BENGALURU NORTH UNIVERSITY

TAMAKA, KOLAR- 563103

Curriculum/Syllabus
for
Undergraduate Programme

Bachelor of Computer Applications

Choice Based Credit System
As per State Education Policy - Karnataka

Faculty of Science

(With Effect from Academic Year 2024-25)

Version 1.0 (12th August, 2024)

BENGALURU NORTH UNIVERSITY

KOLAR - 563103

State Education Policy - 2024
(Semester Scheme)

Curriculum Structure for Bachelor of Computer Applications (BCA)

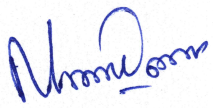
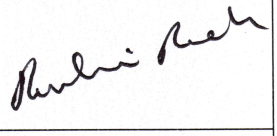
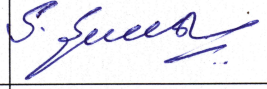
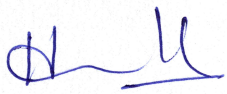
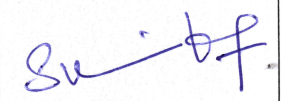
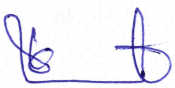
Syllabus for 1st and 2nd Semesters

With Effect From

Academic Year 2024 - 2025 and onwards

Curriculum Design/Syllabus Framing Committee

The following BOS members were present:

Sl.No.	Name and Address	Designation	Signature
1.	Dr. Murugan K, Associate Professor Department of Computer Science Government First Grade College K R Puram, Bengaluru-560036.	Chairperson	
2	Smt. Rashmi Rao K, Associate Professor Department of Computer Science Government First Grade College Hoskote, Bengaluru (Rural)	Member	
3	Dr. Sumanth S, Associate Professor Department of Computer Science Government College for Women Kolar – 563101	Member	
4	Dr. Rajendirakumar S, Associate Professor Department of Computer Science Government College for Women Kolar – 563101	Member	
5	Dr. Hamela K, Associate Professor Department of Computer Science Government First Grade College Malur, Kolar (Dist)	Member	
6	Mr. Manikandan S, Assistant Professor Department of Computer Science Government First Grade College K. R. Puram, Bengaluru	Member	
7	Dr. K. S. Manjunatha, Professor Department of Computer Science, Maharanis Science College for Women JLB Road, Mysore.	Member (External)	

Minutes:

1. The BoS members have approved the course structure and recommended (Theory and Lab).
2. The BoS members unanimously approved the proposed course structure for the newly introduced subjects.
3. The BoS members are accepted the detailed syllabi for the 1st and 2nd semester.

Regulations, Scheme of study and Examination for BCA Degree Course under Choice Based Credit System - Semester System (SEP Scheme)
(With effect from 2024 -2025)

R1**.** a) Title of the course: **Bachelor of Computer Applications**

b) Duration of the Course: Durations of the undergraduate programme shall extend SIX semesters (Three academic years) for the regular Bachelor Degree.

c) Scheme of study: there shall be six theory papers and two practical from first semester to five semesters.

d) There will be four theory, one practical and one project/Internship in sixth semester. The project work shall be carried out either independently or jointly (maximum of three students)

e) Medium of Instruction: The medium of instruction shall be English.

f) Scheme of Examination: At the end of each semester there is University Examination of three hours duration in each of the theory paper/practical.

R2. Each semester shall be of 90 working days from the date of commencement of the each Semester.

R3. Attendance: As per Bengaluru North University regulations in force for science degree courses.

R4. A Candidate is allowed to carry over all the previous uncleared (failed) theory papers/Practical to subsequent semesters as per Bengaluru North University regulations in force for science degree courses.

R5. The maximum period for completion of the course shall be as per Bengaluru North University regulations in force for science degree courses.

R6. Eligibility for admission:

a) A candidate who has passed the two years Pre-University Examination conducted by the Pre-University Education Board in Karnataka a minimum of 35% of marks.

b) A candidate who has passed Three years Diploma in Engineering of Government of Karnataka or any other examination considered as equivalent thereto shall be eligible for admission with minimum of 35% of marks in aggregate in all the semester /years.

c) Any student who has passed PUC –II Science, Arts or Commerce other than Karnataka securing with a minimum of 35% of marks.

R8. The total number of students to be admitted to the course shall be decided by the Bengaluru North University.

R9. Results: Results of candidate shall be declared and the classes awarded as per the procedure followed by the Bengaluru North University.

R10. Power to Remove Difficulties:

a) If may difficulty arises in giving effect to the provisions of these regulations, the Vice-Chancellor may be order make such provisions not inconsistent with the Act, Statutes, Ordinances or other Regulations, as appears to be necessary to expedient to remove the difficulty.

b) Every order made under this shall be subject to rectification by the appropriate University Authorities.

R11. The question paper pattern for theory paper has three sections. (80 Marks)

1. Section A includes 12 questions, students has to attend 10 questions. Each carries 2 Marks (10 * 2 = 20)
2. Section B includes 8 questions (question may contain sub questions), students has to attend 6 questions. each carries 5 Marks (6 * 5 = 30)
3. Section C includes 4 questions (question may contain sub questions), students has to attend 3 questions. each carries 10 Marks (3 * 10 = 30)

R12. Internal Assessment Scheme for Theory (4 Credits).

Assessment Criteria	Marks
Two test (Each carries 5 marks)	10
Assignment	5
Seminar	5
Total	20

R13. Internal Assessment Scheme for Theory (2 Credits).

Assessment Criteria	Marks
Test	5
Assignment	5
Total	10

R14. Internal Assessment Scheme for Practical (2 Credits).

Assessment Criteria	Marks
Test	5
Record	5
Total	10

R15. Evaluation Scheme for Practical Examination (SEE).

Assessment Criteria	Marks
Write up two programs (one from Section-A and Section-B)	20
Execution and output	15
Viva Voice based on Lab Activities	5
Total	40

Course Content for Bachelor of Computer Applications (BCA)

Curriculum Structure							
Program: BCA					**Subject: Computer Applications**		
Semester	**Course Code**	**Title of the Paper**	**Credits (L+P)**	**No.of Hours / Per Weak**	**Marks**		**Total Credits**
					SEE	**IA**	
I		Language-I	3+0	4	80	20	24
		English-I	3+0	4	80	20	
	CA1T1	Fundamentals of Computers	4+0	4	80	20	
	CA1T2	Programming in C	4+0	4	80	20	
	CA1T3	Computational Discrete Mathematics	4+0	4	80	20	
	CA1P1	Office Automation Lab	0+2	4	40	10	
	CA1P2	C Programming Lab	0+2	4	40	10	
		Constitutional Values-I	2+0	2	40	10	
II		Language-II	3+0	4	80	20	24
		English-II	3+0	4	80	20	
	CA2T1	Data Structures Using C	4+0	4	80	20	
	CA2T2	Statistical Methods using R Programming	4+0	4	80	20	
	CA2T3	Operating System Concepts	4+0	4	80	20	
	CA2P1	Data Structures Lab	0+2	4	40	10	
	CA2P2	R Programming Lab	0+2	4	40	10	
		Constitutional Values-II	2+0	2	40	10	

Semester: I
CA1T1: Fundamentals of Computers

Course Code: CA1T1	Course Title: Fundamentals of Computers
Course Credits: 04	Teaching Hours/Week: 04
Total Contact Hours: 60	Exam Duration : 3 Hours
Internal Assessment : 20 Marks	Semester End Exam: 80 Marks

Course Outcomes (COs):

The student will be able to:

- Introduction to computers, classification of computers, anatomy of computer.
- Perform number conversions from one system to another system.
- Algorithm, Flowchart and Flowgorithm.
- Basics of Internet and E-mail, MS-Word, MS-Excel, MS-PowerPoint.

Course Content	Hours
Unit-I	15
Fundamentals of Computers: Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organisation of a Digital Computer. Computer Language and Software: Machine Language, Assembly Language, High Level Language, Assembler, Compiler, Interpreter. Software – System and Application Software. Algorithm, Flowchart and Pseudo code with Examples. Introduction to Flowgorithm, Flowgorithm Features.	
Unit-II	15
Input/Output Devices: Input Device – keyboard, mouse, scanner, MICR, OMR. Output Devices – VDU, Printers – Dot Matrix, line printers and page printers. Computer Memory: Memory Concept, Memory Cell, Memory Organisation, Semiconductor Memory – RAM, ROM, PROM, EPROM, Secondary Storage Devices – Magnetic Tape, Magnetic Disk-Floppy Disk, Hard Disk, Compact Disk. Logic Gates: The Inverter, The AND gate, The OR gate, The NAND gate, NOR gate, The Exclusive–OR gate and Exclusive-NOR gate.	
Unit-III	15
Number Systems – Different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII and Unicode; Introduction of Internet and email: Features of Internet, Internet applications, web browser, search engine, e-mail, How to create e-mail, E-mail operations, E-mail-attaching a document,	
Unit-IV	15
MS Office: Introduction to MS Office, Components and Features. MS Word: Creating Letter, Table, Fonts, Page Layout Document, Formatting, Spell Check, Print Preview, Template, Color, Mail Merge, Auto Text, Inserting Picture, Word Art. MS Excel: Introduction to Excel, Sorting, Graphs, Scientific Functions. PowerPoint: Introduction to PowerPoint, Creation of Slides, Inserting Pictures, Preparing Slide Show with Animation.	

References:

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication
2. Floyd, Thomas L, "Digital Computer Fundamentals", 10 th Edition, University Book Stall,
3. Bartee, Thomas C, "Digital Computer Fundamentals", 6th Edition, TMH.
4. Introduction to Computer Science, ITL Education Solutions, Pearson Education

CA1T2: Programming in C

Course Code: CA1T2	Course Title: Programming in **C**
Course Credits: 04	Teaching Hours/Week: 04
Total Contact Hours: 60	Exam Duration : 3 Hours
Internal Assessment : 20 Marks	Semester End Exam: 80 Marks

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Confidently operate Desktop Computers to carry out computational tasks.
- Understand working of Hardware and Software and the importance of operating systems.
- Understand programming languages, number systems, peripheral devices, networking, multimedia and internet concepts.
- Read, understand and trace the execution of programs written in C language.
- Write the C code for a given problem.
- Perform input and output operations using programs in C.
- Write programs that perform operations on arrays, strings, pointers and files.

Course Content	Hours
Unit-I	15
Overview of C Language: History of C, Character set, C tokens, Identifiers, Keywords, Data types, Variables, Constants, Symbolic Constants , Operators in C, Hierarchy of Operators, Expressions, Type Conversions and Library Functions. Managing Input and Output Operation: Formatted and Unformatted I/O Functions.	
Unit-II	15
Decision making, branching and looping: Decision Making Statements - if Statement, if–else statement, nested if statement, else–if ladder, switch statement, Looping - while, do-while, for loop, Nested loop, break, continue, and goto statements. Functions: Function Definition, prototyping, types of functions, passing arguments to functions, Nested Functions, Recursive functions.	
Unit-III	15
Arrays: Declaring and Initializing, One Dimensional Arrays, Two Dimensional Arrays, Multi Dimensional Arrays - Passing arrays to functions. Strings: Declaring and Initializing strings, Operations on strings, Arrays of strings, passing strings to functions. Storage Classes - Automatic, External, Static and Register Variables. Structures-Declaring and Initializing, Nested structure, Array of Structure, Passing Structures to functions, Unions, typedef, enum, Bit fields.	
Unit-IV	15
Pointers – Declarations, Pointer arithmetic, Pointers and functions, Call by value, Call by reference, Pointers and Arrays, Arrays of Pointers, Pointers and Structures. Meaning of static and dynamic memory allocation, Memory allocation functions. Files - File modes, File functions, and File operations, Text and Binary files, Command Line arguments. C Preprocessor directives, Macros – Definition, types of Macros, Creating and implementing user defined header files.	

References**:**

1. C: The Complete Reference, By Herbert Schildt.
2. C Programming Language, By Brain W. Kernighan
3. Kernighan & Ritchie: The C Programming Language (PHI)
4. P. K. Sinha & Priti Sinha: Computer Fundamentals (BPB)
5. E. Balaguruswamy: Programming in ANSI C (TMH)

CA1T3: Computational Discrete Mathematics

Course Code: CA1T3	Course Title: Computational Discrete Mathematics
Course Credits: 04	Teaching Hours/Week: 04
Total Contact Hours: 60	Exam Duration : 3 Hours
Internal Assessment : 20 Marks	Semester End Exam: 80 Marks

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- To understand the basic concepts of mathematical reasoning, set and functions.
- To understand various counting techniques and principle of inclusion and exclusion.
- Understand the concepts of various types of relations, partial ordering and equivalence relations.
- Apply the concepts of generating functions to solve the recurrence relations.
- Familiarize the fundamental concepts of graph theory and shortest path algorithm.

Course Content	Hours
Unit-I	15
The Foundations: Basic Concepts, Propositions, Truth Table, Connectives and Compound Propositions, Implication, Biconditional of Connectives, Converse, Inverse and Contra positive of an Implication, Tautology, Contradiction, Logical Equivalence, Applications of Propositional Logic, Propositional Equivalences. Basic Structures: Definition, Types of sets, Operation on Sets, Union, Intersection and Complements of Sets, Cartesian Product, Cardinality of Set. Determinants: Definition, Minors, Cofactors, Properties of Determinants. Matrices: Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint, Inverse, Cramer's Rule.	
Unit-II	15
Counting: Basics of counting, Pigeonhole principle, Permutation and combination, Binomial Coefficient and Combination, Generating Permutation and Combination**.** Advanced Counting Techniques: Applications of Recurrence Relations, Solving Linear Recurrence Relations, Generating functions, Inclusion-Exclusion, Applications of Inclusion-exclusion.	
Unit-III	15
Induction and Recursion: Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Corrections. Relations and Functions: Properties of Relations, Equivalence Relation, Partial Order Relation Function: Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions.	
Unit-IV	15
Graphs: Graphs and Graph models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.	

References:

1. Discrete Mathematics and Its Applications, Kenneth H. Rosen: Seventh Edition.
2. Discrete Mathematical Structure, Bernard Kolman, Robert C, Busby, Sharon Ross.
3. Graph Theory with Applications to Engg and Comp. Sci: Narsingh Deo-PHI.
4. Discrete and Combinatorial Mathematics Ralph P. Grimaldi, B. V. Ramatta, Pearson, Education, 5 Edition.
5. Discrete Mathematical Structures, Trembley and Manohar.

CA1P1: Office Automation Lab

Course Code: CA1P1	Course Title: Office Automation Lab
Course Credits: 02	Teaching Hours/Week: 04
Total Contact Hours: 60	Exam Duration : 3 Hours
Internal Assessment : 10 Marks	Semester End Exam: 40 Marks

Section - A

1. Write a leave letter to the principal by using different alignments using MS-Word.

2. Create a bio-data using different alignments and use the page border using MS-Word.

.3. Create a time table of your class using MS-Word.

4. Create documents of your own and write the steps using MS-Word:

   a) Insert Pictures
   b) Insert Shapes

5. Create a documents using MS-Word.

   a) The word "MS-Word" as the watermark of the document.
   b) Set the background color of the document.
   c) Choose the indent tab.
   d) Change the space between paragraphs by adding space.

6. To prepare students mark sheet with the fields of Name, Register_Number, Mark1, Mark2, Mark3, Total, Average, Result and Class using MS-Excel.

7. To prepare employees payroll data with the fields of Sl.No. Name, Basic_pay, HRA, DA, PF, Gross_salary and Net_salary.

   a) Calculate HRA (10 % of Basic Pay), DA (25% of Basic Pay), DA (12% of Basic Pay).
   b) Calculate Gross_salary=Basic_pay+HRA+DA.
   c) Calcualte Net_salary=Gross_salary-PF

8. Prepare a bar chart and pie chart for analysis of five year results of your college using MS-Excel.

9. Create a line chart and bar chart using its data series using MS-Excel.

10. To prepare worksheet contains Name and Sales of 10 salesmen. Calculate commission as per the following:

Sales	Commission
First 30,000	5%
Next 40,000	10%
Excess	15%

Section - B

1. Create a power-point presentation with minimum 5 slides.

   a. The first slide must contain the topic of the presentation and name of the presentation.

   b. Second slide must contain at least 5 bullets, 5 numbers.

   c. The heading must be, font size:32, font-face: Arial Rounded MT Bold, font-color: blue.

   d. Last slide must contain "Thank you".

2. Create a power-point presentation with minimum 5 slides.

a. Use custom animation option to animate the text; the text must move left to right one line at a time.

b. Use proper transition for the slides.

3. Create a PowerPoint presentation with different animation format.

4. Create a PowerPoint presentation for company product by using different features.

5. Create a presentation about Computer Generations. The presentation should contain 5 slides, one for each generation. Apply transaction effect and slide advances in every two seconds automatically.

6. Using flowgorithm software, Execute different arithmetic tasks for sum, average, product, difference, quotient and remainder of given numbers.

7. Using flowgorithm software to calculate the area of shapes for square, rectangle, circle and triangle.

8. Using flowgorithm software,

a. Calculate the Fahrenheit to Celsius. F=(celsius*1.8)+32.

b. Calculate the Celsius to Fahrenheit. C=(Fahrenheit-32)/1.8.

9. Using flowgorithm software to check the given year is leap year or not.

10. Using flowgorithm software to find the largest of three integer numbers.

CA1P2: C Programming Lab

Course Code: CA1P2	Course Title: C Programming Lab
Course Credits: 02	Teaching Hours/Week: 04
Total Contact Hours: 60	Exam Duration : 3 Hours
Internal Assessment : 10 Marks	Semester End Exam: 40 Marks

Section-A

1. Program to read radius of a circle and to find area and circumference.
2. Program to read three numbers and find the biggest of three.
3 Program to generate N primes.
4. Program to read a number, find the sum of the digits, reverse the number and check it for palindrome.
5. Program to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers.
6. Program to read percentage of marks and to display appropriate message (Demonstration of else-if ladder).
7. Program to find the roots of quadratic equation (demonstration of switch case statement).
8. Program to read marks scored by N students and find the average of marks (Demonstration of single dimensional array).
9. Program to remove duplicate element in a single dimensional array.
10. Program to perform addition and subtraction of matrices

Section-B

1. Program to find the length of a string without using built in function

2. Program to demonstrate string functions.

3. Program to demonstrate pointers in C.

4. Program to check a number for prime by defining isprime( ) function.

5. Program to read, display and add two m x n matrices using functions.

6. Program to read, display and multiply two m x n matrices using functions.

7. Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.

8. Program to reverse a string using pointer
9. Program to swap two numbers using pointers
10. Program to demonstrate student structure to read and display records of N students.

Semester: II

CA2T1: Data Structures using C

Course Code: CA2T1	Course Title: Data Structures using C
Course Credits: 04	Teaching Hours/Week: 04
Total Contact Hours: 60	Exam Duration : 3 Hours
Internal Assessment : 20 Marks	Semester End Exam: 80 Marks

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
- Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs
- Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs
- Demonstrate different methods for traversing trees.
- Describe the concept of recursion, give examples of its use.
- Discuss the computational efficiency of the principal algorithms for sorting and searching.

Course Content	Hours
Unit-I	15
Introduction and Overview: Definition, Elementary data organization, Data Structures, data structures operations, Abstract data types, Complexity of algorithms, asymptotic notations for complexity of algorithms. Arrays: Definition, Linear arrays, arrays as ADT, Representation of Linear Arrays in Memory, Traversing Linear arrays, Inserting and deleting elements, Multidimensional arrays, Representation of multidimensional Arrays and Sparse matrices.	
Unit-II	15
Sorting: Bubble sort, Insertion sort, Selection sort, Searching: Linear Search, Binary search. Linked list: Definition, Representation of Singly linked list in memory, Traversing a Singly linked list, Searching a Singly linked list, Memory allocation, Garbage collection, Insertion into a singly linked list, Deletion from a singly linked list; Doubly linked list, Header linked list, Circular linked list.	
Unit-III	15
Stacks – Definition, Array representation of stacks, Linked representation of stacks, Stack as ADT, Arithmetic Expressions: Polish Notation, Application of Stacks, Recursion, Towers of Hanoi, Implementation of recursive procedures by stack. Queues – Definition, Array representation of queue, Linked list representation of queues Types of queue: Simple queue, Circular queue, Double ended queue, Priority queue, Operations on Queues, Applications of queues	

Unit-IV	15
Tree – Definitions, Binary trees, Representing binary trees in memory, Traversal of binary tree; preorder, inorder and postorder traversal; Binary Search Trees, Searching, Inserting and Deleting in a Binary Search Tree. Graphs: Graph terminology, Sequential representation of Graphs: Adjacency matrix, Graph Traversals: Breadth First Search and Depth First Search.	

References:

1. Ellis Horowitz and Sartaj Sahni: Fundamentals of Data Structures
2. Tanenbaum: Data structures using C (Pearson Education)
3. Kamathane: Introduction to Data structures (Pearson Education)
4. Y. Kanitkar: Data Structures Using C (BPB)

CA2T2: Statistical Computing and R Programming

Course Code: CA2T2	Course Title: Statistical Computing and R Programming
Course Credits: 04	Teaching Hours/Week: 04
Total Contact Hours: 60	Exam Duration : 3 Hours
Internal Assessment : 20 Marks	Semester End Exam: 80 Marks

Course Outcomes (COs):

After the successful completion of the course, the student will be able to:

- Explore fundamentals of statistical analysis in R environment.
- Describe key terminologies, concepts and techniques employed in Statistical Analysis.
- Define Calculate, Implement Probability and Probability Distributions to solve a wide variety of problems.
- Conduct and interpret a variety of Hypothesis Tests to aid Decision Making.
- Understand, Analyse, and Interpret Correlation Probability and Regression to analyse the underlying relationships between different variables.

Course Content	Hours
Unit-I	15
The Language: Introduction – Advantages of R over Other Programming Languages, R Studio: R script file, Handling Packages in R: Installing R Package, Syntax, Comments, Operators, R Keywords, R Data Types - numeric, Integer, logical, complex, character and raw, Variables, Input and Output statement, Data Structures – Strings, Vectors, Matrices, Arrays, Non-numeric Values, Lists and Data Frames, Special Values, Classes, and Coercion, Reading and Writing Files.	
Unit-II	15
Programming: Conditions and Loops - If statements - Stand-Alone Statement, Using If Else, Nesting and Stacking Statements, The Switch Function. Coding Loops - For Loops, While Loops, Repeat Loop, Other Control Flow Mechanisms - Declaring Break, Next and goto statement, R-Function: function definition, Built-in functions: Basic Math function - min(), max(), sum(), sqrt(),abs(),ceiling(),floor(), trunc(), round(), cos(), sin(), tan(), String function - grep(), nchar() , paste(), sprintf(), substr(), strsplit(), regex() gregexpr(), toupper(), tolower(), paste(), User Defined Function, Exception Handling, Progress and Timing, Visibility.	

Unit-III	15
Statistics and Probability: Elementary Statistics, Basic data visualisation, probability, common probability distributions: common probability mass functions - Bernoulli, Binomial, Poisson distributions, common probability density functions - Uniform, Normal, Student's t-distribution.	
Unit-IV	15
Statistical Testing and Modelling: Sampling distributions, hypothesis testing, Analysis of variance, Simple linear regression, multiple linear regressions. Advanced graphics: Basic Plotting, plot customization, plotting regions and margins, point and click coordinate interaction, customizing traditional R plots, specialized text and label notation, Defining colors and plotting in higher dimensions.	

References:

1 Tilman M. Davies, "The book of R: A first course in programming and statistics", San Francisco, 2016.
2 Vishwas R. Pawgi, "Statistical computing using R software", Nirali prakashan publisher, e1 edition, 2022.
3 https://www.geeksforgeeks.org/r-tutorial/
4. https://www.tutorialspoint.com/r/index.htm

CA2T3: Operating System Concepts

Course Code: CA2T3	Course Title: Operating System Concepts
Course Credits: 04	Teaching Hours/Week: 04
Total Contact Hours: 60	Exam Duration : 3 Hours
Internal Assessment : 20 Marks	Semester End Exam: 80 Marks

Course Outcomes (COs):

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

- Explain the fundamentals of the operating system.
- Comprehend multithreaded programming, process management, process synchronization, memory management and storage management.
- Compare the performance of Scheduling Algorithms
- Identify the features of I/O and File handling methods.

Course Content	Hours
Unit-I	15
Introduction to Operating System: Definition, History and Examples of Operating System; Computer System organization; Types of Operating Systems; Functions of Operating System; Systems Calls; Operating System Structure. Process Management: Process Concept- Process Definition, Process State, Process Control Block, Threads; Process scheduling- Multiprogramming, Scheduling Queues, CPU Scheduling, Operations on Processes- Creation and Termination of Processes; Inter process communication (IPC)- Definition and Need for Inter process Communication, CPU Scheduling Criteria, Scheduling algorithm, Multiple Processor Scheduling, Real time Scheduling.	

Unit-II	15
Process Synchronization: Introduction; Race Condition; Critical Section Problem and Peterson's Solution; Synchronization Hardware, Semaphores; Classic Problems of Synchronization- Readers and Writers Problem, Dining Philosophers Problem; Monitors. Deadlocks: System Model; Deadlocks Characterization; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection; and Recovery from Deadlock	
Unit-III	15
Memory Management: Logical and Physical Address Space; Swapping; Contiguous Allocation; Paging; Segmentation; Segmentation with Paging. Virtual Memory: Introduction to Virtual Memory; Demand Paging; Page Replacement; Page Replacement Algorithms; Allocation of frames, Thrashing.	
Unit-IV	15
File System: File Concepts- Attributes, Operations and Types of Files; File System; File Access methods; Directory Structure; Protection; File System Implementation- File System Structure, Allocation Methods, Free Space Management. Disk Structure & Scheduling methods, Disk management, Swap – Space management.	

References:

1. Operating System Concepts, Silberschatz' et al., 10thEdition, Wiley.
2. Operating System Concepts - Engineering Handbook, Ghosh PK.
3. Operating Systems - Internals and Design Principles, William Stallings, 9th Edition, Pearson.
4. Operating Systems – A Concept Based Approach, Dhamdhere, 3rd Edition, McGraw Hill Education India.
5. Modern Operating Systems, Andrew S Tanenbaum, 4th Edition, Pearson.

CA2P1: Data Structures Lab

Course Code: CA2P1	Course Title: Data Structures Lab
Course Credits: 02	Teaching Hours/Week: 04
Total Contact Hours: 60	Exam Duration : 3 Hours
Internal Assessment : 10 Marks	Semester End Exam: 40 Marks

Section-A

1. Program to find GCD using recursive function
2. Program to display Pascal Triangle using binomial function
3. Program to generate n Fibonacci numbers using recursive function.
4. Program to implement Towers of Hanoi.
5. Program to implement dynamic array, find smallest and largest element of the array.
6. Program to create two files to store even and odd numbers.
7. Program to create a file to store student records.
8. Program to read the names of cities and arrange them alphabetically.
9. Program to sort the given list using selection sort technique.
10. Program to sort the given list using bubble sort technique.

Section-B

1. Program to sort the given list using insertion sort technique.
2. Program to sort the given list using quick sort technique.
3. Program to sort the given list using merge sort technique.
4. Program to search an element using linear search technique.
5. Program to search an element using recursive binary search technique.
6. Program to implement Stack.
7. Program to convert an infix expression to postfix.
8. Program to implement simple queue.
9. Program to implement linear linked list.
10. Program to display traversal of a tree.

CA2P2: R Programming Lab

Course Code: CA2P2	Course Title: R Programming Lab
Course Credits: 02	Teaching Hours/Week: 04
Total Contact Hours: 60	Exam Duration : 3 Hours
Internal Assessment : 10 Marks	Semester End Exam: 40 Marks

Section-A

1. Write a R program that includes various data types in R.
2. Write a R program for different types of data structures in R
3. Write a R program that includes linear algebra operations on vectors and matrices.
4. Write a R program that includes various looping statements.
5. Write a R program for quick sort implementation, binary search tree.
6. Write a R program for calculating cumulative sums, products, minima, maxima and calculus.
7. Write a R program for finding stationary distribution of Markanov chains.
8. Write a R program for any visual representation of an object with creating graphs using graphic functions: Plot(),Hist(), Linechart(),Pie(),Boxplot(),Scatterplots().
9. Write a R program with any dataset containing data frame objects, indexing, and subsetting data frames, and employ manipulating and analyzing data.
10. Write a program to create any application of Linear Regression in a multivariate context for predictive purposes.

Section-B

1. Write a R program to take input from the user (name, age, address, city, state) and display the values. Also, print the version of the R installation.
2. Write a R program that includes different operators.
3. Write a R program to default values for arguments, returning complex objects.
4. Write a R program to create and store an array of 4×4 matrix and calculate its sum
5. Write a R program that includes various if statements.
6. Write a R program to calculate both simple interest and compound interest using functions.
7. Write a R program to implement various statistical functions in R.
8. Write a R program to find Correlation and Covariance.
9. Write a R program to import the data set and perform an ANOVA test.
10. Write a R program to define colors in various ways. (Use of named colors, RGB colors, hexadecimal color codes, and the colors()).