Statistical Computing With R Programming (BHCS-301) (6hrs per week)

Unit I
What is R Programming Language? Introduction & Basics, How to Download & Install R, RStudio, Anaconda on Mac or Windows, Difference:Rvs Python, Difference: SAS vs R:,R Data Types, Arithmetic & Logical Operators with Example.

Unit II
IF, ELSE, ELSE IF Statement in R, For Loop in R with Examples for List and Matrix, While Loop in R with Example, apply(), lapply(), sapply(), tapply() Function in R with Examples, Import Data into R: Read CSV, Excel, SPSS, Stata, SAS Files, and Exporting Data to Excel, CSV, SAS, STATA, Text File, R Matrix: Create, Print, Add Column, Slice, Factor in R: Categorical & Continuous Variables.

Unit III
R Data Frame: Create, Append, Select, Subset, List in R: Create, Select Elements with Example, R Sort a Data Frame using Order(),Data Manipulation(Join) & Cleaning(Spread), Merge Data Frames in R: Full and Partial Match, Functions in R Programming (with Example), How to Replace Missing Values(NA) in R using na.omit& na.rm, , Scatter Plot in R using ggplot2 (with Example), Boxplot in R (with Example), Bar Chart & Histogram in R (with Example).

Unit IV
Statistics: Definition and Scope, Concepts of Statistical Population and Sample,Data: Quantitative and Qualitative, Scales of Measurement: Nominal, Ordinal, Interval and Ratio. Frequency Distribution.Presentation: Tabular and Graphical including Histogram.

Unit V
Measures of Central Tendency: Mean, Median, Mode. Measures of Dispersion: Range, Mean Deviation, Standard Deviation, Coefficient of Variation,Correlation and Rank Correlation, Regression Analysis: Linear and Non -linear regression, Multiple Regression.

Recommended Text and Reference Books:

1. "R for Data Analysis in easy steps", Author: McGrath Mike, Publisher: BPB,2nd Edition.
2. "R for Everyone - Advanced Analytics and Graphics", Author: Jared P. Lander, Publisher: Pearson, 2nd Edition.

3. "Beginning R: The Statistical Programming Language", Author: Dr. Mark Gardener, Publisher: Wiley India Pvt. Ltd, 1st Edition.
4. "Statistical Methods", Author: Gupta S. P., Publisher: Sultan and Sons,4th Edition.

DBMS and SQL/ PLSQL (BHCS-302)   (6hrs per week)

Unit I
Introduction of Database: Overview of a Database Management System, File Processing and DBMS, Data/Information/Knowledge, Needs and Benefits of Database System, Database User/Administrator, Data Models/ Schema/ Instances, Architecture of DBMS, Data Independence.

Unit II
The Relational Data Model: Basic concepts of ER Model, Elements and Components of the E/R Data Model-Design, Describe Basic Constructs of E-R Modelling, Describe Developing the Basic Schema, Constraints, Weak Entity Sets, Design of Relational Database Schemas.

Unit III
SQL: SQL, Simple Queries in SQL, Query Execution, DDL, DML, TCL and Sub Queries, Full-Relation Operations-Database Modifications, Tuples and Views, Constraints and Attributes, Keys (Super, Primary, Unique, Alternate, Candidate, Composite/Compound Key, Foreign Key).

Unit IV
PL/SQL- Environment, Syntax, Data Types, Variables, Constant, Operators, Conditions, Loops, Strings, Array, Literals, Procedures, Functions, Triggers, Cursor.

Unit V
Normalization, Concurrency Control, Deadlocks: First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Lossless Join Decomposition, Concurrency Control, Locking Systems with Several Lock Modes and Timestamps, Transaction Management, Deadlocks-Distributed Databases: Commit and Lock.

Recommended Text and Reference Books:

1. "Database System Concepts", Author: Silberschatz, H. Korth and Sudarshan S., Publisher:McGraw-Hill International, 6th Edition.

2. "Fundamentals of Database Systems",Author:Elmasri R. and ShamakantB.Navathe, ,Publisher: AddisionWesley, 6th Edition.

3. "Database Systems: The Complete Book", Author:Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, Publisher: Pearson Education, 2nd Edition.
.
 4. "An Introduction to Database Systems", Author: Bipin C. Desai, Publisher:West Publishing Company, 4th Edition.

Mathematics III (CBOT) (BHCS-303) (6hrs per week)

Unit I
Basics ofOperations Research (OR): Characteristics ofOR –Importance ofOR in Industry – OR and Decision Making –Role of Computers in OR.

Unit II
Algebraic solution: Simplex Method: Artificial variable method, Two Phase method, Charne's Big –M method, Duality, Dual Simplex method, Graphical Method.

Unit III
Transportation Model: Definition –Formulation and Solution of Transportation Models – Initial Basic Feasible Solution by the Methods of North West Corner, the Row Minima, Column –Minima, Matrix Minima and Vogel's Approximation Method – Assignment Problem by Hungarian Method.Optimal Solutions.

Unit IV
PERT and CPM: Arrow Networks – Time Estimates – Earliest Expected Time, Latest Allowable Occurrence Time and Slack – Critical Path – Probability of Meeting Scheduled Date of Completion of Project –Operation Time Cost Trade off Curve-Project Time Cost Trade off Curve-Selection of Schedule Based on Cost Analysis.

Unit V
Theory of Games: Characteristics–Pure Strategies –Saddle Point –Value of the Game –Mixed Strategies –Rules of Dominance –Two Persons Zero Sum Game –Graphical Solutions of 2 X M andN X 2 Game (Excluding LPP) –Limitations.Introduction to Queuing Theory.

Recommended Text and Reference Books:
1. "Operation Research", Publisher:Sharma S.D. Publisher:Kedar Nath Ram Nath, 18th Edition,2017.
2. "Operation Research" Author: Kapoor V.K,Publisher:Sultan Chand and Sons,New Delhi, 5thRevised Edition, 2017.

3. "Operations Research". Author: Kanti Swarup, Gupta P.K. and Man Mohan, Publisher: Sultan Chand&Sons. New Delhi,5th Revised Edition, 2017.
4. "Optimization Methods in Operations Research and System Analysis" Author: Mittal, K.V., Publisher: New Age International (P) Ltd, New Delhi, 5th Edition 2020.

Operating System (BHCS-304) (6hrs per week)

Unit I
Introduction and Operating-Systems Structures: Definition of Operating System, Role of Operating System, OperatingSystem Operations, Functions of Operating System, Various Computing Environments.
Types of Operating Systems – MultiProgramming Batch, Time Sharing, Single User and Multiuser, Process Control & Real Time Systems.
Operating-System Structures: Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, Operating-System Structure.

Unit II
Processes: Process Concept, Operations on Processes, Interprocess Communication, Threads: Overview, Multicore Programming, Multithreading Models
Process Synchronization: General Structure of a Typical Process, Race Condition, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors.

Unit III
CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Strategy: Non-pre-emptive and Pre-emptive Strategies, Scheduling Algorithms.
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Unit IV
Main Memory: Background, Logical address space, Physical address space, MMU, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.
Virtual Memory: Background, Demand Paging, Page Replacement, Allocation of Frames, Thrashing.
Mass-Storage Structure: Overview, Disk Structure, Disk Scheduling, Disk Management
File-System Interface: File Concept, Access Methods, Directory and Disk Structure, File-System Structure, Allocation Methods, Free-Space Management.

Unit V
Case study of various Operating Systems, Windows, XP, UNIX/LINUX

Recommended Text and Reference Books:
1. "Operating System Concepts", Author: Abraham Silberschatz, Peter Galvin, Greg Gagne, Publisher:Wiley, 8th Edition.
2. "Operating Systems",Author: Achyut S. Godbole, Atul Kahate, Publisher:Tata McGraw Hill, 3rd Edition.

3. "Principles of Operating Systems", Author: Naresh Chauhan, Publisher: Oxford Press, 4th Edition.
4. "Modern Operating Systems", Author: Andrew S Tanenbaum,Herbert Bos, Punblisher: Pearson Education, 4th Edition.
5. "Introduction to Unix and Shell Programming ",Author: M.G. Venkateshmurthy, Publisher: Pearson,3rd Edition.

R Programming Lab (BHCS-351)(4hrs per week)

1. Program to take input from the user (name and age) and display the values. Also print the version of R installation
2. Program to create a sequence of numbers from 20 to 50 and find the mean of numbers from 20 to 60 and sum of numbers from 51 to 91
3. Program to get the first 10 Fibonacci numbers.
4. Program to extract first 10 Englishletter in lower case and last 10 5-letters in upper case and extract letters between 22nd to 24th letters in upper case
5. Program to find the factors of a given number
6. Program to find the maximum and the minimum value of a given vector
7. Programto get the unique elements of a given string and unique numbers of vector.
8. 8Programto create a 5 x 4 matrix, 3 x 3 matrix with labels and fill the matrix by rows and 2×2 matrix with labels and fill the matrix by columns
9. Programto create a simple bar plot of five subjects' marks.
10. Programto create a Data Frames which contain details of 5 employees and display summary of the data
11. Program to create the system's idea of the current date with and without time
12. Program to convert a given matrix to a 1-dimensional array.
13. Program to create an 3 dimensional array of 24 elements using the dim() function
14. Program to create a two-dimensional 5x3 array of sequence of even integers greater than 50.
15. Program to create an array using four given columns, three given rows, and two given tables and display the content of the array
16. to create an array using four given columns, three given rows, and two given tables and display the content of the array
17. Program to list containing a vector, a matrix and a list and give names to the elements in the list
18. Program to create a list containing a vector, a matrix and a list and add element at the end of the list.
19. Program to select second element of a given nested list.
20. Program to create a list containing a vector, a matrix and a list and update the last element.

DBMS LAB (BHCS-352) (4 hrs per week)

1. Data Definition, Table Creation, Constraints,
2. Insert, Select Commands, Update & Delete Commands.
3. Nested Queries & Join Queries
4. Views
5. High Level Programming Language Extensions (Overview of Control structures, Procedures and Functions)
6. Front end tools
7. Forms
8. Triggers(overview)
9. Menu Design
10. Reports
11. Database Design and implementation (Mini Project).

Java Programming (BHCS-401)(6 hrs per week)

Unit I

Introduction to Java, History of Java,Features of Java, Importance of Java, Byte Code, JVM, JRE, JDK,JIT, Java Implementation, Application of Java, Sample Program & Compilation, Lexical Issues (White Space, Identifiers, Literals, Comments, Separators, Keyword).

Data Type, Operators, Control Structures: Variables, Constants, Declaration, Literals, Scope of Variable, Type Casting, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operator, Dot Operators, Control Statements.Array: Declaration, Creation, Initialization, Length, Two-dimensional Arrays, Command-Line Arguments. String Handling: Predefined Functions in String, String Methods.

Unit II

Introduction of Classes, Objects and Methods: Introduction to Object, Class, Defining Class, Adding Variables, Adding Methods, Creating Objects. Constructors: Types of Constructors, Keyword this & static, Garbage Collection

Unit III

Inheritance: What is Inheritance, Types of Inheritance, Creating Multilevel Hierarchy, Method Over Loading & Overriding, Dynamic Method Dispatching, Final Keyword, Abstract Class.

Packages and Interfaces: Defining Interfaces, Extending and Implementing Interfaces Defining Packages, Access Protection, Importing Packages.

Unit IV

Exception Handling: Exception Types, Multiple Catch Clauses, Nested Try Statements, Throw, Throws,Finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses. Multithreaded Programming: Thread Life Cycle, Creating Threads, Thread Methods, Thread Priority.

Unit V

Applet Programming: Introduction to Applet,Applet Architecture,Applet Life Cycle, Applet Class, Applet Tag, Passing Parameters, Use of Graphics Class, Applet Methods.

Recommended Text and Reference Books:
1. "Introduction to Java Programming", Author: Balagurusamy Publisher: TMH,5th /6th Edition.
2. "Java: The Complete Reference": Author: Herbert Schildt,Publisher:tata MC Graw Hill 7th Edition.

Computer Networks (BHCS-402)(6 hrs per week)

Unit I

Introduction to Computer Networks,Network Hardware,Network Software, Network Topologies (Star, Ring, Bus, Mesh),Network Classifications, Network Protocol,Layered Network Architecture,Overview of OSI Reference Model,Overview of TCP/IP Protocol Suite.

Unit II

Communication Fundamentals and Techniques, Analog andDigital Signal, Data-rate Limits,Multiplexing Techniques: FDM, TDM, Transmission Media,Networks Switching Techniques and Access Mechanisms, Circuit Switching,Packet Switching: Connectionless Datagram Switching, Connection-Oriented, Virtual Circuit Switching.

Unit III

Data Link layer Protocol, HDLC and its Protocols, CSMA/CD Protocols,Ethernet LANs,Connecting LAN and Back-bone Networks: Repeaters, Hubs, Switches, Bridges, Router and Gateways, Routing Protocols, IP Addressing.

Unit IV

Transport Layer Functions and Protocols, Error and Flow Control, Connection Establishment and Release, Three-way Handshaking, Overview of Application Layer Protocol, DNS,Overview of WWW &HTTP Protocols.

Unit V

URL, HTML, DNS, HTTP, HTTPS, FTP, SMTP, POP protocols, Remote login VPN, Overview of Internet

Recommended Text and Reference Books:
1. "Data Communications and Networking" Author: B. A. Forouzan, Publisher: Mc Graw Hill ,4th Edition
2. "Computer Networks" Author: A. S. Tanenbaum, Publisher: Mc Graw Hill,4th Edition.
3. "Computer Networking, A Top-Down Approach" Author: Kurose/Ross, Publisher:Pearson, 6th Edition.

Design and Analysis of Algorithms (BHCS -403)(6 hrs per week)

Unit I

IntroductionBasic Design and Analysis Techniques of Algorithms, Correctness of Algorithm, Asymptotic Notations, Growth of Functions, Notion of an Algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithmic Efficiency, Performance Analysis: Space complexity, Time complexity, Asymptotic Notations and their Properties. Mathematical Analysis for Recursive and Non-recursive Algorithms.

Unit II

Sorting and Searching Techniques: Bubble Sort, Insertion Sort, Selection Sort.Sorting in Linear Time: Bucket Sort, Radix Sort and Count Sort and their Analysis using Asymptotic Notations.

Unit III

Algorithm Design Techniques: Greedy method-General method, Applications-Knapsack Problem, Iterative Techniques, ,Travelling Salesman Problem , Assignment ProblemDivide and Conquer Searching Techniques, Binary Search – Merge Sort – Quick Sort – Heap Sort - Multiplication of Large Integers.

Unit IV

Dynamic Programming and Greedy Technique: Dynamic Programming – Principle of Optimality – Coin Changing Problem, Computing a Binomial Coefficient,Lower – Bound Arguments – P, NP,NP- Complete and NP Hard Problems, Backtracking – n-Queen Problem.

Unit V

GraphsSearch: BFS, DFS, Floyd's Algorithm, Multi Stage Graph, Optimal Binary Search Trees, Knapsack Problem and Memory Functions' Prim's Algorithm and Kruskal's. Branch and Bound – LIFO Searchand FIFO Search.

Recommended Text and Reference Books:
1. "Introduction to Algorithms",Author: T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Publisher:PHI, 3rd Edition.
2. "Computer Algorithm – Introduction to Design and Analysis", Author: Sarabasse& A.V. Gelder, Publisher: Pearson, 3rd Edition.
3. "Design and Analysis of Algorithms", Author: Prabhakar Gupta,Vineet Agarwal, Manish Varshney Publisher: Prentice Hall of India, 2nd Edition.

Compiler Design (BHCS-404) (6 hrs per week)

Unit I

Introduction to Compiler: Phases and Passes, Bootstrapping, Types of Grammar-Context-free Grammars, Finite State Machines and Regular Expressions and their Applications to Lexical Analysis, Finite Automation (Deterministic &Non-deterministic), Conversion of NDFA to DFA - Conversion of Regular Expression of NDFA – Thompson's Construction-Minimization of NDFA –Derivation - Parse Tree – Ambiguity.

Unit II

Syntax Analysis: Basic Parsing Techniques- Top Down and Bottom Up Parsers, - Left Recursion - Left Factoring, Shift Reduce Parsing, Operator Precedence Parsing, Predictive Parsers, LR Parsers, the Canonical Collection of LR(0) Items, Constructing SLR Parsing Tables, Constructing Canonical LR Parsing Tables, Constructing LALR Parsing Tables.

Unit III

Syntax-directed Translation: Syntax-directed Translation Schemes, Intermediate Code, Prefix, Postfix Notation, Three Address Code, Quadruple & Triples, Translation of Assignment Statements, Boolean Expressions, Evaluation of Expression - Three-Address Code- Synthesized Attributes – Inherited Attributes.

Unit IV

Code Optimization: Local Optimization- Loop Optimization Techniques – DAG – Dominators- Flow Graphs – Storage Allocations- Peephole Optimization. Machine-Independent Optimizations, Loop Optimization, DAG Representation of Basic Blocks, Value Numbers and Algebraic Laws, Global Data-Flow Analysis.

Unit V

Code Generation: Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator.

Recommended Text and Reference Books:

1. "Compilers, Principles techniques and tools" Author: Alfred V.Aho, Jeffery D. Ullman, Ravi Sethi, Publisher :Pearson Education, 2nd Edition.

2. "Compiler Design",Author: Santanu Chattopadhyay, Publisher:Pearson Education,6th Edition.

3. "Principles of Compiler Design", Author:Raghavan V,Publisher: Tata Mc Graw Hill Education Pvt.Ltd, 2nd Edition

Design & Analysis of Algorithms Lab (BHCS-451) (2hrs in a week)

1. Program for Recursive Binary & Linear Search
2. Program for Heap Sort
3. Program for Merge Sort
4. Program for Selection Sort
5. Program for Insertion Sort
6. Program for Quick Sort
7. Program to Implement BFS
8. Program to Implement DFS

Java Programming Lab(BHCS-452) (4hrs per week)

1. Program to demonstrate sleep method in Multithreading.
2. Program to illustrate a basic Applet.
3. Program to draw various shapes on an Applet.
4. Program for filling various graphical object with color.
5. Program to implement the Mouse Motion Listener Interface.
6. Program to demonstrate the key listener interface.
7. Program to design an Applet for Recording the Student Information.
8. Program to design an Applet to draw a polygon.
9. Program to create Arithmetic Math Calculator using Applet Class and Event Handling.
10. Program to implement Dialog box.
11. Program to implement Smiley Face using Applet.
12. Program to implement Flood Fill algorithm.
13. Program to draw an ellipse and a Rectangle in Java Applet.
14. Program to code for Moving Text using Applet.
15. Program to Code for Digital Stop watch using Applet.
16. Program to draw an Olympic Symbol in Java Applet.
17. Program to draw a Chessboard in Java Applet.
18. Program to display an Analog Clock.
19. Program to display a Digital Clock.
20. Program to create an Applet Project in Eclipse Processing.