numbers, 1's and 2's complement representation. | |
| Unit-III | Graphs | (8) |
| | Definition, Basic properties, Examples, Special Graphs, Directed and undirected graphs, Concept of degree, Matrix representation of graphs, Walk, Trail, Path and Circuits. | |
| Unit-IV | Trees | (6) |
| | Definition and examples of trees, Rooted trees, Binary trees and their properties, Spanning trees, Minimal spanning trees, Kruskal's Algorithm. | |

Course Outcomes: Students will be able to...

1. Understand the fundamental concepts in Discrete mathematics, including sets, logic, proof techniques etc.
2. Apply mathematical reasoning and formal logic to construct valid arguments, analyze prepositions and solve problems.
3. Analyze the efficiency of algorithms using concept from Discrete mathematics.
4. Evaluate complex problems by applying appropriate mathematical techniques and arrive at logical solutions.

Reference Books:

1. S. Lipschutz and M. Lipson, Computational Mathematics I, Schaum's Outlines Series, Tata McGraw Hill, 2017.
2. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics, 4 th edition, McGraw Hill Education, 2017.
3. N. L. Biggs, Computational Mathematics I, 2nd edition, Oxford University Press, 2013.
4. R. Johnsonbaugh, Computational Mathematics I, 8th edition, Pearson, 2013.
5. R. M. Somasundaram, Discrete Mathematical Structures, PHI Learning Pvt. Ltd., 2003.
6. K. H. Rosen, Discrete Mathematics and its Application, McGraw Hill, 2002.
7. Susanna S., Discrete Mathematics with Applications, PWS Publishing Company, 1995.

BDST 118: Computational Mathematics II

Course Objectives: - Student should be able to...

1. Understand the basic concepts of statistics.
2. Perform Frequency distribution and data presentation.
3. Compute various measures of central tendency and dispersion.
4. Analyze the data and interpret the results.
5. Study the Correlation and Regression.

| Credits=2 | BDST 118: Computational Mathematics II | No. of hours per unit/ credits |
|-----------------|---|--------------------------------------|
| UNIT I | Data Condensation and Measures of Central Tendency | (8) |
| | <p>Definition, importance, scope and limitations of Statistics, Data Condensation: Qualitative & Quantitative. Scales of measurement: Nominal, Ordinal, Interval and Ratio, Raw data, Attributes and variables, discrete and continuous variables, Organization of data, Collection of data, classification and construction of frequency distribution, Graphical Representation: Histogram, Frequency polygon, Frequency curve, Ogive Curves, Boxplot, Examples.</p> <p>Measures of Central tendency: Concept of central tendency, Criteria for good measures of central tendency, Types: Arithmetic mean, G.M., H.M., Median, Mode, Quintiles, Combined Mean, Weighted Mean, Corrected Mean, Examples</p> | |
| UNIT II | Measures of Dispersion and Moments | (8) |
| | <p>Concept of dispersion and measures of dispersion, absolute and relative measures of dispersion' Types: Range, Quartile Deviation, Mean Deviation, S.D. and Variance.</p> <p>Moments: Concept of moments, Types: Raw moment, Central moment, and moment about any arbitrary point "a" for ungrouped and grouped data (only first four moments), relation between central and raw moments (statement only),</p> <p>Skewness: Types of skewness, Pearson's and Bowley's coefficient of skewness, Measures of skewness based on moments.</p> <p>Kurtosis: Types of kurtosis, Measures of kurtosis based on moments.</p> | |
| UNIT III | Correlation | (7) |
| | <p>Concept of bivariate data, scatter diagram. Concept of correlation, positive correlation, negative correlation, cause and effect relation, Karl Pearson's coefficient of correlation, Properties of correlation coefficient, interpretation of correlation coefficient, Spearman's Rank Correlation coefficient (formula with and without ties).</p> | |
| UNIT IV | Regression | (7) |
| | <p>Concept of regression. Derivation of lines of regression by method of least squares, Regression Coefficients, and their significance. Properties of regression coefficients, Point of intersection and acute angle between regression lines.</p> | |

Course Outcomes: - Students will be able to ...

1. Apply various types of sampling methods to data collection.
2. Create and interpret frequency tables.
3. Display data graphically and interpret graphs.
4. Recognize, describe, and calculate the measures of central tendency and dispersion.
5. Measure the correlation between two variables and estimate the value.

Reference Books: –

1. S. C. Gupta and V. K. Kapoor, Fundamental of Mathematical Statistics (12th Edition), Delhi, Sultan Chand and Sons, 2020
2. T.C. Gupta. Fundamental of Statistics (7th Edition), Mumbai, Himalaya Publishing House, 2018.
3. Gentle, E. James, Numerical Linear Algebra for Applications in Statistics. Springer, 2018.
4. Efron, Bradley, Hastie Trevor, Computer Age Statistical Inference: Algorithms, Evidence, and Data Science. Cambridge University Press, 2016.
5. S. P. Gupta, Sultan Chand, Statistical Methods, Delhi, 2014
6. B. L. Agarwal Basic Statistics (6th Edition), New Age International Private Ltd, Delhi, 2013.
7. Christian P. Robert, and Casella, George. Carlo Monte Statistical Methods. Springer, 2004.
8. M. Goon, M. K. Gupta, B. Das Gupta. Fundamentals of Statistics, The World Press Private Ltd., Calcutta, 1968.

BDSP 119: Lab III – Based on

(BDST 117: Computational Mathematics – I and BDST 118: Computational Mathematics –II)

Course Objectives: Student should be able to ...

1. Learn the basic concepts of Computational Mathematics.
2. Understand the uses of Matrices in various fields
3. Learn the fundamental properties of matrices and their applications.
4. Analyze the data and interpret the results.
5. Study the Correlation and Regression.

| | | |
|-------------------------------------|---|---|
| Credit :2 Group A- | BDST 117: Computational Mathematics – I 1. Eigenvalues and Eigen vectors of matrix. 2. Caley’s-Hamilton theorem. 3. Interco version of a Number system to another number system. 4. 1’s and 2’s complement with an example. 5. Number system and their conversion. 6. Degree of vertices and graph. 7. Matrix representation of graph. 8. Minimal spanning trees. 9. Kruskal’s Algorithm. 10. Maximal flow algorithm. | No. of hours per unit (60) |
| Group B: - | BDST 118: Computational Mathematics –II 1. Construction of Discrete frequency distribution. 2. Construction of continuous Frequency distribution. 3. Graphical and diagrammatical representation. 4. Compute Mean, Median, Mode and quartile for Individual data. 5. Compute Mean, Median, Mode and quartile for discrete frequency distribution. 6. Compute Mean, Median, Mode and quartile for continuous frequency distribution. 7. Compute Range, S.D., variance and its relative measures for Individual data. 8. Compute Range, S.D., variance and its relative measures for Discrete and Continuous frequency distribution. 9. Correlation (for ungrouped data) 10. Regression (for ungrouped data) | |

Course Outcomes: Students will be able to...

1. Understand the fundamental concepts in discrete mathematics, including sets, logic, proof techniques etc.
2. Apply mathematical reasoning and formal logic to construct valid arguments, analyze prepositions and solve problems.
3. Analyze the efficiency of algorithms using concept from discrete mathematics.
4. Evaluate complex problems by applying appropriate mathematical techniques and arrive at logical solutions.

Reference Books:

1. S. Lipschutz and M. Lipson, Computational Mathematics I, Schaum's Outlines Series, Tata McGraw Hill, 2017.
2. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics, 4th edition, McGraw Hill Education, 2017.
3. N. L. Biggs, Computational Mathematics I, 2nd edition, Oxford University Press, 2013.
4. R. Johnsonbaugh, Computational Mathematics I, 8th edition, Pearson, 2013.
5. R. M. Somasundaram, Discrete Mathematical Structures, PHI Learning Pvt. Ltd., 2003.
6. K. H. Rosen, Discrete Mathematics and its Application, McGraw Hill, 2002.
7. Susanna S., Discrete Mathematics with Applications, PWS Publishing Company, 1995

Semester-II

BDST 121: Data Storage Technology

Course Objectives: Student will be able to...

1. To understand storage systems
2. To learn data storage technologies
3. To understand storage networking fundamentals
4. To acquaint learners with knowledge of how to secure storage infrastructure.

| Credits=2 | BDST 121: Data Storage Technology | No. of hours per unit/credits |
|-------------------------------|---|--------------------------------------|
| Credit –I UNIT I | Introduction to storage system | (7) |
| | Introduction to Information Storage - Information Storage, Functions and Importance of Data Storage , Challenges to effective data storage , Data, Types of Data, Big Data, Information, Storage, Evolution of Storage Architecture. | |
| Credit –1 UNIT II | Data Center Infrastructure | (7) |
| | Core Elements of a Data Center, Key Characteristics of a Data Center, managing a Data Center, Data Center Environment – Application, Storage, Disk Drive Components, Disk Drive Performance, Storage Design Based on Application, Introduction to Flash Drives. | |
| Credit –1 UNIT III | Intelligent Storage Systems and Virtualization | (7) |
| | ISS- Front end, Cache, Back End, Physical disk, Storage Provisioning- Traditional Storage Provisioning, Comparison between Virtual and Traditional Storage Provisioning, Types of Intelligent Storage Systems, High-End Storage Systems, Server and Storage I/O Fundamentals- Server and I/O Architectures. | |
| Credit –1 UNIT IV | Securing the Storage Infrastructure | (9) |
| | Storage Hierarchy, Disk Storage Fundamentals, Initiators and Targets, How write and read from a Storage Device, Storage Sharing , Data Sharing, I/O Connectivity and Networking Fundamentals, IT Clouds, Virtualization: Servers, Storage, and Networking, Virtualization and Storage Services, Data and Storage Access | |

Course Outcomes- Student should be able to ...

1. Describe storage system architecture, its elements, and characteristics.
2. Compare intelligent storage systems and select one for a storage application.
3. Demonstrate the functioning of SAN and NAS using open-source simulators.
4. Describe the mechanisms to secure storage infrastructure.

Reference Books:

1. Prachi S. Deshpande (Author), Subhash C. Sharma (Author), Sateesh K. Peddoju ,”Security and Data Storage Aspect in Cloud Computing” (Studies in Big Data, 52) 1st ed. 2019 Edition, Springer, 2019
2. Gustavo Santana, Data Center Virtualization Fundamentals: Understanding Techniques and Designs for Highly Efficient Data Centers with Cisco Nexus, UCS, MDS, and Beyond, Cisco Press; 1 edition, 2013.
3. G. Somasundaram, Alok Shrivastava, Information Storage and Management, EMC Education Series, Wiley, Publishing Inc., 2011.
4. S. N. Piramanayagam (Editor), Tow C. Chong, “Developments in Data Storage: Materials Perspective” 1st Edition, Kindle Edition (2011)
5. Greg Schulz, “The Green and Virtual Data Center”, CRC Press 1st Edition,2009.
6. Ulf Troppens, Wolfgang Muller-Friedt, Rainer Erkens, and Nils Haustein "Storage Networks: The Complete Reference" Springer 1st Edition 2003
7. Richard Barker, Paul Massiglia, Wiley “Storage area network essentials” (2002)

BDST 122 Relational Database Management System

Course Objectives: - Student will able to learn ...

1. Develop a deep understanding of Relational Database concepts.
2. Master advanced SQL querying techniques.
3. Acquire skills for data modelling and efficient database design.
4. Familiarize with various Database Management Systems (DBMS).

| Credits=2 | BDST 122: Relational Database Management System | No. of hours perunit/ credits |
|-----------------|--|--------------------------------------|
| UNIT I | Foundations of SQL and Database Design | (8) |
| | Introduction to Advanced Database Design, Understanding the importance of advanced database design, Key principles of good database design, Review of SQL Basics, Querying data with SELECT, JOIN, and WHERE, Data modification with INSERT, UPDATE, and DELETE , Introduction to normalization and denormalization, normalization vs. denormalization ,Advanced SQL Data Types-Date and time data types | |
| UNIT II | Advanced SQL Techniques and Performance Optimization | (8) |
| | Complex Queries and Subqueries-Subquery types: scalar, table, correlated, Using EXISTS and IN, Common table expressions (CTEs),SQL Window Functions- Introduction to window functions, PARTITION BY and ORDER BY clauses, Examples of ranking, aggregation, and analytic functions,SQL Indexing and Performance-Index types: B-tree, hash, and bitmap, Query optimization and indexing strategies, Understanding execution plans, Transactions and Concurrency Control-ACID properties and transactions, Locking and isolation levels, Deadlocks and transaction management. | |
| UNIT III | Advanced Database Design and Management | (7) |
| | Designing schemas for complex data structures, Schema versioning and migration, Schema security and access control, Unique and check constraints, Trigger creation and usage, Cursor Creation PL Block ,real-world case studies, Designing databases for specific industry domains, Lessons from successful database design projects. | |
| UNIT IV | Database Management and Security | (7) |
| | Database encryption and data privacy, Access control and permissions, Auditing and compliance, Peer and instructor evaluations Guidelines for the project, Project proposal and topic selection, Capstone Project Presentation and Evaluation, Capstone Project Presentation and Evaluation. | |

Course Outcomes: - Students should be able to...

1. Ability to design and implement complex database schemas efficiently.
2. Proficiency in crafting advanced SQL queries, including sub queries and joins.
3. Skills to optimize database performance through indexing and query tuning.
4. Understanding of database security and access control mechanisms.
5. Problem-solving abilities in complex data management challenges.
6. In-depth understanding of advanced database concepts and normalization.

Reference Books:

1. Lewis, Toby J. Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More. O'Reilly Media, 2019.
2. Silberschatz, Abraham, Henry F. Korth, and S. Sudarshan. Database System Concepts. McGraw-Hill, 2019.
3. Elmasri, Ramez, and Shamkant B. Navathe. Fundamentals of Database Systems. Pearson, 2015.
4. Teorey, Toby J., Sam S. Lightstone, and Tom Nadeau. Database Modeling and Design: Logical Design. Morgan Kaufmann, 2011.
5. Garcia-Molina, Hector, Jeffrey D. Ullman, and Jennifer Widom. Database Systems: The Complete Book. Pearson, 2008.
6. Date, C. J. An Introduction to Database Systems. Addison-Wesley, 2003.
7. Ramakrishnan, Raghu, and Johannes Gehrke. Database Management Systems. McGraw-Hill, 2003.
8. Melton, Jim, and Alan R. Simon. SQL:1999 - Understanding Relational Language Components. Morgan Kaufmann, 2001.

BDSP 123: Lab I – Based on

(BDST 121: Data Storage Technology and BDST 122: Relational Database Management System)

Course Objectives: - Student should be able to...

1. To understand storage systems
2. To learn data storage technologies
3. Develop a deep understanding of Relational Database concepts.
4. Master advanced SQL querying techniques.

| | | |
|-------------------------------|---|---|
| Credit :2 Group A- | BDST 121: Data Storage Technology <ol style="list-style-type: none">1) Case study on Data Storage Technology.2) Case Study on Data Center Management.3) Case Study on issues in Data Center Management.4) Case Study on Data Center Management in Banking System.5) Case study on ISS.6) Demonstration of Comparison between Virtual and Traditional Storage Provisioning.7) Demonstration of Server and I/O Architectures.8) Demonstration of Impact of Intelligent Storage Systems on Enterprise Data Management.9) Demonstration of High-End Storage Systems in Data Centers.10) Demonstration of IT Clouds. | No. of hours per unit (60) |
| Group B: - | BDST 122: Relational Database Management System <ol style="list-style-type: none">1. Installation of PG SQL.2. To Perform operation on DDL & DML Commands.3. To Perform operation on DISTINCT Statement, WHERE Clause, AND Operator, OR Operator, BETWEEN Operator.4. To Perform operation on PRIMARY KEY, FOREIGN KEY.5. To Perform operation on NULL Operator, NOT NULL Operator, NOT Operator, Aliases, CHECK Constraint.6. To Perform operation on Aggregate Functions.7. To Perform operation SQL LIKE Operator, Wildcard Characters, IN Operator.8. To Perform Operation Joins9. To Perform operation on UNION Operator, GROUP BY Statement, HAVING Clause.10. To Perform operation on Sub query | |

Course Outcomes: - Students should be able to...

1. Ability to design and implement complex database schemas efficiently.
2. Proficiency in crafting advanced SQL queries, including subqueries and joins.
3. Skills to optimize database performance through indexing and query tuning.
4. Understanding of database security and access control mechanisms.
5. Problem-solving abilities in complex data management challenges.
6. In-depth understanding of advanced database concepts and normalization.

Reference Books:

1. Lewis, Toby J. Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More. O'Reilly Media, 2019.
2. Silberschatz, Abraham, Henry F. Korth, and S. Sudarshan. Database System Concepts. McGraw-Hill, 2019.
3. Elmasri, Ramez, and Shamkant B. Navathe. Fundamentals of Database Systems. Pearson, 2015.
4. Teorey, Toby J., Sam S. Lightstone, and Tom Nadeau. Database Modeling and Design: Logical Design. Morgan Kaufmann, 2011.
5. Garcia-Molina, Hector, Jeffrey D. Ullman, and Jennifer Widom. Database Systems: The Complete Book. Pearson, 2008.
6. Date, C. J. An Introduction to Database Systems. Addison-Wesley, 2003.
7. Ramakrishnan, Raghu, and Johannes Gehrke. Database Management Systems. McGraw-Hill, 2003.
8. Melton, Jim, and Alan R. Simon. SQL:1999 - Understanding Relational Language Components. Morgan Kaufmann, 2001.

BDST124: Web Development

Course Objectives: Student should be able to ...

1. Understand the fundamental concepts of web development.
2. Understand principles of HTML & CSS.
3. Design website using HTML and CSS.
4. Understand HTML and HTML

| Credits=2 | BDST 124: Web Development | No. of hours perunit/ credits |
|-----------------|---|-------------------------------|
| UNIT I | Fundamentals of Internet & Website | (8) |
| | Internet-Basics, Internet Protocols(HTTP,FTP,IP) , World Wide Web(WWW),HTTP, DNS, IP Address, Working of Website ,Web Browser, Web Server, Types of Websites(Static and Dynamic Websites),Web Development lifecycle ,Basics of web hosting. | |
| UNIT II | Web Development Concepts | (8) |
| | Introduction to web development, Application and programming language use for web development, Benefits of web development, Difference between HTML and HTML5. | |
| UNIT III | HTML for Web Development | (7) |
| | Introduction to HTML, History, and Features HTML tags & attributes, HTML Form elements, HTML Frameset, Limitations of HTML, Basics of CSS, Syntax, HTML table creation. | |
| UNIT IV | CSS for Web Development | (7) |
| | Introduction to CSS, Types of CSS, Importance of CSS,CSS Selectors- Group, id, class, CSS properties- Border, background, list, image, margins, Advantages and limitations of CSS. | |

Course Outcomes: - After completion of this course student should be able to-

1. Understand basics of website and web development life cycle.
2. Design website using HTML and CSS.
3. Implement client side scripting for website development.
4. Understand importance and working of HTML.

Reference Books:

1. Complete HTML-Thomas Powell
2. HTML and JavaScript–Ivan Bayross
3. Javascript:The Complete Reference by ThomasPowell, FritzSchneider
4. Introducing HTML-BruceLawson,RemySharp
5. .HTML BlackBook- Steven Holzner
6. HTML&CSS- Castro Elizabeth 7thEdition
7. Web Development and Design Foundations with HTML- Terry A.Felke-Morris

BDST 125: Operating system concept

Course Objectives: Student should be able to...

1. Provide basic knowledge of computer operating system structures and functioning.
2. Compare several different approaches to memory management, file management and process management
3. Understand various problems related to concurrent operations and their solutions.
4. Understand the fundamental concepts of Operating System.

| Credits=2 | BDST 125: Operating system concept | No. of hours per unit/credits |
|-------------------------------|---|--------------------------------------|
| Credit –I UNIT I | Operating system Concepts | (7) |
| | Definition, Types of Operating system, Real-Time operating system, System Components- System Services, Systems Calls, System Programs, System structure. Virtual Machines, System Design and Implementation, System Generations. | |
| Credit –1 UNIT II | Processes and CPU Scheduling | (7) |
| | Process Concept, Process Scheduling, Operation on process, Cooperating processes. Threads, Inter-process Communication, Scheduling criteria, scheduling Algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Scheduling Algorithms and performance evaluation. | |
| Credit –1 UNIT III | Process Synchronization | (7) |
| | The critical-section problem, Critical regions, Synchronization Hardware, Semaphores, Classical Problems of synchronization, and Monitors Synchronizations in Solaris. | |
| Credit –1 UNIT IV | Memory Management | (9) |
| | Basic concept, Logical and Physical address map, Memory allocation: Continuous Memory Allocation, Fixed and variable partition, Internal and external fragmentation and compaction, Paging: Principle of operation, Page allocation - Hardware support for paging, Protection and sharing, Disadvantages of paging. | |

Course Outcomes: Student should be able to...

1. Outline the basic concept of operating systems.
2. Analyze the working of operating system.
3. Examine the working of various scheduling/allocation approaches.
4. Measure the performance of various scheduling/allocation approaches.

Reference Books:

1. Emmanuel Simeu ,Kosai Raof Optimizing the performance of synchronization process Paperback – Illustrated, 7 June 2013
2. Francky Catthoor Custom Memory Management Methodology: Exploration of Memory Organization for Embedded Multimedia System Design Hardcover – Illustrated, 30 September 1998
3. IRESH A. DHOTRE Introduction to Operating Systems for BE Anna University R21CBCS (IV - CSE / IT - CS3451) & Operating Systems for BE Anna University R21CBCS (IV - AI&DS / CS&BS - AL3452) Paperback – 25 December 2022
4. Abraham Silberschatz (Author), Peter Baer Galvin (Author), Greg Gagne (Author)Operating System Concepts:8th Edition Wiley Student Edition Paperback – 13 February 2009

5. Emmanuel Simeu (Author), Kosai Raoof (Author)Optimizing the performance of synchronization process.
6. "Operating System Concepts" by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne, Wiley, 2018.
7. "Modern Operating Systems" by Andrew S. Tanenbaum and Herbert Bos, published by Pearson in 2014.

BDSP 126: Lab II– Based on

(BDST 124: Web Development and BDST 125: Operating system concept)

Course Objectives: - Student should be able to...

1. Provide basic knowledge of computer operating system structures and functioning.
2. Compare several different approaches to memory management, file management and process management
3. Understand various problems related to concurrent operations and their solutions.
4. Understand the fundamental concepts of Operating System.

| | | |
|---|---|-----------------------------------|
| Credit :2 Group A- | BDST 124: Web Development 1. Design web page using heading and formatting tags in HTML 2. Design web page using tags-marquee, Image tags, hyperlink, list 3. Create Railway timetable using Table tag 4. Create HTML form for students registration 5. Create your class timetable using table tag. 6. Design a web page of your home town with an attractive background color, text color, an Image, font etc. (use internal CSS). 7. Use Inline CSS to format your resume that you created. 8. Use External CSS to format your class timetable as you created. 9. Use External, Internal, and Inline CSS to format college web page that you created. 10. Design a web page of your home town with a background color, text color, an Image, font etc. (use internal CSS). | No. of hours per unit (60) |
| Group B: - | BDST 125: Operating system concept 1. To perform introduction to Ubuntu, Linux operating system 2. To perform how to install ubuntu 3. To perform how to install Ubuntu, Linux operating system in VMware step by step 4. To perform how to use Ubuntu, Linux operating system step by step 5. To perform how to use Ubuntu, Linux commands 6. To perform how to fix repository in Ubuntu, Linux and install any package 7. To perform basic commands, editors, permission step by step 8. To perform how to manage SSD services, disk, user, permission management 9. To perform how to install and configure apache web server in ubuntu 10. To perform file system hierarchy in ubuntu | |

Course Outcomes: - Students should be able to...

1. Outline the basic concept of operating systems.
2. Analyze the working of operating system.
3. Examine the working of various scheduling/allocation approaches.
4. Measure the performance of various scheduling/allocation.

Reference Books:

- 1 Emmanuel Simeu ,Kosai Raof Optimizing the performance of synchronization process Paperback – Illustrated, 7 June 2013
- 2 Francky Cathoor Custom Memory Management Methodology: Exploration of Memory Organization for Embedded Multimedia System Design Hardcover – Illustrated, 30 September 1998
- 3 IRESH A. DHOTRE Introduction to Operating Systems for BE Anna University R21CBCS (IV - CSE / IT - CS3451) & Operating Systems for BE Anna University R21CBCS (IV - AI&DS / CS&BS - AL3452) Paperback – 25 December 2022
- 4 Abraham Silberschatz (Author), Peter Baer Galvin (Author), Greg Gagne (Author)Operating System Concepts:8th Edition Wiley Student Edition Paperback – 13 February 2009
- 5 Emmanuel Simeu (Author), Kosai Raof (Author)Optimizing the performance of synchronization process
- 6 Emmanuel Simeu (Author), Kosai Raof (Author)Optimizing the performance of synchronization process
- 7 "Modern Operating Systems" by Andrew S. Tanenbaum and Herbert Bos, published by Pearson in 2014.

BDST-127: Computational Mathematics – III

Course Objectives: Student will be able to ...

1. Understand recursive techniques to count element of set and knowledge of set theory.
2. Solve simple application problems related to computer based on these.
3. Construct simple mathematical proofs and possess ability to verify them
4. Learn the concept of Divisibility of integers

| Credits=2 | BDST 127: Computational Mathematics - III | No.of hours per unit/credits |
|-----------------|---|-------------------------------------|
| UNIT I | Mathematical Logic | (7) |
| | Introduction, Definition: Statement (Proposition), Types of Statements: Simple and compound statements, Truth values of a statement, Truth Tables and construction of truth tables, Logical Operations: Negation, Conjunction, Disjunction, Implication, Double Implication, Equivalence of Logical statements, Statement forms: Tautology, Contradiction, and Contingency. Laws of logic: Idempotent laws, Commutative laws, Associative laws, Distributive laws, Complement laws, De Morgan's laws. | |
| UNIT II | Set Theory | (9) |
| | Introduction, definition of set, subset, Methods of describing of a set: Tabular form, Set builder form, Cardinality of set, types of set: Finite set, Infinite set, Empty set, Universal set, Equal sets, Disjoint sets, complementary set, Operation on Sets: Union of sets, Intersection of sets, Difference of sets, De Morgan's Laws, Cartesian product of two sets, Properties of set operations: Commutative law, Associative law, Distributive law. | |
| UNIT III | Function and Relation | (7) |
| | Introduction of function, Domain, Codomain, Range of Function, Operation on function, Definition of Relation, Reflexive relation, Symmetric relation, Transitive relation, Inverse Relation, Equivalence Relation, Identity Relation. | |
| UNIT IV | Divisibility of integers | (7) |
| | Introduction, Divisibility Definition and Properties, Division algorithm. Greatest common Divisor (GCD), Least common multiple (LCM), Prime number Euclidean algorithm Fundamental theorems of Arithmetic (Statement) | |

Course Outcomes: Student should be able to ...

1. Apply logic when creating systems.
2. Demonstrate mathematical skills, analytical and critical thinking abilities.
3. Analyze the types of relations and function.
4. Measure the performance of various scheduling/allocation

REFERENCES:

1. S.R. Patil and others “A text book of Discrete mathematics” (India : NIRALI Prakashan .2008).
2. Oscar Levin, Discrete Mathematics – An Open Introduction (Greekly University of Northen Colorado Press,2013).
3. Gaisi Takeuti,SAML (2018), “Advances in Mathematical Logic by professor “.
4. S.C. Malik and Savita Arora, “Mathematical Analysis (Fifth Edition)”, New Age International (P) Limited, 2017(UNIT I, II, III, IV).
5. Davender Malik, “Discrete Mathematics (India: Indian Binding House, 2009), Unit 1: 226-262, Unit 3: 413-442, Unit 4:263-291”.
6. Ken Levasseur, Al Doerr, “Applied Discrete Structures (Pearson Education, Inc. 2012), Unit 1: 20-33, Unit 2: 100-133, Unit 3:343-361, Unit 4:149-159”.
7. U.Langote, “Discrete Mathematics (Pune: Tech-Max Publications, 2009), Unit 1: 6.1-7.3 , Unit 2: 8.1-9.5 , Unit 3:10.1-10.4”.

BDST-128: Computational Mathematics IV

Course Objectives: Student will be able to.....

1. Understand the fundamental concepts of probability theory, including experiments, sample spaces, and event types.
2. Develop the essential skills to understanding of discrete random variables and key probability distributions.
3. Learn techniques for analyzing time series data and identifying its components.
4. Familiarize students with hypothesis testing and the interpretation of p-values.
5. Apply statistical concepts to solve real-world problems.

| Credits=2 | BDST 128: Computational Mathematics IV | No. of hours Per unit/ credits |
|-----------------|---|---|
| UNIT I | Probability | 7 |
| | <p>Concepts of experiments and random experiments. Definitions: Sample space, Discrete sample space (finite and countably infinite), Event, Elementary event, Compound event favorable event Definitions of Mutually exclusive events, Exhaustive events, Impossible events, certain event. Power set $P(\Omega)$ Equally likely outcomes (events). Apriori (classical) definition of probability of an event. Axiomatic definition of probability with reference to a finite and countably infinite sample space.</p> <p>Definition of conditional probability of an event. Partition of sample space. Idea of Posteriori probability. Baye's theorem (Statement Only).</p> | |
| UNIT II | Probability Distributions | 8 |
| | <p>Definition of discrete random variable. Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.) of a discrete random variable, Properties of c.d.f. (statements only). Probability distribution of function of random variable.</p> <p>Introduction to Bernoulli, Binomial, Normal, Poisson, Negative Binomial, t, f, Chi-Square distribution.</p> | |
| UNIT III | Time Series Analysis | 7 |
| | <p>Meaning and need of time series analysis, components of times (i) Secular trend (ii) Seasonal Variation (iii) Cyclical Variation (iv) Irregular Variation, Additive and Multiplicative model, Utility of time series.</p> <p>Measurement of trend: (i) Moving averages method (ii) Progressive average method (iii) Least square method. (iv) Measurement of seasonal indices by simple average method</p> | |
| UNIT IV | Testing of Hypothesis | 8 |

| | | |
|--|---|--|
| | Notion of Population, Sample, Parameter, Statistic, Sampling distribution of Statistic, hypothesis, Simple and composite hypothesis, Null and alternative hypothesis, type I and type II errors, Critical region, level of significance, pvalue.one and two tailed test, power of test. | |
|--|---|--|

Course Outcomes: Student should be able to ...

1. Define and distinguish between different types of events and apply probability definitions.
2. Identify, calculate, and interpret discrete random variables and probability distributions.
3. Analyze time series data and apply methods for measuring trends and variations.
4. Formulate and test hypotheses, interpret errors, and conduct statistical tests.
5. Apply their statistical knowledge to address real-world challenges effectively.

Reference Books:

1. Gupta, S.C., and V.K. Kapoor. Fundamentals of Mathematical Statistics. 11th ed. New Delhi: Sultan Chand & Sons, 2014.
2. T.C. Gupta. Fundamental of Statistics (7th Edition), Mumbai, Himalaya Publishing House, 2018.
3. B. L. Agarwal Basic Statistics (6th Edition), New Age International Private Ltd, Delhi, 2013.
4. Parimal Mukhopadhyaya, An Introduction to the Theory of Probability, World Scientific Publishing, 2011 Veerarajan, T. Probability, Statistics, and Random Processes. 4th ed. New Delhi: Tata McGraw-Hill, 2008.
5. Chatfield, Chris. The Analysis of Time Series: An Introduction. 6th ed. Boca Raton: CRC Press, 2003.
6. A. M. Goon, M. K. Gupta, B. Das Gupta. Fundamentals of Statistics, The World Press Private Ltd., Calcutta, 1968.

Lab Course III: BDSP129: based on

(BDST127 Computational Mathematics-III AND BDST128 Computational Mathematics-IV)

Course Objectives: Student should be able to ...

1. Learn the basic concepts of Computational Mathematics.
2. Understand the uses of Matrices in various fields
3. Learn the fundamental properties of matrices and their applications.
4. Learn the concept of Divisibility of integers.

| | | |
|------------------------------------|---|---|
| Credit :2 Group A | Computational Mathematics-III <ol style="list-style-type: none">1. Problems on Logical operation.2. Laws of logic with an example.3. Examples on Tautology, Contradiction, and Contingency.4. De Morgan's law with an example.5. Cartesian product of set and Difference of set with an example.6. Example of Functions and Relation.7. Greatest common divisor and Least common Multiplier with an Example.8. Examples of Operations and function.9. Examples of Tautology, Contradiction and contingency.10. Euclidian algorithm with an examples. | No. of hours per unit (60) |
| Credit :2 Group A | Computational Mathematics-IV <ol style="list-style-type: none">1. Computations of probabilities2. Time Series-I Trend by Progressive averages3. Time Series-II Trend by Moving average4. Time Series-III Trend by least square methods5. Tests based on t distribution6. Test based on F distribution7. Test based on Chi square distribution8. Applications of Normal Distribution9. Applications of Binomial Distribution10. Large and small sample | |

BDSTVEC-I

DEGG: Democracy, Election and Good Governance

Course Objectives: Student will be able to...

1. Introduce the meaning of democracy and it's important.
2. Study the various approaches of democracy and governance.
3. Understand the election procedure in India.
4. Learn the role of the good Governance and its initiatives in India.

| Credits=2 | Democracy, Election and Good Governance (DEGG) | No. of hours per unit/credits |
|-----------------|--|-------------------------------|
| Unit I | Democracy in India Introduction | (8) |
| | Meaning, Definition of democracy & Classification: Direct democracy and representative democracy, features of direct and representative democracy | |
| Unit II | Democracy and Decentralization | (8) |
| | Development of the first indigenous electronic computer: HEC-2M, Role of F.C. Kohli in setting up the first computer manufacturing company in India, Computers and Culture in the 1960s, Early Computer Languages and Software | |
| Unit III | Election | (8) |
| | 73rd and 74th Constitutional Amendment Acts: Institutions at the local level and Role of State Election commission – Local Body Elections: Urban & Rural – Duties of an Individual towards electoral process | |
| Unit IV | Good Governance | (6) |
| | Meaning and concept – Government and Governance – Good Governance initiatives in India | |

Course Outcomes: - Student will be able to ...

1. Explain the meaning of democracy and it's important.
2. Describe the various approaches of democracy and governance.
3. Examine critically election process in the country.
4. Define the role of the good Governance and its initiatives in India.

Reference Book: -

1. Banerjee-Dube, I, A history of modern India, Cambridge University Press, (2014).
2. Basu, D. D., Introduction to the Constitution of India, Delhi: Prentice Hall of India, (1982).
3. Bhargava, R, Political theory: An introduction. Chennai: Pearson Education India, (2008).
4. Bhargava, R., &Vanaik, A, Understanding Contemporary India: Critical Perspective. New Delhi: Orient Blackswan, (2010).
5. Chandhoke, N., &Proyadardhi,P. (Ed.), Contemporary India: Economy, Society, Politics. Chennai: Pearson Education India, (2009).
6. Chandra, B, Essays on contemporary India, New Delhi: Har-Anand Publications Pvt Ltd, (1999)
7. .Chaterjee, P, State and Politics in India. New Delhi: Oxford university Press. (1997).
8. Dasgupta. S., (Ed.). Political Sociology. Chennai: Pearson Education India, (2011).

BDSTSEC -I Data Analytics Skills for a Data Scientist

Course Objective: - Student should be able to ...

1. Learn Statistical Analysis
2. Understanding of Data Wrangling
3. Learn Data Visualization.
4. Knowledge about Machine Learning

| Credits=2 | BDSTSEC -I Data Analytics Skills for a Data Scientist | No. of hours per unit/credits |
|-----------------|---|-------------------------------|
| UNIT I | Introduction to Data Analytics and Data Science | (8) |
| | Overview of data analytics and its role in data science, Understanding the data science workflow, Introduction to common data analysis tasks and challenges | |
| UNIT II | Statistics and probability Skills | (8) |
| | Probability distributions, Over and under sampling, Bayesian (or frequency) statistics, Dimension reduction | |
| UNIT III | Data wrangling and database management | (7) |
| | Useful tools for data wrangling include Altair, Talend, Alteryx and database management tools include MySQL, MongoDB, Oracle. | |
| UNIT IV | Machine learning and deep learning | (7) |
| | Linear regression, Logistic regression, Naive Bayes, Decision tree, Random Forest algorithm, K-nearest neighbor (KNN), K means algorithm | |

Course outcomes: - Student will be able to ...

1. Conduct effective data Exploration.
2. Perform Data Cleaning and Preparation
3. Perform data exploration and analysis.

Reference Books:

1. David Stephenson, Business Skills for Data Scientists, Data Science Innovation, 2021
2. Vincent Granville, Developing Analytic Talent: Becoming a Data Scientist, Wiley, 2014
3. Dr. Briit, The Data Science Mindset, 2021
4. Jones Herbert, Data Science: What the Best Data Scientists Know About Data Analytics, Data, 2019
5. Mining, Statistics, Machine Learning, and Big Data, 2018
6. Data Science for Business by Foster Provost and Tom Fawcett, O'Reilly Media, 2013.
7. Python for Data Analysis by Wes McKinney, O'Reilly Media, 2017.

