ರಾಯಚೂರು ವಿಶ್ವವಿದ್ಯಾಲಯ RAICHUR UNIVERSITY

Under Graduate Curriculum for Degree of

Bachelor of Computer Applications

BCA III Semester

With effect from 2025-26

BOS(Computer Application) UG meeting
Approval Dated: 06-09-2025

BCA 3rd semester Syllabus w.e.f. 2025-26 onwards

Paper 1	Operating System Concepts	Credits: 4	Contact Hours: 60	Theory 04 Hrs/week
Internal assessment: 20 marks	Term end exam: 80 marks	Exam duration: 03hrs		

Course Outcomes (COs): At the end of the course, students will be able to:

- Explain the structure and functions 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

UNIT 1 **12Hrs**

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.

UNIT 2 **12Hrs**

Process Management: Process Concept- Process Definition, Process State, Process Control Block, Threads; Process scheduling- Multiprogramming, Scheduling Queues, CPU Scheduling, Context Switch; Operations on ProcessesCreation and Termination of Processes; Inter process communication (IPC)- Definition and Need for Inter process Communication; IPC Implementation Methods- Shared Memory and Message Passing;

UNIT 3 **12Hrs**

Multithreaded Programming: Introduction to Threads; Types of Threads; Multithreading- Definition, Advantages; Multithreading Models; Thread Libraries; Threading Issues. CPU Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling; Multiprocessor Scheduling; Real-Time CPU Scheduling.

UNIT 4 **12Hrs**

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 5 **12Hrs**

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

Text Book

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne., 9th Edition, Wiley, 2012.

References:

2. Operating System Concepts - Engineering Handbook, Ghosh PK, 2019.
3. Understanding Operating Systems, McHoes A et al., 7 th Edition, Cengage Learning, 2014.
4. Operating Systems - Internals and Design Principles, William Stallings, 9th Edition, Pearson Education.
5. Operating Systems – A Concept Based Approach, Dhamdhere, 3rd Edition, McGraw Hill Education India.
6. Modern Operating Systems, Andrew S Tanenbaum, 4th Edition, Pearson Education.

Paper-1Lab	**LAB: Operating System Lab**	Credits: 2	Contact Hours: 60	Practical 04 Hrs/week
Internal assessment: 10 marks	Term end exam: 40 marks	Exam duration: 02 hrs		

Assignments based on the subject Paper-1: **Operating System Concepts** shall be implemented in the lab.

1. Basic UNIX Commands and various UNIX editors such as vi, ed, ex and EMACS
2. UNIX and Windows File manipulation commands
3. C Program For System Calls Of Unix Operating Systems (Opendir, Readdir, fork, getpid, exit)
4. C programs to simulate UNIX commands like cp, ls, grep.
5. Simple shell programs by using conditional, branching and looping statements (to check the given number is even or odd,the e given year is leap year or not, find the factorial of a number, swap the two integers)
6. To write a C program for implementation of Priority scheduling algorithms
7. To write a C program for implementation of Round Robin scheduling algorithms.
8. To write a C program for implementation of SJF scheduling algorithms
9. To write a C-program to implement the producer – consumer problem using semaphores
10. To write a C program to implement banker"s algorithm for deadlock avoidance.
11. To write a c program to implement Threading and Synchronization Applications.
12. To write a C program for implementation of memory allocation FCFS and SJF scheduling algorithms.
13. To write a c program to implement Paging technique for memory management.
14. To write a c program to implement semaphores.
15. To write a c program to implement Bankers algorithm.

EvaluationSchemeforLab. Term end Examination

AssessmentCriteria		Marks
Program– 1	Writingthe Program	05
	ExecutionandFormatting	05
Program– 2	Writingthe Program	05
	ExecutionandFormatting	05
VivaVoice		05
PracticalRecord book		05
	Total	**40**

Paper 2	Design and Analysis of Algorithms	Credits: 4	Contact Hours: 60	Theory 04 Hrs/week
Internal assessment: 20 marks	Term end exam: 80 marks	Exam duration: 03hrs		

Course Outcomes (COs): At the end of the course, students will be able to:

- the time complexity of an algorithm and asymptotic notation is used to provide classification of algorithms
- understand different computational models and their complexity(e.g., divide-and-conquer, greedy algorithms, dynamic programming, etc)
- analyze and design algorithms and the impact of algorithm design in practice
- write program to execute and analyze different algorithms
- understand the concepts of deterministic and non-deterministic algorithms.

UNIT 1 **12Hrs**

Design of Efficient Algorithms and Elementary Data Structures: Algorithm specification, Performance analysis, Time and Space Complexity, Asymptotic notation, Review of Stack, Queues, Trees. Operations on Stack, Queue and Trees. Recursion, Heaps and Heap Sort

UNIT 2 **12Hrs**

Divide and Conquer: General Method, Binary Search, Max and Min, Merge Sort, Quick Sort, Matrix Multiplication and Related Operations; Strassen's Matrix Multiplication, Boolean Matrix Multiplication.

UNIT 3 **12Hrs**

The Greedy Method: The General Method, Knapsack Problem, JobSequencing with Deadlines, Minimum Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm. Single Source Shortest Paths

UNIT 4 **12Hrs**

Dynamic Programming: The General Method, Multistage Graphs, All Pair's Shortest Paths,0/1 knapsack, Travelling Salesman Problem

UNIT 5 **12Hrs**

Backtracking: General Methods, 8 – Queens Problem, Sum of Subsets, Knapsack Problem, NP – Hard and NP – Complete Problems.

Text Book:

1. Ellis, Horwitz, SartajSahani and Rajashekaran S., "Computer Algorithms", (1999) GalgotiaPublications Pvt.,Ltd.

Reference Books:

1. Aho A.V, Hopcroft J.E and Ullman, J.D., "The Design and Analysis of Computer Algorithms", (1976) Addison – Wesley.
2. Introduction to Algorithms, (2009) third edition, by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, MIT press.
3. Sara Baase, Computer Algorithms, "An Introduction to Design and Analysis", Addison Wesley.

4. Allen Weiss (2009), Data structures and Algorithm Analysis in C++, 2nd edition, Pearson education, New Delhi.
5. R. C. T. Lee, S. S. Tseng, R.C. Chang and T. Tsai (2006), Introduction to Design and Analysis of Algorithms A strategic approach, McGraw Hill, India.

Paper-2 Lab	**LAB: Algorithms Lab. Using C/JAVA**	Credits: 2	Contact Hours: 60	Practical 04 Hrs/week
Internal assessment: 10 marks	Term end exam: 40 marks		Exam duration: 02 hrs	

Assignments based on the subject Paper-2: **Introduction to Algorithms Design** shall be implemented in the lab.

1. Program to construct a stack of elements and to perform the following operations on: push, pop, status, empty, full, display
2. Program to construct a queue of integers and to perform following operations on it: enqueuer, de-queue, status, empty, full
3. Program to implement
    a. Binary Search,
    b. Max and Min,
    c. Merge Sort,
    d. Quick Sort,
    e. Strassen's Matrix Multiplication,
    f. Boolean Matrix Multiplication
4. Program to implement
    a. Job Sequencing with Deadlines,
    b. Prim's Algorithm,
    c. Kruskal's Algorithm
5. Program to implement All Pair's Shortest Paths
6. Dijkstras Algorithm
7. Program to implement all pair shortest problem using dynamic programming technique
8. Program to solveTravelling Salesman Problem

EvaluationSchemeforLab. Term end Examination

AssessmentCriteria		Marks
Program– 1	Writingthe Program	05
	ExecutionandFormatting	05
Program– 2	Writingthe Program	05
	ExecutionandFormatting	05
VivaVoice		05
PracticalRecord book		05
	Total	**40**

Paper 3	Computer Oriented Numerical Methods	Credits: 4	Contact Hours: 60	Theory 04 Hrs/week
Internal assessment: 20 marks	Term end exam: 80 marks	Exam duration: 03hrs		

Course Outcomes (COs): At the end of the course, students will be able to:

- Understand the concepts of rounding and truncation errors, their propagation
- Apply numerical techniques to find roots of algebraic, transcendental, and systems of linear equations.
- Fit polynomials to data points using interpolation techniques .
- Compute derivatives and integrals of functions numerically
- Apply numerical methods to find approximate solutions for ordinary differential equations
- Develop the ability to choose, develop, and apply suitable numerical methods to solve practical problems, and use programming languages to implement algorithms and interpret results.

UNIT 1 **12Hrs**

Errors in Numerical Calculation – Introduction, Numbers and their Accuracy, Mathematical Preliminaries, errors and their computation ,absolute, relative and percentage errors, General error formula, Error in the series Approximation.

Solving Non linear Equations - computer & arithmetic errors, method of bisection, the secant method, Newton–Raphson's method, Newton's method for polynomial, Horner's method, Muller's method, order of convergence of other method.

UNIT 2 **12Hrs**

Interpolation- Introduction, errors in polynomial Interpolation, Finite Difference, Forward, Backward, Central Difference, Newton's Formulae for Interpolation, Lagrange's Interpolation Formula.

Linear System of Equation- Matrix notation, determinants and matrix inversion, norms, eigen values and eigen vectors of a matrix, the elimination method, Gauss elimination and Gauss-Jordan Method, Iterative method Jacobi Iterative Method and Gauss Seidal Iteration Method.

UNIT 3 **12Hrs**

Curve Fillting, B- Splines and Approximation - Least –Square Curve Fitting procedures, fitting a straight line, nonlinear curve fitting, Method of Least Squares for continuous Functions, Orthogonal Polynomial , Gram-Schmidt Orthogonalization Process, B-Splines, Least Square solution, Representation of B- Spines, The Cox-de Boor Recurrence Formula, Computation of B-Splines, Approximation of functions, Chebyshev polynomials, Economization of Power Series.

UNIT 4 **12Hrs**

Numerical Differentiation – Errors in Numerical Differentiation, The cubic spline method, Maximum and Minimum values of a Tabulated function.

Integration - Numerical Integration, Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule, Boole's and Weddle's Rulres, Romberg Integration, Newton-Cotes Integration Formulae, Euler – Maclaurin Formula.

UNIT 5 **12Hrs**

Numerical Solution of Ordinary Differential Equations- Solution by Taylor's Series, Picard's Method of successive approximation, Euler's Method, Error Estimate for the Euler Method, Modified Euler's Method, Rung – Ktta Method , Preditor- Corrector Methods, Adams-Moulton Method , Milne's Method, Boundary Value Problems.

TEXT BOOKS:

1. S. S. Satry – Introductory Methods of Numerical Analysis, 3rd edition Prentice-Hall India.
2. M. K. Jain, S. R. K. Iyengar, R. K. Jain- Numerical Methods for Scientific and Engineering Computation, 3rd Edition New Age International (P) Limited.

REFERENCES:

1. F. Gerald, Patrick O. Wheatley, Applied Numerical Analysis, 6/e, Pearson Education.
2. Madhumangal Pal, Numerical Analysis for Scientists and Engineers, Narosa Publications.
3. **Conte S.D. and Carl DeBoor, Elementary Numerical Analysis, McGraw Hill .**
4. **Shankar Rao K., Numerical Methods for Scientists and Engineers, PHI.**

Evaluation Scheme for Lab. Term end Examination

Assessment Criteria		Marks
Program– 1	Writing the Program	05
	Execution and Formatting	05
Program– 2	Writing the Program	05
	Execution and Formatting	05
VivaVoice		05
Practical Record book		05
	Total	**40**