

Mahakaushal University, Jabalpur (M.P.)



Scheme & Syllabus

For

B.Sc (Data Science)

with Research/honors Bachelor of
Computer Applications

2022-23

Duration of Course: 4 Years

Examination Mode: Semester

Examination System: CBCS

Mahakaushal University

Village-Aithakheda, Mukunwara Road, Post-Tilwara Jabalpur

(M.P.) 482003

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BDSC101T: Programming in C

UNIT I(12Lectures)

Introduction to C: Introduction to the C programming language, its history, evolution, and importance in modern programming. Overview of C as a procedural and structured language. Structure of a C program including header files, main function, and program statements. Compilation, linking, and execution process of a C program. Constants, variables, and data types (int, float, double, char, void) with examples. Operators in C: arithmetic, relational, logical, assignment, increment/decrement, conditional, and bitwise operators. Operator precedence, associativity, and type conversion rules. Introduction to input/output using `printf` and `scanf` including format specifiers, escape sequences, and control strings.

UNIT II(10Lectures)

Control Structures: Decision-making statements in C: `if`, `if-else`, nested `if`, `switch-case` with multiple examples and use cases. Looping constructs: `for`, `while`, `do-while` including nested loops and applications in repetitive tasks. Jump statements: `break`, `continue`, `goto`, and their practical usage. Conditional (ternary) operator `?:` and short-hand decision making. Emphasis on logical thinking and program flow control. Examples including number comparisons, conditional calculations, and iterative problems.

UNIT III(12Lectures)

Functions and Recursion: Defining, declaring, and calling functions in C. Importance of modular programming and reusability. Function parameters, passing techniques: call by value and call by reference. Recursive functions: factorial, Fibonacci series, and practical recursion problems. Scope and lifetime of variables: local, global, static, and external variables. Storage classes: `auto`, `register`, `static`, and `extern` with examples. Inline functions and their usage in optimizing performance. Function prototypes, return values, and void functions.

UNIT IV(14Lectures)

Arrays, Strings, and Pointers: One-dimensional and two-dimensional arrays: declaration, initialization, traversal, searching, and sorting. Multi-dimensional arrays and their applications in matrices. String handling: string declaration, manipulation, and functions like `strcpy`, `strlen`, `strcmp`, `strcat`, `strrev`, and `strupr/strlwr`. Introduction to pointers: declaration, initialization, pointer arithmetic, pointer to array, pointer to function, and pointers with strings. Dynamic memory allocation using `malloc`, `calloc`, `realloc`, and `free`. Examples of passing arrays and pointers to functions, pointer-based string manipulation, and memory-efficient programs.

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UNIT V(12Lectures)

Structures, Unions, and File Handling: Introduction to user-defined data types using structures, nested structures, and arrays of structures. Unions and enumerations, their memory management and usage in real-time applications. File handling in C: opening and closing files using `fopen` and `fclose`, reading and writing using `fread`, `fwrite`, `fprintf`, `fscanf`, and handling text and binary files. Command line arguments for input to programs. Sorting and searching records using arrays, structures, and files. Error handling in file operations. Applications of structures and file handling in student databases, employee records, and inventory systems.

Reference Books

1. E. Balagurusamy – *Programming in ANSI C*, McGraw Hill
2. Brian W. Kernighan & Dennis M. Ritchie – *The C Programming Language*, PHI
3. Yashavant Kanetkar – *Let Us C*, BPB Publications
4. H. Schildt – *C: The Complete Reference*, McGraw Hill
5. K. N. King – *C Programming: A Modern Approach*, W. W. Norton & Company
6. Reema Thareja – *Programming in C*, Oxford University Press
7. R. Subburaj – *Programming in C*, Vikas Publishing House
8. Ashok Kamthane – *Programming in C and Data Structures*, Pearson
9. Tony Gaddis – *Starting Out with C*, Pearson
10. Alfred V. Aho & Jeffrey D. Ullman – *Data Structures and Algorithms in C*, Pearson

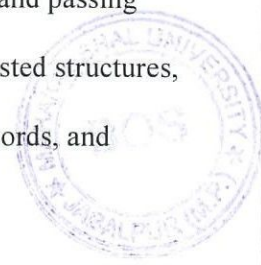
C Programming Lab

1. **Hello World & Basic I/O** – Display messages, input/output of numbers, characters, and strings.
2. **Arithmetic Operations** – Perform addition, subtraction, multiplication, division, and modulus operations.
3. **Largest/Smallest of Numbers** – Find the largest and smallest among three or more numbers using if-else and switch-case.
4. **Prime Number Check** – Determine whether a given number is prime or not.
5. **Fibonacci Series** – Generate Fibonacci series up to n terms using loops and recursion.
6. **Factorial Calculation** – Compute factorial of a number using loops and recursion.
7. **Swapping Numbers** – Swap two numbers using functions (call by value and call by reference).
8. **GCD & LCM Calculation** – Find Greatest Common Divisor and Least Common Multiple using functions.
9. **Arrays – Sum, Average & Max/Min** – Calculate sum, average, maximum, and minimum of array elements.
10. **Matrix Operations** – Perform addition, subtraction, and multiplication of two-dimensional arrays (matrices).
11. **String Handling** – Reverse a string, check palindrome, concatenate strings, and compare strings using built-in functions.
12. **Dynamic Memory Allocation** – Create, use, and free dynamic arrays using `malloc`, `calloc`, `realloc`, and `free`.
13. **Pointers & Pointer Arithmetic** – Demonstrate pointer declaration, arithmetic, and passing arrays to functions using pointers.
14. **Structures & Unions** – Create student or employee records using structures, nested structures, and unions; display and manipulate data.
15. **File Handling** – Read and write data to text and binary files, search and sort records, and implement simple menu-driven database using files.

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BDSC0102T:Data Base Management Systems

(10Lectures)

Unit-I

Databases and Database Users: Introduction, An example, Characteristics of the Database Approach, Actors on the Scene, Workers behind the Scene, Advantages of Using DBMS Approach, A Brief History of Database Applications, When Not to Use a DBMS. Database System Concepts and Architecture: Data Models, Schemas, and Instances, Three-schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment, Centralized and Client-Server Architectures, Classification of Database Management Systems.

Unit-II(20Lectures)

Data Modeling Using Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity

Types, Refining the ER Design Company Database Diagrams, Naming Conventions and Design. Issues, File organization and storage, secondary storage devices, type of single level ordered index, multi-level indexes, indexes on multiple keys, other types of indexes.

Unit-III(8 Lectures)

Relational Model and Relational Algebra: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations, Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from SET Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations, Examples of Queries in Relational Algebra.

Unit-IV(8Lectures)

Relational Database Design: Anomalies in a database, functional dependency, normal forms, lossless join and dependency, BCNF, normalization through synthesis, higher order normal

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forms. SQL- SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema Change Statements in SQL, Basic Queries in SQL, More Complex SQL Queries, Insert, Delete and Update Statements in SQL, Specifying Constraints as Assertion and Trigger, Views (Virtual Tables) in SQL, Embedded SQL, Dynamic SQL.

Unit-V(14 Lectures)

Introduction to transaction processing, transaction and system concepts, desirable properties of transactions, transaction support in SQL. Concurrency control techniques: two-phase locking techniques, concurrency, control based on timestamp ordering. Recovery techniques: recovery concepts, recovery in multi-database systems, database backup and recovery from catastrophic failures.

Reference Books:

- Elmasri and Navathe: Fundamental of Database Systems, 7th Edition, Addison- Wesley, 2016.
- Silberschatz, Korth and Sudharshan Database System Concepts, 7th Edition, Tata McGraw Hill, 2019
- C.J.Date, A.Kannan, S.Swamynatham: An Introduction to Database Systems, 8th Edition, Pearson education, 2009

Database Management Systems: Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition, McGraw Hill, 2003

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BDSC0102P:Data Base Management Systems Lab

List of Programs:

Program 1: Draw E-R diagram and convert entities and relationships to relation table for a given scenario. Two assignments shall be carried out i.e. consider two different scenarios (eg. bank, college)

Consider the Company database with following Schema

EMPLOYEE (FNAME, MINIT, LNAME, SSN, BDATE, ADDRESS, SEX, SALARY, SUPERSSN, DNO)

DEPARTMENT (DNAME, DNUMBER, MGRSSN, MGRSTARTDATE)

DEPT_LOCATIONS (DNUMBER, DLOCATION)

PROJECT (PNAME, PNUMBER, PLOCATION, DNUM) WORKS_ON (ESSN, PNO, HOURS)

DEPENDENT (ESSN, DEPENDENT_NAME, SEX, BDATE, RELATIONSHIP)

Program 2: Perform the following:

Viewing all databases, Creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback)

Program 3: Perform the following:

Altering a Table, Dropping/Truncating/Renaming Tables, Backing up / Restoring a Database.

Program 4: For a given set of relations, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause).

Program 5: Execute the following queries:

- a. How the resulting salaries if every employee working on the 'Research' Department is given a 10% raise.

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b. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department.

Program 6: Execute the following queries.

a. Retrieve the name of each employee controlled by Department number 5 (use EXISTS operator).

b. Retrieve the name of each department and number of employees working in each Department which has at least 2 employees

Program 7: Execute the following queries:-

a. For each project, retrieve the project number, the project name, and the number of employee who work on that project. (use GROUP BY)

b. Retrieve the name of employees who born in the year 1990's

Program 8: For each Department that has more than five employees, retrieve the department number and number of employees who are making salary more than 40000.

Program 9: For each project on which more than two employees work, retrieve the project number, project name and the number of employees who work on that project.

Program 10: For a given set of relation tables perform the following: Creating Views (with and without check option), Dropping views, Selecting from a view.

Program 11: Create the following tables with properly specifying Primary keys, Foreign keys and solve the following queries. BRANCH (Branchid, Branchname, HOD) STUDENT (USN, Name, Address, Branchid, sem) BOOK (Bookid, Bookname, Authorid, Publisher, Branchid)

AUTHOR (Authorid, Authorname, Country, age) BORROW (USN, Bookid, Borrowed_Date)

1) Perform the following:

a. Viewing all databases, Creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting

Records in a Table, Saving (Commit) and Undoing (rollback) Execute the following Queries:

2) a. List the details of Students who are all studying in 2nd sem BCA.

b. List the students who are not borrowed any books.

3) a. Display the USN, Student name, Branch_name, Book_name, Author_name, Books_Borrowed_Date of 2nd sem BCA Students who borrowed books.

c. Display the number of books written by each Author.

4) a. Display the student details who borrowed more than two books.

b. Display the student details who borrowed books of more than one Author.



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5)a.DisplaytheBooknamesindescendingorderoftheirnames.

b. List the details of students who borrowed the books which are all published by the same publisher.

Considerthefollowing schema:

STUDENT(USN,name, date_of_birth,branch,mark1,mark2,mark3,total,GPA)

6)Performthefollowing:

a.CreatingTables(WithandWithoutConstraints),Inserting/Updating/DeletingRecords in a Table, Saving (Commit) and Undoing (rollback)

7)Executethefollowingqueries:

a.FindtheGPAscoreofallthestudents.

b.Findthestudentswhobornonaparticularyearofbirthfromthedata_of_birth column.

8)a.Listthestudentswhoarestudyinginaparticularbranchof study.

b.FindthetmaximumGPAscoreofthestudentbranch-wise.

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BDSC0201T :OBJECT ORIENTED PROGRAMMING WITH C++

UNIT-I(14Lectures)

Introduction to object oriented programming, user defined types, structures, unions, polymorphism, encapsulation. Getting started with C++ syntax, data-type, variables, strings, functions, default values in functions, recursion, namespaces, operators, flow control, arrays and pointers.

UNIT- II(14Lectures)

Abstraction mechanism: Classes, private, public, constructors, destructors, member data, member functions, inline function, friend functions, static members, and references.

Inheritance: Class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance, role of virtual base class, constructor and destructor execution, base initialization using derived class constructors.

UNIT- III(14Lectures)

Polymorphism: Binding, Static binding, Dynamic binding, Static polymorphism: Function Overloading, Ambiguity in function overloading, Dynamic polymorphism: Base class pointer, object slicing, late binding, method overriding with virtual functions, pure virtual functions, abstract classes.

UNIT- IV(8Lectures)

Operator Overloading: This pointer, applications of this pointer, Operator function, member and non member operator function, operator overloading, I/O operators. Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration, unexpected exceptions, exception when handling exceptions, resource capture and release.

UNIT- V (10Lectures)

Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.

Template: template classes, template functions.

Standard Template Library: Fundamental ideas about string, iterators, hashes, iostreams and other types.

Namespaces: user defined namespaces, namespaces provided by library. Object Oriented Design, design and programming, role of classes.

Reference Books:

1. Big C++ -WileyIndia
2. C++: The Complete Reference-Schildt, McGraw-Hill Education (India)
3. C++ and Object Oriented Programming-Jana, PHI Learning.
4. Object Oriented Programming with C++ -Rajiv Sahay, Oxford
5. Mastering C++ - Venugopal, McGraw-Hill Education (India)

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TextBooks:

1. ObjectOrientedProgrammingwithC++ by E. Balagurusamy, McGraw-HillEducation(India)
2. ANSlandTurboC++ by AshokeN.Kamthane,PearsonEducation

LIST OF PRACTICALS OF C++ :-

1. Write a Program That Just Outputs 'Hello World
2. Write a Program to Find Maximum and Minimum of Given 3 Numbers.
3. Write a Program That Output Value as Number and as Character.
4. Implementation of the Function That Calculates the Cross Sum of an Integer.(123 as 1+2+3).
5. Determine Number of Characters in a String.
6. Raising a Number N to a Power P is the Same as Multiplying N By Itself P Times. Write a Function Called Power () That Takes a Double Value for N and an INT Value for P and Returns the Result as Double Value. use a Default Argument of 2 for P So That If This Argument is Omitted the Number Will Be Squared. Write a Main () Function That Gets Values from the User to Test This Function.
7. Write a C++ Program to Sort an Array of Integer in Ascending Order Using a Function Called Exchange () Which Accepts Two Integer Arguments By Reference.
8. Write a C++ Program to Implement Function Overloading in Order to Compute.
9. Write a C++ Program to Implement Power(MN) Where
I) M is Double and N is Int II) M and N are Int.
10. Write a Program That Uses a Structure Called Point to Model a Point. Define Three Points and Have the User Input Values to Two of Them. Then Set the Third Point Equal to the Sum of the Other Two and Display the Value of the New Point. Interaction with the Program Might Look Like This:
Enter Coordinates for P1: 3 4
Enter Coordinates for P2: 5 7 Coordinates of P1 + P2 are: 8 11
11. Create the Equivalent of a Four Function Calculator. the Program Should Request the User to Enter a Number an Operator and Another Number. It Should Then Carry Out the Specified Arithmetical Operation: Adding Subtracting Multiplying Or Dividing the Two Numbers. (It Should use a Switch Statement to Select the Operation). Finally It Should Display the Result. When It Finishes the Calculation the Program Should Ask If the User Wants to Do Another Calculation. the Response Can Be Y Or N. Some Sample Interaction with the Program Might Look Like This.
Enter First Number Operator Second Number: 10/ 3 Answer = 3.333333
Do Another (Y/ N)? Y
Enter First Number Operator Second Number 12 + 100 Answer = 112
Do Another (Y/ N)? N
12. Create a 'Distance' Class with :
☐ Feet and Inches as Data Members

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- ☐ Member Function to Input Distance
- ☐ Member Function to Output Distance
- ☐ Member Function to Add Two Distance Objects
- ☐ Write a Main Function to Create Objects of Distance Class. Input Two Distances and Output the Sum.

13. Create a Class Called 'Time' That Has

- ☐ Three Integer Data Members for Hours Minutes and Seconds
- ☐ Constructor to Initialize the Object to Zero
- ☐ Member Function to Add Two Time Objects
- ☐ Member Function to Display Time in Hh:Mm:Ss Format
- ☐ Write a Main Function to Create Two Time Objects Add Them and Display the Result in Hh:Mm:Ss Format.

14. Create a Class Called 'Employee' That Has

- ☐ Empcode and Empname as Data Members
- ☐ Member Function Getdata() to Input Data
- ☐ Member Function Display() to Output Data
- ☐ Write a Main Function to Create Emp an Array of Employee Objects. Accept and
- ☐ Display the Details of At Least 6 Employees.

15. Create a Class Rational Which Represents a Numerical Value by Two Double Values- Numerator & Denominator. Include the Following Public Member Functions: Constructor with No Arguments (Default). Constructor with Two Arguments.

- ☐ Void Reduce() That Reduces the Rational Number By Eliminating the Highest Common Factor Between the Numerator and Denominator.
- ☐ Overload + Operator to Add Two Rational Number.
- ☐ Overload >> Operator to Enable Input Through Cin.
- ☐ Overload << Operator to Enable Output Through Cout.
- ☐ Write a Main () to Test All the Functions in the Class.

16. Create a Class 'Complex' to Hold a Complex Number. Write a Friend Function to add Two Complex Numbers. Write a Main Function to Add Two Complex Objects.

17. Create a 'Matrix' Class of Size M X N. Overload the '+' Operator to Add Twomatrix Objects. Write a Main Function to Implement It.

18. Create a 'String' Class Which Overloads '=' Operator to Compare Two Stringobjects.

19. Create a Base Class Called 'Shape' Having

- ☐ Two Data Members of Type Double.
- ☐ Member Function Get-Data() to Initialize Base Class Data Members.
- ☐ Pure Virtual Member Function Display-Area() to Compute and Display the Area of the Geometrical Object.

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BDS0C202T: DISCRETE MATHEMATICS**Unit I(10Lectures)**

Logic: Propositional equivalence, predicates and quantifiers, Methods of proofs, proof strategy, sequences and summation, mathematical induction, recursive definitions and structural induction, program correctness.

Unit-2 (10Lectures)

Counting: The basics of counting, the pigeonhole principle, permutations and combinations, recurrence relations, solving recurrence relations, generating functions, inclusion-exclusion principle, application of inclusion-exclusion.

Unit -3(16Lectures)

Relations: Relations and their properties, n-array relations and their applications, representing relations, closure of relations, equivalence of relations, partial orderings.

Graph theory: Introduction to graphs, graph terminology, representing graphs and graph isomorphism, connectivity, Euler and Hamilton paths, planar graphs, graph coloring, introduction to trees, application of trees.

Unit -4(12Lectures)

Group theory: Groups, subgroups, generators and evaluation of powers, cosets and Lagrange's theorem, permutation groups and Burnside's theorem, isomorphism, automorphisms, homomorphism and normal subgroups, rings, integral domains and fields.

Unit -5(12Lectures)

Lattice theory: Lattices and algebras systems, principles of duality, basic properties of algebraic systems defined by lattices, distributive and complimented lattices, Boolean lattices and Boolean algebras, uniqueness of finite Boolean expressions, propositional calculus. Coding theory: Coding of binary information and error detection, decoding and error correction.

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Text Books:

- 1) K.H. Rosen: Discrete Mathematics and its application, 5th edition, Tata McGraw Hill. Chapter 1(1.1-1.5), Chapter 3(3.1-3.4,3.6), Chapter 4(4.1-4.3,4.5), Chapter 6(6.1,6.2,6.4-6.6) Chapter 7(7.1-7.6), Chapter 8(8.1-8.5,8.7,8.8)
2. C.L. Liu: Elements of Discrete Mathematics, 2nd edition, TMH 2000. Chapter 11(11.1-11.10 except 11.7), Chapter 12(12.1-12.8)
- 2.3. B. Kalman: Discrete Mathematical Structure, 3rd edition, Chapter 1(11.1,11.2)

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BDSC0301T :Object Oriented Concepts using JAVA**Unit-I(8Lectures)**

Fundamentals of Object-Oriented Programming: Introduction, Object Oriented Paradigm, BasicConceptsofOOP,BenefitsandApplicationsofOOP.IntroductiontoJava:JavaFeatures, Java Environment, Simple Java Program, Java Program Structure, Java Tokens, Java Statements, Java Virtual Machine.

Unit-II (14Lectures)

Java Programming Basics: Constants, Variables, Data Types, Declaration of variables, Giving values to the variable, Scope of variables, Symbolic constants, Type casting.

OperatorsandExpressions:ArithmeticOperators,RelationalOperators, Logical Operators, Assignment Operator, Increment and Decrement Operators, Conditional Operator, Special Operators, Mathematical functions.

Using I/O: Byte streams and character streams, predefined streams, reading console input, reading characters, strings, writing console output.

Decision Making & Branching: Simple if statement, if..else statement, nesting of if..else statement, the else..if ladder, the Switch statement.

Unit-III (12Lectures)

Decisionmaking&Looping-Thewhilestatement,thedostatement,theforstatement.Jumpsin loops, Labelled loops. Class & Objects - Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The 'this' keyword, Overloading Methods, Using Objects as Parameters, Returning Objects, Recursion, Understanding 'static', Introducing 'final ', Using Command-LineArguments,Varargs :Variable-Length Arguments Arrays and Strings: One dimensional arrays, Creating an arrays, Two dimensional arrays , Strings, Vectors, Wrapper classes.

Unit-IV (12Lectures)

Inheritance-InheritanceBasics,Using'super,CreatingMultilevelhierarchy,Methodverriding, Using Abstract Classes, Using final with Inheritance.

Packages & Interfaces - Packages, Access protection in packages, Importing Packages, Interfaces.Exception Handling - Exception Handling Fundamentals -Exception Types,

Uncaught

Exceptions, Using try and catch, Multiple catch clauses, Nested try statements, throw, throws, finally, Java's built-in Exceptions.

Unit-V(14 Lectures)

Multithreaded Programming- Introduction, Creating threads, Extending the thread class, stopping & blocking thread, Life cycle of a thread, Using thread methods, Implementing the runnable interface.

Event and GUI programming: The Applet Class, Types of Applets, Applet Basics, Applet Architecture, An Applet Skeleton, SimpleApplet Display Methods, Requesting Repaint, The HTMLAPPLET tag. Event Handling - The delegation event model, Event Classes – Action Event, KeyEvent & MouseEvent Classes, Event Listener Interfaces – ActionListener, KeyListener & MouseListener interfaces. Using the Delegation Event Model. Window Fundamentals, Working with Frame Windows, Creating a Frame Window in an Applet. Creating a Windowed Program, Displaying information within a window.

Introducing swing – two key swing features, components and containers, the swing packages, a simple swing application, event handling. Exploring Swing- JLabel, JTextField, JButton, Check boxes, Radio buttons, JList, JComboBox.

Reference Books:

- E. Balagurusamy, Programming with Java – A Primer, Fourth Edition, Tata McGraw Hill Education Private Limited.
- Herbert Schildt, Java: The Complete Reference, Seventh Edition, McGraw Hill Publication.
- Herbert Schildt, Java 2 – The Complete Reference, Fifth Edition, McGraw Hill publication.
- Cay S. Horstmann, Core Java Volume I – Fundamentals, Prentice Hall.
- Somashekara, M. T., Guru, D. S., Manjunatha, K. S., Object Oriented Programming with Java, 3rd Edition, PHI.

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List of Programs:

1. Program to accept student name and marks in three subjects. Find the total marks, average and grade (depending on the average marks).
2. A menu driven program to input two integers & an operator to perform basic arithmetic operations (+, -, *, and /) using switch case structure.
3. Program, which reads two numbers having same number of digits. The program outputs the sum of product of corresponding digits. (Hint Input 327 and 539 output $3 \times 5 + 2 \times 3 + 7 \times 9 = 84$)
4. Program to input Start and End limits and print all Fibonacci numbers between the ranges. (Use for loop)
5. Define a class named Pay with data members String name, double salary, double da, double hra, double pf, double grossSal, double netSal and methods: Pay(String n, double s) - Parameterized constructor to initialize the data members, void calculate() - to calculate the following salary components, and void display() - to display the employee name, salary and all salary components.

Dearness Allowance = 15% of salary HouseRentAllowance = 10% of salary Provident Fund = 12% of salary

GrossSalary = Salary + DearnessAllowance + HouseRentAllowance Net Salary = Gross Salary - Provident Fund

Write a main method to create object of the class and call the methods to compute and display the salary details.
6. Program to create a class DISTANCE with the data members feet and inches. Use a constructor to read the data and a member function Sum () to add two distances by using objects as method arguments and show the result. (Input and output of inches should be less than 12.)
7. Program to check whether the given array is Mirror Inverse or not.
8. Program to create a class "Matrix" that would contain integer values having varied numbers of columns for each row. Print row-wise sum.
9. Program to extract portion of character string and print extracted string. Assume that 'n' characters extracted starting from mth character position.
10. Program to add, remove and display elements of a Vector.

BDSC0302T: DATA MINING

Unit 1

Introduction to Data Mining:-Overview of data mining: definition, objectives, applications, Data mining process: problem definition, data collection, data preprocessing, modeling, evaluation, deployment, Data mining techniques: supervised learning, unsupervised learning, semi-supervised learning, reinforcement learning.

Unit 2

Data Preprocessing:-Data cleaning: handling missing values, noisy data, inconsistent data, Data integration: resolving data conflicts, schema integration, entity identification, Data transformation: normalization, aggregation, attribute construction, discretization.

Unit 3

Classification and Prediction:-Classification: decision tree induction, rule-based classifiers, Bayesian classifiers, support vector machines, ensemble methods, Evaluation of classification models: accuracy, precision, recall, F1-score, ROC curve, AUC, Prediction: regression analysis, linear regression, logistic regression.

Unit 4

Clustering and Association Rule Mining:-Clustering: K-means clustering, hierarchical clustering, density-based clustering, evaluation metrics (e.g., silhouette score), Association rule mining: Apriori algorithm, frequent itemset mining, rule generation, interestingness measures (e.g., support, confidence, lift).

Unit 5

Advanced Topics in Data Mining:-Text mining: text preprocessing, document representation, sentiment analysis, topic modeling, Web mining: web content mining, web structure mining, web usage mining, Social media mining: mining social networks, community detection, influence analysis, Big data analytics: challenges and techniques for mining large-scale datasets.

Recommended Book:

"Data Mining: Concepts and Techniques" by Jiawei Han, Micheline Kamber, and Jian Pei. This book is a comprehensive guide to data mining concepts, techniques, and algorithms. It covers both fundamental principles and advanced topics in data mining, making it suitable for beginners as well as experienced practitioners. The book also includes numerous examples and case studies to illustrate the application of data mining techniques in real-world scenarios.

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DATA MINING Lab:-

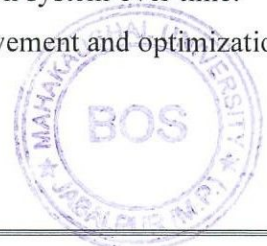
1. Data Collection and Preprocessing:
2. Collect customer data from various sources such as transaction records, demographic information, and browsing history.
3. Preprocess the data by handling missing values, outlier detection, and data transformation.
4. Customer Segmentation:
5. Perform customer segmentation using clustering algorithms such as K-means clustering or hierarchical clustering.
6. Explore different features for segmentation (e.g., purchasing behavior, demographic attributes) and evaluate the quality of the resulting segments.
7. Segment Profiling:
8. Profile each customer segment by analyzing their characteristics, preferences, and purchasing patterns.
9. Identify key attributes that distinguish one segment from another and gain insights into customer behavior.
10. Recommendation System:
11. Develop a recommendation system that suggests products or services to customers based on their segment membership and past purchasing behavior.
12. Implement collaborative filtering, content-based filtering, or hybrid recommendation approaches to personalize recommendations.
13. Evaluation and Validation:
14. Evaluate the effectiveness of the segmentation model and recommendation system using relevant metrics such as silhouette score for clustering and precision, recall, and F1-score for recommendation accuracy.
15. Validate the models using cross-validation techniques and assess their generalization performance.
16. Deployment and Integration:
17. Deploy the segmentation model and recommendation system into a production environment, such as an e-commerce platform.
18. Integrate the models with the company's existing customer management and marketing systems for real-time decision-making.
19. Performance Monitoring and Improvement:
20. Monitor the performance of the segmentation model and recommendation system over time.
21. Collect feedback from users and stakeholders to identify areas for improvement and optimization.

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BDSC0401T : DIGITAL ELECTRONIC AND COMPUT ORGANIZATION

UNIT-I(12Lectures)

Data Representation Data Types and Number Systems Binary Number System Octal & Hexa-Decimal Number System Fixed Point Representation 1's & 2's Complement Binary Fixed-Point Representation Arithmetic Operation On Binary Numbers Overflow & Underflow Floating Point Representation Codes ASCII EBCDIC Codes Gray Code Excess-3 & BCD Error Detection & Correcting Codes Binary Storage and Registers.

UNIT- II(14Lectures)

Boolean Algebra and Digital Logic Circuits -Logic Gates and OR NOT Gates and Their Truth Tables NOR, NAND & XOR Gates Boolean Algebra Basic Definition and Properties Basic Boolean Law's Demorgan's Theorem Map Simplification Minimization Techniques K Map – Two Three and More Variables Maps Sum of Product & Product of Sums Don't Care Conditions Combination Circuits Half Adder & Full Adder, Full Subtractor, and Decimal Adder Code Conversion Multilevel NAND and NOR Circuits Multiplexers and Demultiplexers, RAM and ROM Working & Circuit

UNIT- III(12Lectures)

Sequential Circuits Flip-Flops - RS D JK & T Flip-Flop Triggering in Flip Flops Analysis of Clocked Sequential Circuits State Reduction and Assignment Flip Flop Excitation Tables Registers Counters and the Memory UNIT Shift Registers Ripple Counters and Synchronous Counters Design of Counters. Common Bus System Computer Instructions Timing and Control Instruction Cycle Memory-Reference Instructions Complete Computer Description

UNIT- IV(10Lectures)

Design of Basis Computer Control Logic Gates Control of Registers and Memory Design of Accumulator Logic Control of Ac Register Adder and Logic Circuit Multiple Bus Organization of Computer Memory Addressing Micro Program Programming the Basis Computer Machine Languages Assembly Language.

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UNIT- V(12Lectures)

Input-Output Organizations- I/O Interface I/O Devices Isolated Vs Memory-Mapped I/O Synchronous & Asynchronous Data Transfer. Memory Organization - Auxiliary Memory Magnetic Drum Disk & Tape Semi-Conductor Memories Direct Memory Access (DMA) Memory Hierarchy Main Memory Auxiliary Memory Associative Memory Cache Memory Virtual Memory Address Space & Memory Space Address Mapping Page Table Page Replacement Segmentation Cache Memory Hit Ratio Mapping Techniques Memory Management Hardware.

Reference Books:

- 1.M. Morris Mano-Computer System Architecture Revised 3rd Edition Pearson Publication.
- 2.Morris Mano-Digital Logic and Computer Design.

:DIGITALELECTRONICSLAB

The laboratory work consists of 16 experiments. Minimum 9 experiments to be done

- 1) Familiarise with various components- Resistors, Capacitors, Diode, LED, Zener Diode & transistor.
- 2) Diode characteristics (forward and reverse)
- 3) Clipping circuits (series clippers)
- 4) Verification of truth table of logic gates
- 5) SR flip flop (Truth Table Verification)
- 6) Half adder (Truth Table Verification)
- 7) Code Converter (Binary to Gray and Gray to Binary)
- 8) Magnitude comparator (To compare the given inputs)
- 9) Four Bit Binary Up Counter (Synchronous) (Truth Table Verification)
- 10) Astable multi-vibrator (Using 555 IC)
- 11) Full wave rectifier and filter
- 12) Half wave rectifier and filter
- 13) R-C phase shift oscillator
- 14) JK flip flop (Truth Table Verification)
- 15) Multiplexer (Truth Table Verification)
- 16) Decoder (Truth Table Verification)

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BDSC0402T: Machine learning technique

UNIT-I: INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS (10 Lectures)

Fundamentals Of Neural Networks – Model of Artificial Neuron – Neural Network Architectures – Learning Methods – Taxonomy Of Neural Network Architectures – Applications.

UNIT-II: FEED FORWARD NEURAL NETWORKS (12 Lectures)

Perceptron Models: Discrete, Continuous and Multi-Category – Training Algorithms: Discrete and Continuous Perceptron Networks – Limitations of the Perceptron – Model Credit Assignment Problem – Generalized Delta Rule, Derivation of Back propagation (BP) Training, and Summary of Back propagation Algorithm – Kolmogorov Theorem.

UNIT-III: MACHINE LEARNING (14 Lectures)

Machine Learning Fundamentals – Types of Machine Learning – Supervised, Unsupervised, Reinforcement – The Machine Learning process. Terminologies in ML – Testing ML algorithms: Overfitting, Training, Testing and Validation Sets – Confusion matrix – Accuracy metrics – ROC Curve – Basic Statistics: Averages, Variance and Covariance, The Gaussian – The Bias-Variance trade off – Applications of Machine Learning.

UNIT IV: SUPERVISED LEARNING (12 Lectures)

Regression: Linear Regression – Multivariate Regression – Classification: Linear Discriminant Analysis, Logistic Regression – K-Nearest Neighbor classifier. Decision Tree based methods for classification and Regression – Ensemble methods.

UNIT V: UNSUPERVISED LEARNING (12 Lectures)

Clustering – K-Means clustering, Hierarchical clustering – The Curse of Dimensionality – Dimensionality Reduction – Principal Component Analysis – Probabilistic PCA – Independent Components analysis

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TEXTBOOKS

1. Charu C. Aggarwal, "Neural Networks and Deep Learning" Springer International Publishing, 2018
2. Satish Kumar, "Neural Networks, A Classroom Approach", Tata McGraw - Hill, 2007.
3. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
4. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", CRC Press, 2009.
5. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, "Machine Learning", Pearson Education, 2018.
6. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2011.

REFERENCE BOOKS

1. Andreas C. Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly, 2016.
2. Sebastian Raschka, "Python Machine Learning", Packt Publishing, 2015.
3. Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", 2nd Edition, Springer, 2017.
4. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Revised edition, MIT Press, 2010.

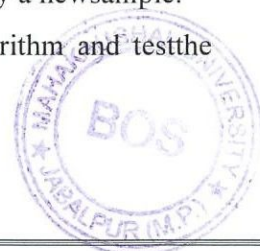
LIST OF EXPERIMENTS

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate datasets.

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5. Write a program to implement the naïve Bayesian classifier for a sample training data set.

stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem. 10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

REFERENCES:-

1. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Chapman and Hall, CRC Press, Second Edition, 2014.
3. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
4. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
5. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

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BDSC0501T:Python Programming

Unit-I

(10Lectures)

PythonBasics,Objects-PythonObjects,StandardTypes,OtherBuilt-inTypes,InternalTypes, StandardTypeOperators,StandardTypeBuilt-inFunctions,CategorizingtheStandardTypes, Unsupported Types Numbers - Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions, Related Modules Sequences - Strings, Lists, and Tuples, Mapping and Set Types.

Unit-II(16Lectures)

FILES: File Objects, File Built-in Function [open()], File Built-in Methods, File Built-in Attributes, Standard Files, Command-lineArguments, File System, File Execution, Persistent StorageModules,RelatedModulesExceptions:ExceptionsinPython,DetectingandHandling Exceptions, Context Management, *Exceptions as Strings, Raising Exceptions, Assertions, StandardExceptions,*CreatingExceptions,WhyExceptions(Now)?,WhyExceptionsatAll?, Exceptions and the sys Module, Related Modules Modules: Modules and Files, Namespaces, ImportingModules,ImportingModuleAttributes,ModuleBuilt-inFunctions,Packages,Other Features of Modules.

Unit-III(12Lectures)

Regular Expressions: Introduction, Special Symbols and Characters, Res and Python Multithreaded Programming: Introduction, Threads and Processes, Python, Threads, and the Global Interpreter Lock, Thread Module, Threading Module, Related Modules.

Unit-IV(12Lectures)

GUIProgramming:Introduction,TkinterandPythonProgramming,BriefTourofOtherGUIs, RelatedModulesandOtherGUIsWEBProgramming:Introduction,WedSurfingwithPython, Creating Simple Web Clients, Advanced Web Clients, CGI-Helping Servers Process Client Data, Building CGIApplicationAdvanced CGI, Web (HTTP) Servers.

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Unit-V(10Lectures)

Database Programming: Introduction, Python Database Application Programmer's Interface (DB-API), Object Relational Managers (ORMs), Related Modules.

ReferenceBooks:

- CorePythonProgramming, WesleyJ.Chun, SecondEdition, Pearson.
- ThinkPython, AllenDowney, GreenTeaPress
- IntroductiontoPython, KennethA.Lambert, Cengage
- PythonProgramming:AModernApproach, VamsiKurama, Pearson
- LearningPython, MarkLutz, O'Really.

BDSC501P:PythonProgrammingLab:-

List ofPrograms:

1. Writeaprogramtodemonstratedifferentnumberdatatypesin Python.
2. WriteaprogramtoperformdifferentArithmeticOperationsonnumbersin Python.
3. Writeaprogramto create, concatenate and print a string and access its sub-string from a given string.
4. Write a python script to print the current date in the following format "Sun May 2902:
5. 26:23 IST 2017"
6. Writeaprogramto create, append, and remove lists in python.
7. Writeaprogramtodemonstrate working with tuples in python.
8. Writeaprogramtodemonstrate working with dictionaries in python.
9. Write a python program to find largest of three numbers.
10. Write a Python program to convert temperature to and from Celsius, Fahrenheit. [Formula : $c/5 = f-32/9$]
11. Write a Python program to construct the following pattern, using a nested for loop.

```
*
* *
* * *
* * * *
* * * * *
```

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```

* * * *
* * *
* *
*

```

12. Write a Python script that prints prime numbers less than 20.
13. Write a Python program to find factorial of a number using Recursion.
14. Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one side equals the sum of the squares of the other two sides)
15. Write a Python program to define a module to find Fibonacci Numbers and import the module to another program.
16. Write a Python program to define a module and import a specific function in that module to another program.
17. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
18. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
19. File in alphabetical order.
20. der.
21. Write a Python class to convert an integer to a Roman numeral.
22. Write a Python class to implement $\text{pow}(x, n)$.
23. Write a Python class to reverse a string word by word.

Reference Books:

- Core Python Programming, Wesley J. Chun, Second Edition, Pearson.
- Think Python, Allen Downey, Green Tea Press
- Introduction to Python, Kenneth A. Lambert, Cengage
- Python Programming: A Modern Approach, Vamsi Kurama, Pearson
- Learning Python, Mark Lutz, O'Reilly.

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BDSC0601T: Ethics and Privacy in Data Science

Unit 1

Introduction to Ethics and Privacy in Data Science: -Overview of ethical considerations in data science: importance, relevance, and impact, Ethical principles: fairness, transparency, accountability, responsibility, Legal and regulatory frameworks: GDPR, CCPA, HIPAA, etc. Introduction to privacy concepts: personally identifiable information (PII), data anonymization, data minimization.

Unit 2

Data Collection and Consent: -Data collection practices: types of data sources, data ownership, data stewardship, Informed consent: principles of consent, consent forms, consent management, Ethical issues in data collection: bias, discrimination, surveillance, consent fatigue.

Unit 3

Data Analysis and Bias: -Bias in data analysis: types of bias (e.g., algorithmic bias, selection bias, confirmation bias), sources of bias, Fairness in machine learning: fairness definitions (e.g., demographic parity, equal opportunity), fairness-aware algorithms, fairness evaluation, Mitigating bias: bias detection techniques, bias mitigation strategies.

Unit 4

Privacy Preservation Techniques: -Privacy-preserving data analysis: differential privacy, secure multiparty computation, homomorphic encryption, Anonymization techniques: k-anonymity, l-diversity, t-closeness, Privacy-enhancing technologies: privacy-preserving data sharing, privacy-aware data mining.

Unit 5: Ethical Decision Making and Responsible Data Science: -Ethical decision-making frameworks: utilitarianism, deontology, virtue ethics, Ethical considerations in data science research and practice: data sharing, data reuse, open data, Responsible data science practices: data ethics committees, ethical impact assessments, ethical guidelines and codes of conduct.

Recommended Book:

"Ethics of Big Data: Balancing Risk and Innovation" by Kord Davis and Doug Patterson. This book provides a comprehensive overview of ethical considerations in the context of big data, including discussions on privacy, consent, bias, and accountability. It offers practical guidance for navigating ethical challenges in data science projects and is suitable for both beginners and experienced practitioners. Additionally, "The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power" by Shoshana Zuboff offers a critical analysis of the implications of data collection and surveillance capitalism on privacy and society.

BDSC0601p: Ethics and Privacy Lab:-

1. Dataset Selection: Choose a dataset that is relevant to a real-world application (e.g., loan approvals, hiring decisions, predictive policing).
2. Exploratory Data Analysis (EDA): Conduct EDA to understand the dataset's characteristics, including demographic distributions and potential biases.
3. Model Training: Train a machine learning model on the dataset to predict the target variable of interest (e.g., loan approval, job acceptance).
4. Fairness Evaluation: Evaluate the fairness of the model across different demographic groups (e.g., gender, race) using fairness metrics such as disparate impact, equal opportunity, and predictive parity.
5. Bias Analysis: Identify sources of bias in the dataset and model predictions. This may include

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historical biases present in the data or biases introduced during model training.

6. Mitigation Strategies: Propose and implement strategies to mitigate bias and improve fairness in the model. This could involve algorithmic adjustments, feature engineering, or data preprocessing techniques.
7. Evaluation and Documentation: Evaluate the effectiveness of the mitigation strategies and document the entire process, including findings, challenges faced, and lessons learned.

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BDSC0701T:R Programming

Unit-I(10Lectures)

Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations – Recycling – Common Vector Operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Element names.

Unit-II(10Lectures)

Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

Unit-III(18Lectures)

Creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying functions to Data Frame

s – Factors and Tables – Factors and levels – Common Functions used with factors – Working with tables – Other factors and table related functions – Control statements – Arithmetic and Boolean operators and values – Default Values for arguments – Returning Boolean Values – Functions are objects – Environment and scope issues – Writing Upstairs – Recursion – Replacement functions – Tools for Composing function code – Math and Simulation in R.

Unit-IV(12Lectures)

S3 Classes – S4 Classes – Managing your objects – Input/output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving Graphs to files – Creating Three-Dimensional plots.

Unit-V(10Lectures)

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear Models – Time Series and Auto-Correlation – Clustering.

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ReferenceBooks:

- NormanMatloff,—TheArtofRProgramming:ATourofStatisticalSoftwareDesignI, No Starch Press, 2011.
- JaredP.Lander,—RforEveryone:AdvancedAnalyticsandGraphicsI,Addison- Wesley Data & Analytics Series, 2013.
- MarkGardner,—BeginningR—TheStatisticalProgrammingLanguagel, Wiley, 2013.
- Robert Knell, —Introductory R:ABeginner's Guide to DataVisualisation, Statistical Analysis and programming in RI, Amazon Digital South Asia Services Inc, 2013. Richard Cotton(2013). Learning R, O'Reilly Media.
- GarretGrolemund(2014).Hands-onProgrammingwithR.O'ReillyMedia,Inc.
- RogerD.Peng(2018).R ProgrammingforDataScience.LeanPublishing.
- https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
https://onlinecourses.swayam2.ac.in/arp19_ap79/preview

BDSC0701P:RProgramming Lab

List ofPrograms:

1. RExpressionsandDataStructures
2. Manipulationofvectors and matrix
3. OperatorsonFactorsinR
4. DataFramesinR
5. ListsandOperators
6. Workingwithloopingstatements.
7. GraphsinR
8. 3DplotsinR

ReferenceBooks:

- S.RussellandP.Norvig,—ArtificialIntelligence:AModernApproachI,PrenticeHall, Third Edition, 2009.
- I. Bratko, - Prolog: Programming forArtificial Intelligence, Fourth Edition,Addison- Wesley Educational Publishers Inc., 2011.
- M.TimJones,-ArtificialIntelligence:ASystemsApproach(ComputerScience),Jones and Bartlett Publishers Inc.; First Edition, 2008.

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- Nils J. Nilsson, - The Quest for Artificial Intelligence, Cambridge University Press, 2009.
- William F. Clocksin and Christopher S. Mellish, Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2003.
- Gerhard Weiss, - Multi Agents Systems, Second Edition, 2013.
- David L. Poole and Alan K. Mackworth, - Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
- Implement an application that stores big data in Hbase/MongoDB/Pig Using Hadoop
- https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
- https://onlinecourses.swayam2.ac.in/arp19_ap79/preview

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BDSC0702T: Optimization technique

UNIT I INTRODUCTION

(10 Lectures)

Statement of an optimization problem – classification of optimization problem – classical optimization techniques; Single variable optimizations, Multivariable optimization, equality constraint, inequality constraints, No constraints.

UNIT II LINEAR PROGRAMMING (16 Lectures)

Graphical method for two dimensional problems – central problems of Linear Programming – Definitions – Simplex – Algorithm – Phase I and II of simplex Method – Revised Simplex Method. Simplex Multipliers – Dual and Primal – Dual Simplex Method – Sensitivity Analysis – Transportation problem and its solution – Assignment problem and its solution – Assignment problem and its solution by Hungarian method – Karmarkar's method – statement, Conversion of the Linear Programming problem into the required form, Algorithm.

UNIT III NONLINEAR PROGRAMMING

(16 Lectures)

NONLINEAR PROGRAMMING (ONE DIMENSIONAL MINIMIZATION): Introduction –

Unrestricted search – Exhaustive search – interval halving method – Fibonacci method. NON LINEAR PROGRAMMING : (UNCONSTRAINED OPTIMIZATION): - Introduction

– Random search method – Univariate method – Pattern search methods – Hooke and Jeeves method, simplex method - Gradient of a function – steepest descent method – Conjugate gradient method. NON LINEAR PROGRAMMING – (CONSTRAINED OPTIMIZATION):

Introduction – Characteristics of the problem – Random search method – Conjugate gradient method.

UNIT IV DYNAMIC PROGRAMMING

(8 Lectures)

Introduction – multistage decision processes – Principles of optimality – Computation procedures.

UNIT V DECISION MAKING (10 Lectures)

Decisions under uncertainty, under certainty and under risk – Decision trees – Expected value of perfect information and imperfect information.

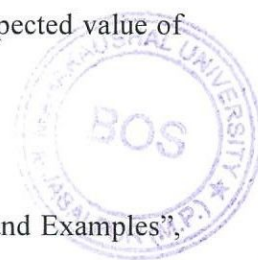
TEXT BOOKS:

1. Kalynamoy Deb, "Optimization for Engineering Design, Algorithms and Examples",

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Prentice Hall, 2012.

2.Hamdy A Taha, "Operations Research – An introduction", Pearson Education ,2017

REFERENCE BOOKS:

1.Hillier / Lieberman, "Introduction to Operations Research", Tata McGraw Hill Publishing company Ltd, 2002.

2.Singiresu S Rao, "Engineering optimization Theory and Practice", New Age International, 1996.

3.MikMisniewski, "Quantitative Methods for Decision makers", MacMillian Press Ltd., 1994.

4.Kambo N S, "Mathematical Programming Techniques", Affiliated East – West press, 1991.

BDSC0702P:Optimization technique LAB:-

- a. Data Collection and Preprocessing:
- b. Collect relevant data related to the supply chain network, including transportation costs, inventory levels, demand forecasts, and production capacities.
- c. Preprocess the data to ensure consistency and compatibility for optimization modeling.
- d. Network Modeling:
- e. Construct a mathematical model of the supply chain network, including nodes (e.g., suppliers, manufacturers, warehouses, retailers) and arcs representing transportation routes.
- f. Define decision variables, such as shipment quantities, production levels, and inventory levels, as well as constraints reflecting capacity limitations and demand requirements.
- g. Objective Function Formulation:
- h. Formulate an objective function that reflects the goals of the optimization problem, such as minimizing total transportation costs, inventory holding costs, or overall supply chain costs.
- i. Optimization Algorithm Selection:
- j. Select appropriate optimization algorithms or techniques based on the characteristics of the problem (e.g., linear programming, integer programming, mixed-integer programming, metaheuristic algorithms).
- k. Model Implementation:
- l. Implement the optimization model using a suitable optimization library or software tool (e.g., PuLP, Gurobi, CPLEX).
- m. Test the model with sample data to ensure correctness and functionality.
- n. Scenario Analysis:
- o. Conduct scenario analysis to evaluate the sensitivity of the solution to changes in parameters or assumptions (e.g., demand variability, transportation costs).
- p. Assess the robustness of the optimization solution under different scenarios.
- q. Performance Evaluation:
- r. Evaluate the performance of the optimized supply chain logistics solution in terms of cost savings, efficiency improvements, and service level enhancements.
- s. Compare the optimized solution with baseline scenarios or heuristic-based approaches.
- t. Documentation and Presentation:
- u. Document the optimization model, including formulation, assumptions, and solution methodology.
- v. Prepare a presentation summarizing the project objectives, methodology, findings, and recommendation

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BDSC0801T: Big Data Analytics Web technology

UNIT-I-INTRODUCTION TO BIG DATA

(10 Lectures)

Introduction to Big Data Platform – Challenges of Conventional Systems – Intelligent data analysis – Nature of Data-Analytic Processes and Tools – Analysis vs Reporting.

UNIT-II-MINING DATA STREAMS

(12 Lectures)

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.

UNIT-III HADOOP

(14 Lectures)

History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analysing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats-Map Reduce Features Hadoop environment.

UNIT-IV FRAMEWORKS

(12 Lectures)

Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere Big Insights and Streams.

UNIT-V PREDICTIVE ANALYTICS (12 Lectures)

Predictive Analytics-Simple linear regression-Multiple linear regression-Interpretation of regression coefficients. Visualizations-Visual data analysis techniques-interaction techniques - Systems and applications.

TEXT BOOK

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.

References:

1. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill Publishing, 2012.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge

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4. Data Stream with Advanced Analytics", John Wiley & Sons, 2012.
5. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.
6. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
8. Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", 2nd Edition, Elsevier, Reprinted 2008.

LIST OF EXPERIMENTS:-

1.(i) Perform setting up and installing Hadoop in its two operating modes:

Pseudo distributed

d, Fully distributed.

(ii) Use web-based tools to monitor your Hadoop setup.

2.(i) Implement the following file management tasks in Hadoop: Adding files and directories • Retrieving files • Deleting files

[ii] Benchmark and stress test an Apache Hadoop cluster

3. Run a basic WordCount MapReduce program to understand MapReduce Paradigm.

Find the number of occurrences of each word appearing in the input file(s)

Performing a MapReduce Job for word search count (look for specific keywords in a file)

4. Stop word elimination problem:

Input:

A large textual file containing one sentence per line

A small file containing a set of stop words (One stop word per line) Output:

A textual file containing the same sentences of the large input file without the words appearing in the small file.

5. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented. Data available at:

<https://github.com/tomwhite/hadoopbook/tree/master/input/ncdc/all>.

Find average, max and min temperature for each year in NCDC data set?

Filter the readings of a set based on value of the measurement, Output the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.

6. Purchases.txt Dataset

Instead of breaking the sales down by store, give us a sales breakdown by product category across all of our stores. What is the value of total sales for the following categories? Toys Consumer Electronics

Find the monetary value for the highest individual sale for each separate store. What are the values for the following stores? Reno Toledo Chandler

Find the total sales value across all the stores, and the total number of sales.

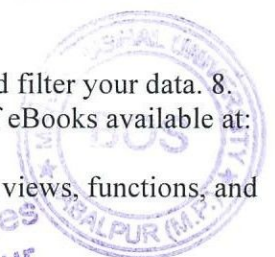
7. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data. 8.

Write a Pig Latin script for finding TF-IDF value for book dataset (A corpus of eBooks available at: Project Gutenberg)

9. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

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10. Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scala. 11. Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together.

Write a single Spark application that:

Transpose the original Amazon food dataset, obtaining a Pair RDD of the type: <USER_ID>(list of the product_ids reviewed by user_id)

Count the frequencies of all the pairs of products reviewed together;

Write on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.

References:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.

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BDSC0802T: Ethics and Human values

UNIT I HUMAN VALUES

(13 Lectures)

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS

(13 Lectures)

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AND SOCIAL EXPERIMENTATION

(10 Lectures)

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS (12 Lectures)

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk –

Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES

(12 Lectures)

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw-Hill, New Delhi, 2017.

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of

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India, New Delhi, 2004.

REFERENCE BOOKS:

- 1.Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
- 2.Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
- 3.John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

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Department Specific Elective

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BDSC0101D-T: Digital marketing analysis

UNIT1:DIGITALMEDIAANDANAL(10Lectures)

Digital media types – Owned and earned social metrics – Paid searches and Organic Searches - Aligning Digital and Traditional Analytics – Identifying social media listening tools – Understanding social media engagement software – Social media engagement tools.

UNIT2:TOOLS FORDIGITALANALYTICS(16Lectures)

Social Media Listening Tools - Evolution, Social analytics life cycle, Social media monitoring software: Sysomos, Radian6, Visible Technologies, Zoho social and others. Search Analytics Tools – Basics of search, Search analytics use cases, Search data, Google trends, YouTube trends, Google Adwords keyword, Yahoo clues, Collecting insights through search data.

Audience Analysis Tools – Audience Analysis Use Cases, Audience analysis tool types – Audience analysis Techniques, Event Triggers. Content Analysis Tools - Content Audits- Optimizing Content Distribution, Analysing Content Consumption. Engagement Analysis Tools – Social Media Engagement Software (SMES), using SMES, study of different SMES in the market.

UNIT 3: DIGITAL INFLUENCE AND LISTENING(14Lectures)

Reality of Digital Influence - Media List - Klout, PeerIndex - Online Versus Offline Influence - Using the Influencer List - Developing Social Media Listening Program - Using Listening Data for Program Planning - Implementing Listening Program - Conversation Audit - Online Influencers - Conducting Social brand benchmarking - Use of Online data for crisis anticipation - Identifying known issues - Crisis day monitoring and ongoing reporting - Corrections after crisis - Improving customer service – Social customer service conflict - Social customer service models.

UNIT 4: RESEARCH PLAN AND SEARCH ANALYSIS(10Lectures)

Launching new product – Product life cycle – Introduction Phase – Growth Phase – Maturity Phase.

Formulating research plan – Developing source list – Research methods – Constructing reports

Delivering reports – Report use cases – Building central repository of information – Search analytics for

digital strategy – Search analytics for content strategy and planning – Search analytics for paid advertising.

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UNIT 5: ROI, MOBILE ANALYTICS AND BUSINESS INTELLIGENCE(10Lectures)

Return on Investment (ROI) – Return on Engagement, Influence, Experience – Tracking ROI

Understanding measurement fundamentals – Measurement reporting cadence - Mobile Analytics –

Mobile market landscape – Mobile marketing measurement – Marketing activities – Audience/visitor

metric – Mobile app performance - Social CRM – Social CRM initiative – Social CRM Initiative –

Future of Digital Data – Business Intelligence.

TEXT BOOKS:

1.ChuckHemann and Ken Burbary, “Digital Marketing Analytics: Making Sense of Consumer Data in a Digital World”, Que Publishing, 2nd edition, 2018.

REFERENCE BOOKS:

- 1.SimonKingsnorth, “Digital Marketing Strategy: An Integrated ApproachMarketing”,KoganPagePublisher,Firstedition,ISBN-13:978-0749474706,2016.
- 2.DaveChaffey,FionaEllis-Chadwick,“DigitalMarketing–Strategy, Implementationand Practice”,PearsonEducation,Sixthedition,ISBN-13:978-1292077611,2016.

EBOOKS

1.EricEnge, Andy Crestodina, Larry Kim, Steve Rayson and Chad White, “How the Pros TurnMarketing Analytics Into Effective Marketing Strategies”, Alexa, An Amazon Company.<https://blog.alexa.com/wp-content/uploads/2016/12/How-to-Pros-Turn-Marketing-Analytics-into-Effective-Marketing-Strategies-ebook.pdf>

MOOC

1.<https://www.coursera.org/learn/marketing-analytic>

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BDSC0102D-T: CLOUD SERVICES FOR IOT

Unit I CLOUD PLATFORM ARCHITECTURE AND SERVICES (14 Lectures)

Cloud computing and service models: Public, Private and Hybrid clouds-Infrastructure as a service(IaaS)-Platform as a service(PaaS)-Software as a service(SaaS)-Architectural design of compute and storage clouds: Layered cloud architectural development-Architectural design challenges- Public cloud platforms: GAE, AWS and Azure

Unit II PROGRAMMING IOT DEVICES FOR CLOUD INTERFACE (12 Lectures)

Basics of Sensors and actuators – examples and working principles of sensors and actuators – Cloud computing and IOT – Arduino/Equivalent Microcontroller platform. IoT Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – Wired Communication.

Unit III CLOUD PLATFORMS FOR IOT (10 Lectures)

Thingspeak IoT Cloud Platform, Kaa Open Source IoT Cloud Platform, AWS IoT Cloud Platform – AWS IoT Device SDK. Arduino AWS IoT development. Raspberry Pi 3-AWS IoT development.

Unit IV CLOUD SERVICES FOR IOT (12 Lectures)

Service Management in Cloud Computing - Service Level Agreements (SLAs), Managing IoT Data – Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing.

Unit V SECURITY AND APPLICATIONS (12 Lectures)

Application Safety and Service Vulnerability in Cloud Network- IoT Security and Privacy Preservation- Security and Challenges in Mobile Cloud Computing-The vital role of Fog computing in Internet of Things.

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TEXT BOOKS:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From parallel processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", McGraw-Hill Education Pvt. Ltd., 2018.
3. Charalampos Doukas, "Building Internet of Things with the Arduino", Create Space, April 2002.
4. Agus Kurniawan "Learning AWS IoT" Packt Publishing (January 29, 2018)

REFERENCE BOOKS:-

1. Dac-Nhuong Le, Chintan Bhatt, Mani Madhukar "Security Designs for the Cloud, IoT, and Social Networking" John Wiley & Sons (11 October 2019)
2. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2013.
3. Marco Schwatz, "Internet of Things with Arduino Cookbook", Packt Publications, 2016.
4. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, 2013.
5. Nick Antonopoulos and Lee Gillam, "Cloud Computing: Principles, Systems and Applications", Second Edition, Springer, 2017.

Extensive Reading:

1. <https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/>
2. <https://aws.amazon.com/iot/>
3. <http://postscapes.com/projects>
4. <http://www.theinternetofthings.eu/what-is-the-internet-of-things>
5. <https://www.theinternetofthings.eu/digital-world-iot>
6. <https://cloud.google.com/solutions/iot>
7. https://swayam.gov.in/nd1_noc20_cs20

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BDSC0103D-T: Augmented reality & virtual reality

UNIT I INTRODUCTION (14Lectures)

The three I's of virtual reality-commercial VR technology and the five classic components of aVR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays&haptic feedback.

UNIT II VR DEVELOPMENT PROCESS(8Lectures)

Geometric modeling - kinematics modeling- physical modeling - behaviour modeling - model Management.

UNIT III CONTENT CREATION CONSIDERATIONS FOR VR(10Lectures)

Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment.

UNIT IV VR ON THE WEB & VR ON THE MOBILE(16Lectures)

JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)- frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics.

UNIT V APPLICATIONS (12Lectures)

Medical applications-military applications-robotics applications- Advanced Real time Tracking other applications- games, movies, simulations, therapy.

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TEXT BOOKS:

- 1.C. Burdea& Philippe Coiffet, "Virtual Reality Technology", Second Edition, Gregory, John Wiley & Sons, Inc.,2008
2. Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA.

REFERENCE BOOKS:

- 1.Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg& Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575
- 2.Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability),Steve Aukstakalnis, Addison-Wesley Professional; 1 edition, 2016.
- 3.The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything, Robert Scoble&Shel Israel, Patrick Brewster Press; 1 edition, 2016.
- 4.Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, Tony Parisi, O'Reilly Media; 1 edition, 2015.
5. Programming3DApplicationswithHTML5andWebGL:3DAnimationandVisualizationforWebPages, TonyParisi,O'ReillyMedia;1edition,2014.
6. LearningThree.js:TheJavaScript3DLibraryforWebGL-SecondEdition,JosDirksen,PacktPublishing-ebooksAccount;2ndReviseded.Edition2015.

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BDSC0104D-T: Image processing and Analysis

UNIT I IMAGE PROCESSING FUNDAMENTALS (12 Lectures)

Introduction – Elements of visual perception, Steps in Image Processing Systems– Digital Imaging

System - Image Acquisition – Sampling and Quantization – Pixel Relationships – File Formats – colour images and models - Image Operations – Arithmetic, logical, statistical and spatial operations.

UNIT II IMAGE ENHANCEMENT AND RESTORATION (12 Lectures)

Image Transforms - Discrete and Fast Fourier Transform and Discrete Cosine Transform, Spatial Domain - Gray level Transformations Histogram Processing Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – Smoothing and Sharpening filters– Homomorphic Filtering., Noise models, Constrained and Unconstrained restoration models.

UNIT III IMAGE SEGMENTATION AND MORPHOLOGY

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation, Image Morphology: Binary and Gray level morphology operations - Erosion, Dilation, Opening and Closing Operations Distance Transforms- Basic morphological Algorithms. Features – Textures - Boundary representations and Descriptions- Component Labeling – Regional descriptors and Feature Selection Techniques.

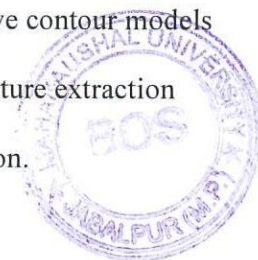
UNIT IV IMAGE ANALYSIS AND CLASSIFICATION (12 Lectures)

Image segmentation- pixel based, edge based, region based segmentation. Active contour models and Level sets for medical image segmentation, Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and statistical image classification.

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UNIT V IMAGE REGISTRATION AND VISUALIZATION (12 Lectures)

Rigid body visualization, Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration, Image visualization – 2D display methods, 3D display methods, virtual reality based interactive visualization.

REFERENCES:

1. Alasdair McAndrew, —Introduction to Digital Image Processing with Matlab, Cengage Learning 2011, India
2. Anil J Jain, —Fundamentals of Digital Image Processing, PHI, 2006.
3. Kavyan Najarian and Robert Splanter, —Biomedical signals and Image processing, CRC – Taylor and Francis, New York, 2006
4. Rafael C. Gonzalez and Richard E. Woods, —Digital Image Processing, Third Edition, Pearson Education, 2008, New Delhi
5. S. Sridhar, —Digital Image Processing, Oxford University Press, 2011.

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BDSC0105D-T: Text Analytics

UNIT1:INTRODUCTION(12Lectures)

Introduction toNLP,RegularExpressions,Words,Corpora,TextNormalization,MinimumEditdistance,NgramLanguageModels,EvaluatingLanguageModels

UNIT2:SYNTACTICANALYSIS(14Lectures)

English Word Classes, The Penn Treebank Part-of-Speech Tagset, Part-of-Speech Tagging,HMMPart-of-SpeechTagging,MaximumEntropyMarkovModels,GrammarRulesforEnglish,Treebanks,GrammarEquivalenceandNormalform,LexicalizedGrammar.

UNIT3:SEMANTICANALYSIS(14Lectures)

Representation of Sentence Meaning: Computational Desiderata for Representations, Model-TheoreticSemantics,First-OrderLogic,EventandStateRepresentations,DescriptionLogics,Semanticroles,Semanticrolelabeling.

UNIT4: SEQUENCEPARSINGWITHRECURRENTNETWORKS(14Lectures)

Simple Recurrent Networks, Applications of RNNs, DeepNetworks:StackedandBidirectional RNNs, Managing Context in RNNs: LSTMs and GRUs, Words, Characters andByte-Pairs.

UNIT5:CASESTUDY (12Lectures)(6Lectures)

Introduction to Case Study Analysis, Problem Identification & Data Analysis,Developing Solutions & Recommendations, Presentations & Final Case Study Report.

TEXTBOOKS

1.DanJurafsky andJamesH.Martin.SpeechandLanguageProcessing(3rded.draft),2019.

REFERENCEBOOKS

1.Steven Bird, Ewan Klein, and Edward Loper, Natural Language Processing with Python,FirstEdition,O'reilly,2009

2.Yoav Goldberg, University of Toronto, Neural Network Methods for Natural languageProcessing,Morgan&Claypool,2017.

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BDSC0106D-T: Cyber forensic analytics

UNIT1:CYBER CRIME(6Lectures)

CyberSpace–CyberCrime–CriminalBehaviour–JurisdictionalConcerns-JurisprudentialInconsistency –
eCash Security – Prepaid Cards – Stored Values Cards – Mobile Payments – InternetPaymentServices-
Cyberstalking–Cyberextortion–Cyberterrorism–Cyberwarfare–Cyberweapons
-ATMfrauds–Phreaking–InternetGambling.

UNIT2:CYBERFORENSICS(6Lectures)

Digital device–Harddisk–Diskcharacteristics-Diskimaging-DataCarving–Techniques–commercialpiracy-
softlifting–Steganography–Networkcomponents-Portscans-Wireshark–pcap.
analysis - Trojans and Backdoors – Botnets - DoS – DDoS Attacks - Honey Pots – Malware – Virus and
Worms.

UNIT 3: CYBER INVESTIGATION(6Lectures)

Concepts of Investigation - cyber investigation, Network Investigation - Investigating audit logs -
Investigating Web attacks - Investigating Computer Intrusions - Profiling – Cyber Criminal profiling –
Stylometric Techniques – Warranted searches – Warrantless searches – Undercover Techniques

UNIT 4: EVIDENCE MANAGEMENT (6Lectures)

Evidence – Digital Evidence - Types – physical evidence – Real evidence – Circumstantial evidence –
network evidence - Evidence collection – Evidence Analysis - Contextual Information –Evidence
Management – pre search activities – On Scene activities – Report Preparations

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UNIT 5: CYBER LAWS AND AUTHORITIES (6Lectures)

Information Technology Act 2000 – Digital signature - Electronic Governance - Secure electronic records - Regulation of certifying authorities – CERNTin - Electronic signature certificates – Penalties compensation - Future Trends and Emerging Concerns.

TEXT BOOKS:

1. Marjie T. Britz, "Computer Forensics and Cyber Crime", Pearson, 2013.
2. Garima Tiwari, "Understanding Laws– Cyber Laws And Cyber Crimes", Lexis Nexis, 2014.

REFERENCE BOOKS:

1. Chuck Easttom, Jeff Taylor, "Computer Crime, Investigation, and the Law", Course Technology, 2018.
2. Eoghan Casey, "Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet", Eoghan Casey, 2018.

E-BOOK

- 1 <http://index-of.es/Miscellaneous/LIVRES/Syngress.Cyber.May.2014.ISBN.0128007435.pdf>
2. <http://index-of.es/Miscellaneous/LIVRES/Syngress.Cyber.May.2014.ISBN.0128007435.pdf>

MOOC

1. <https://www.coursera.org/lecture/cyber-conflicts/introduction-to-cybercrime-and-fundamentalissues-xndSq>.

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BDSC0107D-T: AI and Data Science in Finance

Unit 1: Introduction to AI and Data Science in Finance

- Overview of AI and Data Science in Finance
- Role of AI in Financial Services:
 - Algorithmic Trading
 - Risk Management
 - Fraud Detection
 - Portfolio Optimization
- Types of Financial Data:
 - Market Data (Stock Prices, Forex, Bonds)
 - Fundamental Data (Company Earnings, Economic Indicators)
 - Alternative Data (News Sentiment, Social Media, Web Scraping)
- Data Sources: Bloomberg, Quandl, Yahoo Finance, Alpha Vantage

Unit 2: Financial Data Processing and Feature Engineering

- Data Cleaning and Preprocessing for Financial Applications
- Handling Missing Data and Outliers in Financial Datasets
- Feature Engineering for Financial Models:
 - Moving Averages (SMA, EMA)
 - Bollinger Bands
 - Volatility Indicators (ATR, Standard Deviation)
- Time Series Analysis and Stationarity
- Feature Selection Techniques

Unit 3: Machine Learning for Financial Forecasting

- Overview of ML Models in Finance:
 - Regression (Linear, Ridge, Lasso)
 - Classification (Random Forest, XGBoost)
 - Time Series Forecasting (ARIMA, LSTM, Prophet)
- Sentiment Analysis for Market Prediction
- Risk Prediction and Credit Scoring using ML
- Model Evaluation Metrics (MSE, RMSE, Sharpe Ratio)

Unit 4: AI in Algorithmic Trading and Portfolio Management

- Basics of Algorithmic Trading
- Building Trading Strategies using Machine Learning
- Reinforcement Learning for Trading Bots
- Portfolio Optimization:
 - Modern Portfolio Theory (MPT)
 - Efficient Frontier Calculation
 - Risk-Adjusted Returns (Sharpe & Sortino Ratios)
- AI-based Risk Management

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Unit 5: Fraud Detection, Risk Management, and AI Ethics

- Fraud Detection using AI:
 - Anomaly Detection in Transactions
 - Pattern Recognition for Fraudulent Activities
- AI in Risk Management:
 - Credit Risk Modeling
 - Stress Testing and Scenario Analysis
- Ethics and Regulations in AI for Finance
- Explainability and Interpretability of AI Models (SHAP, LIME)

Recommended Books & Resources:

1. "Machine Learning for Asset Managers" – Marcos López de Prado
2. "Advances in Financial Machine Learning" – Marcos López de Prado
3. "Python for Finance" – Yves Hilpisch
4. Kaggle Datasets & Research Papers on Financial AI

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BDSC0108D-T: High Dimensional Data Analysis

UNIT1: CLASSICALMETHODS(8Lectures)

Classical method- Multi variant and High dimensional problems – Visualization – Multi variant Randomvectoranddata-Multidimensionaldata

UNIT2: DISCRIMINANTANALYSIS(16Lectures)

Visualizing principal component analysis – Properties of principal component - Standardized data andhighdimensionaldata-Asymptoticresults-Numberofcomponentsandregression– Canonicalcorrelationanalysis-Population-sampleandpropertiesofcanonicalcorrelation,Asymptotic consideration-Canonicalcorrelationandregression.

UNIT 3: FACTORS AND GROUPING(16Lectures)

Norms proximities, features, and dualities - Vectors and matrix norms, measure of proximity – Features and feature maps, dualities of X and X Transpose - Cluster analysis - Hierarchal agglomerative clusters - 3k means clustering, -Principal component and cluster analysis- Factor Analysis, population k factor model - Sample k factor model - Multidimensional scaling, classical scaling, metric scaling and nonmetric scaling.

UNIT 4:NON-GUASSIAN ANALYSIS(10Lectures)

Factor Analysis - Population k factor model – Sample k factor model - Multidimensional scaling – Towards non Gaussianity - Independent component Analysis -Projection pursuit -Kernal and more independent component methods.

UNIT 5: FEATURE SELECTION(10Lectures)

Introduction-Independent component and feature selection -Variable Ranking and statistical learning - Sparse principle component analysis – Consistency of principle component analysis as dimension grows.

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TEXT BOOKS:

1. Inge Koch , Analysis of Multivariate and High-Dimensional Data”, Cambridge University Press, 2014.

REFERENCE BOOKS:

1. Fatemeh Emdad, Seyed Zekavat , “High Dimensional Data Analysis: Overview, Analysis, and Applications, VDM Verlag, 2008

E-BOOK

1 <https://www.cambridge.org/core/books/analysis-of-multivariate-and-highdimensionaldata/2BF8DE949E18E3A68001976784087816>

MOOC

1. <https://www.edx.org/course/high-dimensional-data-analysis>.

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BDSC0101SB-T: Internet of Things

Unit-I

(10Lectures)

Introduction – Definition and Characteristics of IoT, Physical Design of IoT; Things in IOT, Logical Design of IoT; IoT Functional Blocks, IoT Communication APIs, IoT Enabling Technologies; WSN, Cloud Computing, Big Data Analysis, Communication Protocols, Embedded Systems.

Unit-II (10Lectures)

(14Lectures) IoT Hardware, Devices and Platforms – Basics of Arduino Hardware, The Arduino IDE, Basic Arduino Programming, Basics of Raspberry pi; Introduction to Raspberry pi, Programming with Raspberry pi, C DAC IoT devices: Ubimote, WiFimote, BLE Mote, WINGZ gateway, Introduction to IoT Platforms, IoT Sensors and actuators.

Unit-III(14Lectures)

IoT Protocols – IoT Data link Protocols, Network Layer Routing Protocols, Network Layer Encapsulation Protocols, Session Layer Protocols, IoT Security Protocols, Service Discovery Protocols, Infrastructure Protocols.

Unit-IV(12Lectures)

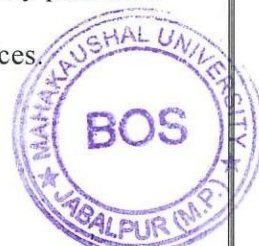
IoT Programming – Arduino Programming: Serial Communications – Getting Input from Sensors, Visual, Physical and Audio Outputs,

Remotely Controlling External Devices, Wireless Communication, Programming with Raspberry pi: Basics of python Programming, Python Packages of IoT, IoT Programming with CADC IoT devices.

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Unit-V(10Lectures)

Domain Specific IoT – Home automation, smart cities, Smart Environment, IoT in Energy, Logistics, Agriculture, industry and Health & Lifestyle sensors, Case Studies: A Case Study of Internet of Things Using Wireless Sensor Networks and Smart Phones, Security Analysis of Internet-of-Things: A Case Study of August Smart Lock, Open IoT Platform

Reference Books:

- Vijay Madiseti and Arshdeep Bahga, —Internet of Things (A Hands-on Approach) I, 1st Edition, VPT, 2014.
- Margolis, Michael. —Arduino Cookbook: Recipes to begin, Expand and Enhance Your Projects I. O'Reilly Media Inc. 2011.
- Monk, Simon. Raspberry Pi Cookbook: Software and hardware problems and Solutions. O'Reilly Media, Inc. 2016.
- https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
- https://onlinecourses.swayam2.ac.in/arp19_ap79/preview

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BDSC0102SB-T: Ethical Hacking

Unit-I(14Lectures)

Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Footprinting – Information Gathering Methodology – Footprinting Tools – WHOIS Tools – DNS Information Tools – Locating the Network Range – Meta Search Engines.

Unit-II(10Lectures)

Introduction to Scanning – Objectives – Scanning Methodology – Tools Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools.

Unit-III(14Lectures)

Introduction – Cracking Passwords – Password Cracking Websites – Password Guessing – Password Cracking Tools – Password Cracking Countermeasures – Escalating Privileges – Executing Applications – Keyloggers and Spyware.

Unit-IV

(12Lectures)

Programming Fundamentals – C language – HTML – Perl – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures – Linux OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures.

Unit-V(10Lectures)

Introduction – Security Assessments – Types of Penetration Testing – Phases of Penetration Testing – Tools – Choosing Different Types of Pen-Test Tools – Penetration Testing Tools.

Reference Books:

- ECCouncil, — Ethical Hacking and Countermeasures: Attack Phases I, Cengage Learning, 2010.
- Jon Erickson, — Hacking, 2nd Edition: The Art of Exploitation I, No Starch Press Inc., 2008.

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- Michael T. Simpson, Kent Backman, James E. Corley, —Hands-On Ethical Hacking and Network Defense, Cengage Learning, 2013.
- Patrick Engebretson, —The Basics of Hacking and Penetration Testing—Ethical Hacking and Penetration Testing Made Easy, Second Edition, Elsevier, 2013.
- Rafay Boloch, —Ethical Hacking and Penetration Testing Guide, CRC Press, 2014
- https://onlinecourses.swayam2.ac.in/aic20_sp06/preview

https://onlinecourses.swayam2.ac.in/arp19_ap79/preview

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BDSC0103SB-T: Predictive modeling analysis

UNIT I: DATA PREPARATION (16 Lectures)

Introduction–Predictive Analytics in the Wild–Exploring Data types and associated Techniques - Complexities of data - Applying Models: Models and simulation,

Categorizing Models, Describing, summarizing data, and decisions–

Identify similarities in Data: Data Clustering, converting Raw Data into a Matrix, Identify K-groups in Data

UNIT II: DATA CLASSIFICATION–PART I (11 Lectures)

Background–Exploring Data classification process-Using Data Classification to predict the future: Decision tree, Algorithm for generating Decision Trees, Support Vector Machine.

UNIT III: DATA CLASSIFICATION – PART II (11 Lectures)

Ensemble Methods to Boost Prediction Accuracy: Naive Bayes Classification Algorithm, The Markov Model, Linear Regression, Neural Networks – Deep learning.

UNIT IV: DATA PREDICTION (11 Lectures)

Adopt predictive analytics - Processing data: identifying, cleaning, generating, reducing dimensionality of data – Structuring Data – Build predictive model: develop and test the model.

UNIT V: DATA VISUALIZATION (11 Lectures)

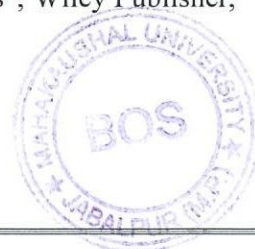
Introduction to visualization tool – Evaluate the data – visualize Model's Analytical Results: hidden grouping, data classification results, outliers, decision trees, prediction – Novel visualization in Predictive Analytics.

TEXT BOOKS

1. Anasse Bari, Mohamed Chaouchi, Tommy Jung, “Predictive Analytics For Dummies”, Wiley Publisher, 2nd Edition, 2016.

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REFERENCE BOOKS

1. Bertt Lantz, Machine Learning with R: Expert techniques for predictive modeling to solve all your data analysis problems, Pack Publisher, 2nd Edition, 2015.
2. Aurelien, "Hands-On Machine Learning with Scikit-Learn & TensorFlow", O'Reilly Publisher, 5th Edition, 2017.
3. Max Kuhn, Kjell Johnson, "Applied Predictive Modeling" Springer, 2013.

E BOOKS

1. https://vuquangnguyen2016.files.wordpress.com/2018/03/applied-predictive-modeling-maxkuhn-kjell-johnson_1518.pdf
2. https://www.researchgate.net/publication/329873035_Prediction_Modeling_Methodology
3. <https://www.memsql.com/releases/oreilly-predictive-analytics/>

MOOC

1. <https://www.coursera.org/learn/predictive-modeling-analytics>
2. <https://www.edx.org/course/predictive-analytics>.

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Unit 1: Introduction to NLP and Text Preprocessing:-Overview of NLP: definition, applications, and challenges,Text preprocessing: tokenization, stemming,lemmatization,stopwordremoval,normalization.

Unit 2: Language Modeling and Text Representation:-Language modeling: n-gram models, probabilistic language models,Text representation: bag-of-words model, TF-IDF, word embeddings (Word2Vec, GloVe).

Unit 3: Syntax and Parsing:-Syntax analysis: context-free grammars, parse trees, constituency vs. dependency parsing,Parsing techniques: top-down parsing, bottom-up parsing, shift-reduce parsing.

Unit 4: Named Entity Recognition and Part-of-Speech Tagging:-

Named Entity Recognition (NER): approaches, features, evaluation, Part-of-Speech (POS) tagging: POS tagging algorithms (e.g., Hidden Markov Models, Conditional Random Fields), evaluation metrics.

Unit 5: Sentiment Analysis and Machine Translation:-Sentiment analysis: approaches (lexicon-based, machine learning-based), sentiment lexicons, evaluation metrics, Machine translation: statistical machine translation, neural machine translation, evaluation methods.

Recommended Book:

"Speech and Language Processing" by Daniel Jurafsky and James H. Martin. This book offers comprehensive coverage of NLP concepts, techniques, and algorithms. It's widely used in academia and provides a good balance between theoretical foundations and practical applications in NLP. Additionally,"Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper is a practical guide that focuses on implementing NLP techniques using the Python programming language, making it a valuable supplementary resource for hands-on learning.

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BDSC0104SB-T :Data Manipulation and Cleaning

UNIT1:Introduction to Data and Its Challenges

Understanding Structured vs. Unstructured Data,Importance of Data Cleaning in Machine Learning & Analytics, Common Data Issues: Missing, Duplicate, Inconsistent, and Outlier Data, Overview of Data Manipulation Libraries (Pandas, NumPy, SQL).

UNIT2: Handling Missing and Duplicate Data

Strategies for Handling Missing Data:Removal (`dropna()`), Imputation (Mean, Median, Mode, Forward/Backward Fill, KNN), Identifying and Removing Duplicates (`drop_duplicates()`), Dealing with Inconsistent Data Formats (Date/Time, String Cleanup).

UNIT 3:Data Transformation and Standardization

Feature Scaling (Normalization vs. Standardization), Encoding Categorical Data: One-Hot Encoding, Label Encoding. Handling Outliers:Z-score Method, IQR Method, Winsorization, Data Type Conversions (String to Numeric, Date Parsing).

UNIT4:Data Cleaning Automation and Feature Engineering

Automating Data Cleaning Pipelines with Python,Text Cleaning: Removing Special Characters, Stopwords, Tokenization,Feature Engineering Techniques:Creating New Features, Feature Selection Methods,Binning and Transformation. Using `sklearn.preprocessing` for Feature Scaling & Encoding

UNIT5: Advanced Data Manipulation with SQL and Big Data Tools

SQL for Data Cleaning:Handling NULL Values, Joins &Aggregations,Working with Large Datasets:Dask for Big Data Processing, Spark DataFrames for Scalable Data Cleaning, Performance Optimization in Data Processing.

Recommended Books & Resources:

1. "Python for Data Analysis" – Wes McKinney (Pandas Creator)
2. "Data Wrangling with Pandas, NumPy, and SQL" – T. Eckhart
3. Kaggle& Google Dataset Search for practice datasets

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Open Elective Compulsory

Course/Generic Elective Compulsory

Course

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OECC0101-T: Fundamental of Computer

UNIT I

Brief History of Development of Computers, Computer System Concept, Computer System

Characteristics, Capabilities and Limitations, Types of Computers-., Personal Computer (PCs) - IBM PCs, Types of PCs- Desktop, Laptop, Notebook, Palmtop, etc. Basic Components of a Computer System- Control Unit, ALU, Input/Output semiconductor Memory. Storage fundamentals - Primary Vs Secondary memory.

UNIT II

Input Devices : Keyboard, Mouse, Joystick, Scanners, Digital Camera, MICR, OCR, OMR, , Light pen, TouchScreen. Output Devices Monitors - Characteristics and types of monitor, Size, Resolution, Refresh Rate, Dot Pitch, Video Standard - VGA, SVGA, XGA etc. Printers - Daisy wheel, Dot Matrix, Inkjet, Laser. Plotter, Sound Card and. Speakers.

UNIT III

Various Storage Devices - Magnetic Disks, Hard Disk Drives, Floppy, Disks, Optical Disks, Computer Software, Need, Types of Software's - System software, Application software System Software - Operating System, compiler, Assemblers, Interpreter .

UNIT IV

Operating Systems – Functions , Types- Batch, Single, Multiprogramming, Multiprocessing Programming languages- Machine, Assembly, High Level, 4GL, Application Software - Word-processing, Spreadsheet, Presentation Graphics, Data Base Management Software, Number System, Number System of computers- Binary, Octal, Hexadecimal, their conversion. Coding System – ASCII, EBCDIC.

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UNIT V

Direction of Transmissions Flow-Simplex, Half Duplex Full Duplex, Types of Network - LAN, WAN, MAN etc. Topologies of LAN- Ring, Bus, Star, Mesh and Tree topologies. Computer Virus: Virus working principals, Types of viruses, Virus detection and Prevention Viruses on network.

TEXT & REFERENCE BOOKS :

COMPUTERS TODAY BY S.K. BASANDRA, GALGOTIA PUBLICATIONS.

FUNDAMENTALS OF INFORMATION TECHNOLOGY BY ALEXIS LEON & MATHEWS LEON,
VIKAS PUBLISHING HOUSE, NEW DELHI.

DOS QUICK REFERENCE BY RAJEEV MATHUR, GALGOTIA PUBLICATIONS.

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