Shiksha Mandal's

Bajaj College of Science, Wardha

(Formerly known as Jankidevi Bajaj College of Science, Wardha)

SYLLABUS FOR Semesters III and IV

(COMPUTER SCIENCE Minor)

(BSc Physics with Computer Science as Minor/ BSc Electronics with Computer Science as Minor/ BSc Mathematics with Computer Science as Minor)

(To be implemented from Academic Session 2024-25, approved in BoS dated 30.03.2024)

Semester III

DATA STRUCTURES and OPERATING SYSTEMS

Course Code: UCS231T

Aim of the Course

To understand the basics of various data structures like stacks, queues, linked lists, etc. and their implementation using C++; and to understand the fundamental concepts related to Operating Systems such as design issues, management of resources and services.

Learning Objectives	Course Learning Outcomes
Students will try to learn:	After successful completion of the course student will be able to:
To understand Stack and Queue data structures and implement it.	Learn Stack and Queue data structures and implement it.
To know and implement Linked List.	Understand and Implementation of Linked List.
To understand and implement sorting techniques, trees, and graphs.	Understand and implement sorting techniques, trees, and graphs.
To get acquainted with components of Operating Systems, roles, process management, and CPU scheduling.	Understand components of Operating Systems, roles, process management, and CPU scheduling.
To know concepts associated with deadlocks and memory management.	Know concepts associated with deadlocks and memory management.
To get familiarised with the principles of IO management, file management, and protection mechanisms.	Get acquainted with the principles of IO management, file management, and protection mechanisms.

Course Outline

Unit I

Stacks: Stacks terminology, Representation of Stacks in Memory, Operation on Stacks, Polish Notations, Translation of infix to postfix & prefix expression, Infix to Postfix Conversion, Evaluation of Postfix Expression, Recursion, Problems on Recursion, Quick Sort and Tower of Hanoi Problem.

Queue: Representation of Queues in Memory, Circular Queue. Dequeue and Priority Queue, Operations of above Structure using Array and Linked Representation.

Unit II

Linked List: Linked List, Representation of Single, Double, Header, Circular Single and Double Linked list, All possible operations on Single and Double Linked List using Dynamic representation, Polynomial Representation and its Manipulation.

Unit III

Sorting and Searching: Selection Sort, Insertion Sort, Merge Sort, Efficiency of Sorting Methods, Big-O Notations. Hash Tables, Hashing Technique, Collision Resolution Technique.

Trees: Basic Terminologies, Representation of Binary Trees in Memory, Traversing of Binary tree, Binary Search Tree, Operation on Binary Search Tree, Heap Tree, Operation on Heap Tree, Heap Sort Method.

Graphs: Basic Terminologies, Definition and Representation of Graphs in Memory: Linked List and Matrix Representation. Traversing graphs: BFS, DFS Method.

Unit IV

Structure of Operating System, Operating System functions, Characteristics of Modern OS. Process Management: Process states, Creation, Termination, Operations on Process, Concurrent processes, Process Threads, Multithreading, Micro Kernels.

CPU Scheduling: Schedulers, Scheduling Methodology, CPU Scheduling Algorithms: FCFS, SJF, RR, Priority Scheduling.

Unit V

Performance Comparison: Deterministic Modeling, Queuing analysis, Simulators. Deadlock and Starvation: Resource Allocation Graph, Conditions for Dead Lock, Dead Lock Prevention, Dead Lock Detection, Recovery from Deadlock.

Memory Management: Logical Vs. Physical Address Space, Swapping, Memory Management Requirement, Dynamic Loading and Dynamic Linking, Memory Allocation Method: Single Partition allocation, Multiple Partitions, Compaction, paging, segmentation, segmentation with paging, protection.

Unit VI

I/O Management: I/O hardware, I/O Buffering, Disk I/O, Raid, Disk Cache.

File Management: File Management system, File Accessing Methods, File Directories, File Allocation Methods, File Space Management, Disk Space Management, Record blocking.

Protection Mechanisms: Cryptography, Digital Signature, User Authentication.

Semester III
COMPUTER SCIENCE PRACTICAL
Course Code: UCS231P

Section A

1. Program to insert a node at the beginning, at the end and in the middle of the given linked list.
2. Program to delete a node at the beginning, at the end and in the middle of the given linked list.
3. Program to create a linked list of customer names and their telephone numbers. (Using Menu Driven and include features of adding a new Customer and deleting an existing Customer.)
4. Program to reverse a linked list.
5. Program to search a value in the given linked list.
6. Program to insert a node at the beginning, at the end or in the middle of a given doubly linked list.
7. Program to delete a node from the beginning, at the end or in the middle of a given doubly linked list.
8. Program to create, insert and delete a node in Circular linked list.
9. Program to push and pop an element into / from a stack implemented using linked list.
10. Program to push and pop an element into / from a stack implemented using Array.
11. Program to evaluate postfix expression.
12. Program to sort an array using quick sort.
13. Program to solve Towers of Hanoi problems using recursion.
14. Program to perform insertion and deletion operation in linear queues.
15. Program to perform insertion and deletion operation on circular queues.
16. Program to sort an array using: Insertion sort.
17. Program to sort an array using: Selection sort.
18. Program to insert an element in a binary search tree.
19. Program to traverse inorder of a binary tree.
20. Program to traverse preorder of a binary tree.
21. Program to traverse postorder of a binary tree.

Section B

Minimum five study experiments based on unit IV through Unit VI

REFERENCE BOOKS:

1. Classical Data Structures: D. Samantha. PHI, New Delhi.
2. DATA STRUCTURE: LIPSCHUTZ SCHAUM OUTLINE SERIES
3. Data Structures Using C++: Y. Kanetkar
4. Data Structures Using C++: Tanenbaum
5. Data Structure (Algorithms & Programs) - Dr. Vishal M. Lichade Sigma Solution Publication
6. Data Structures by Tremblay Sorenson
7. Operating Systems by P. Balakrishna Prasad [Scitech Publication]
8. Operating System Concepts:Silberschatz (Addision Education)
9. Operating Systems – H.M. Deitel–Addision Wesley.
10. Operating Systems– John J. Donoven.
11. Operating System: A.S.Godbole (TMH)
12. Modern Operating Systems: Tanenbaum (Pearson Education)
13. Operating Systems: Peterson

Web Resources:

Students are advised to make use of the resources available on the Internet. Some useful links related to computer science are given below.

1. www.tutorialspoint.com/data_structures_algorithms
2. www.onlinetutorialspoint.com/data-structures/what-is-data-structures
3. www.topcoder.com/community/data-science/data-science-tutorials
4. www.tutorialspoint.com/operating_system
5. www.researchgate.net/publication/3786159_Tutorial

SEMESTER IV
(COMPUTER SCIENCE Minor)

(BSc Physics with Computer Science as Minor/ BSc Electronics with Computer Science as Minor/ BSc Mathematics with Computer Science as Minor)

(To be implemented from Academic Session 2024-25, approved in BoS dated 30.03.2024)

JAVA PROGRAMMING and LINUX OPERATING SYSTEM
Course Code: UCS241T

Aim of the Course

This course imparts the basics of core Java programming concepts and an introduction to Linux Operating System, various commands used to interact with it.

Learning Objectives	Course Learning Outcomes
Students will try to learn:	After successful completion of the course student will be able to:
To know the basic concepts of Java programming like variables, data types, operators, class, and object.	Learn the basic concepts of Java programming like variables, data types, operators, class, and object.
To get familiar with arrays, strings, inheritance, interface, packages and applets.	Understand and Implementation of arrays, strings, inheritance, interface, packages and applets.
To grasp and implement AWT and GUI components in Java.	Understand and implement AWT and GUI components in Java.
To understand components of Linux Operating Systems, anatomy, shell, and basic Linux commands.	Understand components of Linux Operating Systems, anatomy, shell, and basic Linux commands.
To get acquainted with concepts associated backup and recovery mechanisms, and system administration.	Know concepts associated backup and recovery mechanisms, and system administration.
To have knowledge of the techniques for disk management, communication utilities, and Linux GUIs.	Get acquainted with the techniques for disk management, communication utilities, and Linux GUIs.

Course Outline

Unit I

Introduction to Java: History of Java, features of Java, getting started with Java. **Java programs:** Introduction of Application & Applets. **Variables:** naming, initialization, rules. Data types, Operators, Decision and Looping constructs, **Creating a class & subclass:** Declaring a class, Naming a class, Rules to assign Class & Subclass, Creating a new object, **Methods:** Invoke a method, passing arguments to a method, calling method. **Access Specifiers & Modifiers:** Public, Private, Protected, Static & Final. **Overloading:** Method overloading, Constructor overloading.

Unit II

Inheritance: Single & multiple inheritances. **Interfaces:** Defining interfaces, extending interfaces, implementing interfaces.

Packages: Java API packages, creating packages, accessing packages, adding a class to packages, import a package. **Applets:** Introduction and Application, how applets and application are different, creating an applet. Applet life cycle, designing a web page, creating an executable applet, running the applet, applet tags, passing a parameter to applet, HTML tag, Converting applet to application. **Exceptions & Errors:** Introduction, types of error, exception, syntax of exception, handling techniques, exception for Debugging.

Unit III

Event: Event driven programming, handling an (AWT) events. **Graphics class:** Introduction, the Graphics classes, drawing & filling of lines, rectangle, circle & ellipse, arcs, polygons, text & fonts, creating a font class, font objects, text, coloring object. **AWT Applications:** Creating a GUI using AWT toolkit, using component class, frames. **Components & Control:** Textfield, Textarea class, label, button, choice, list, checkbox, class, and combo. **Menus:** Creating a popup menus. **Layouts:** Using Window Listener interface, Different types of Layout, Layout manager. **Swing:** What is Swing? Difference between AWT and Swing, Swing Layouts, Managers, Containers, and Components – JFrame, JButton, JLabel, JText, JTextArea, JCheckBox And JRadioButton, JList, JComboBox, JMenu.

Unit IV

Introduction to Open-Source: Open Source, Need and Principles of OSS, Open-Source Standards, Free Software vs. Open-Source Software, Public Domain. **History:** BSD, The Free Software Foundation and the GNU Project. **Open-Source Operating Systems:** GNU/Linux, Android, Free BSD, Open Solaris. Open-Source Hardware, Virtualization Technologies.

Logging In and Logging Out, Anatomy of Linux OS, Directory Structure, /usr Directory, **File Types:** User data files, System data files, Executable files. Naming files and directories, Spawning Processes. **Shell:** Creating User Account, Shell Program, bash shell, Changing shell prompt.

Unit V

Commands: Basic Syntax for a command, Exploring the Home Directory, ls, mkdir, rmdir, stat, cat, rm, mv, cp. **Editor:** Vi editor. **Hooking up Hardware Devices:** Formatting a Floppy Disk, Gathering important system information.

Backing Up and restoring the File System: Simple Backup, gzip, gunzip, tar. **Printing files:** Print Spool directory, Sending files to Printer. **Sharing Files with other Users:** Maintaining User Accounts, Changing Password, Creating Group Accounts, Granting Access to files, Changing File Ownership, Protecting Files, Making a File Read-Only.

Unit VI

Working with Processes: Types of processes, ps Command, Creating process, killing process, free command and top utility.

Managing Disk Space: df, du commands, Creating Additional Free Disk Space, Locating Unused Files, Setting System Clock. **Communication Utilities:** who, who am i, finger, mesg, write, wall, talk, Creating a message of the day.

Semester IV
COMPUTER SCIENCE PRACTICAL
Course Code: UCS241P
Section A

1. A) Write a program that declares a class, object and also it accesses the data member of it's class.
   B) Write an applet that accepts a value from the user and display it.

2. A) Write a program that accept marks of 5 subject, calculate total, percentage and display the grade according to their percentage.
   B) Write a program that will print the multiplication table from 1 to 10.

3. A) Write a program to accept a set of values from the user into an array, display the values as well as their average.
   B) Accept string into a textfield, sort the characters in the string and display the sorted string into another textfield.

4. A) Write a program to demonstrate the overloading of constructor.
   B) Write an applet that accepts two numbers from user and display all the numbers between them.

5. A) Write a program to demonstrate the single inheritance.
   B) Write an applet to accept 10 numbers into an array, sort the array and display the sorted array. Accept the 10 numbers into the 10 different textfields.
   C) Write a program to create a multiple selection list and also display the list of items selected by the user.

6. A) Write an applet to demonstrate the user menu bar.
   B) Write a sample program that will convert the applet to application.
   C) Write a program to demonstrate the interfaces.

7. A) Write a program for exception handling that accept two numbers as textfields, the values are added and their sum is displayed. The code traps the error when user could enter text instead of numbers.
   B) Write a program that would accept input for the user and store it in a file called Test.java.

8. A) Write a program to implement Graphics class draw (line, rectangle, fill rectangle, circle, oval).

B) Write an applet that display a choice of menu of three buttons (Add, Modify, Delete) selecting a choice from the menu should display the appropriate button. Use the show ( ) method of the Layout Manager.

9. A) Write a Java program to design and display the Swing controls.
   B) Write a program to implement the Swing Layout.

Section B

Minimum five study experiments based on unit IV through Unit VI

REFERENCE BOOKS:

1. The Art of Programming through Flowcharts & Algorithms by Anil B.Chaudhari, Firewall Media, Laxmi Publication, New Publication.
2. Programming with Java a Primer II edition: E Balagurusamy (TMH).
3. Java Programming (For Absolute Beginners) - Russell, PHI
4. Black Book on Java
5. Java-Complete References

14. Java (Theory & Programs) - Dr. Vishal M. Lichade Sigma Solution Publication

6. SAMS Teach Yourself Linux-Craig and Coletta Witherspoon [Techmedia]
7. LINUX Complete Reference by Richard Peterson
8. Linux Operating System Ist Edition - Dr. S.B.Kishor, Suhashini Chaurasia, Das Ganu Prakashan.

Web Resources:

Students are advised to make use of the resources available on the Internet. Some useful links related to computer science are given below.

1. www.tutorialspoint.com/cprogramming/
2. www.tutorialspoint.com
3. www.javatpoint.com/java-tutorial
4. www.tutorialspointexamples.com
5. http://www.javatpoint.com/linux-tutorial
6. http://www.guru99.com/unix-linux-tutorial.html
7. www.w3schools.com