- S. Vijayalakshmi, Hibernate: Java Persistence Framework, Pearson Education India, 1st Edition
- K. M. S. R. Anjaneyulu, Java Hibernate, Laxmi Publications, 1st Edition

SUBJECT NAME: Unix and Shell Programming **Credit: 5 (3L +2P)**
SUBJECT CODE: BCAC602

COURSE OBJECTIVE:

The Unix and Shell Programming course is designed to provide BCA students with a thorough understanding of the Unix operating system and its powerful command-line interface. This course emphasizes the foundational concepts of Unix, including file system structure, process management, and inter-process communication, while focusing on shell scripting for automation and system management.
Students will explore the Unix environment, learning to navigate the file system, manipulate files, and manage processes efficiently. The course also introduces shell programming using popular Unix shells such as Bourne Shell, C Shell, and Korn Shell. Through scripting, students will develop the ability to automate repetitive tasks, schedule jobs, and manage system configurations.
By the end of the course, students will be well-equipped with the knowledge and skills to work in Unix-based environments, enabling them to pursue careers in system administration, software development, and IT support. The course fosters problem-solving abilities and a strong command over Unix tools and scripting techniques.

Course Outcome	
CO1	Demonstrate proficiency in using Unix commands to navigate the file system, manage files, and control processes.
CO2	Develop shell scripts to automate repetitive tasks, schedule jobs, and manage system configurations effectively.
CO3	Utilize Unix utilities such as grep, awk, and sed for file processing, text manipulation, and data extraction.
CO4	Implement inter-process communication and manage process control to optimize system performance and resource usage.
C05	Apply knowledge of Unix tools and shell programming to solve real-world problems in system administration and IT operations.

DETAILED SYLLABUS:

Module	Topics Covered	Hours	Marks
M1	Introduction to Unix; Discuss about POSIX; Discuss about Linux and most popular distributions of Linux; Compare Between the Unix and Linux; Unix system Architecture; Discuss about the Unix kernel and system call interface; Unix directory structure;	2	5
M2	Unix File commands: create directory, change directory, move and copy directory, create file, remove file; remove directory, listing directory information; discuss about the types of files; change file security; creating the empty file and change the timestamp; discuss the access time, modification time and change time; touch with d and t option; finding the files and directorires; soft link and hard link.discuss about i node; size of file system.Use of > and >>, Use of pipe and tee command.	8	12
M3	row eise and column wiseselection from the file with different options, merge lines of files horizontally with different options; split large files into smaller files, counting number of lines, words , characters; sorting the content of the file according to the specific column, numerical sorting, comparing two files line by line, compare two files character by character, compare two sorted files., join the two files, the uniq command, the transformation command.	7	14
M4	Utility command: cal, date, pr, who, bc, echo, zip unzip , gzip commands, Archiving the file	2	
M5	Vi editor: Overview of VI Editor as a text editor in Unix/Linux; Basic mode operations in VI (Command mode, Insert mode, and Last-line mode). Basic Operations in VI Editor (Starting VI: Opening and editing files using vi filename, Navigation: Moving the cursor (h, j, k, l, arrow keys, etc.), Moving by word, line, or page. Text Editing (Inserting text in insert mode (i, I, a, A, o, O), Deleting text (x, dd, dw, D, etc.), Copying and pasting (yy, pp, p, P), Undo and redo changes (u, Ctrl+r).). Working with Files (Saving and Exiting (Saving files: :w, :w filename), Exiting: :q, :q! (force quit without saving), Saving and quitting together: :wq, ZZ.). File Operations (Opening a new file: :e filename.)	2	5

	Search and Replace (Searching forward and backward, using regular expressions for searching.) Replace (Replacing text using :s/old/new/g., Global search and replace in a file.)		
M6	Searching the file with pattern using grep and awk command, Advance searching the file with grep, awk command with print and printf, awk with comparison operator, arithmetic operator, begin and else section,Begin and end section, if else statement, built in variable fs and ofs, awk with string and arithmetic functions, use of loops, Use of searching and substitute function.	8	15
M7	Process in Unix, Discuss the process command with different options, Discuss about the init process and unis login process, discuss briefly the fork() , getpid(), getppid(), wait(0, zombie process, , pipe() and message(), Discuss unix process states and the diagram, Discuss about the scheduler used in unix, swapped memory, discuu about the vmstat and top command, discussion about the nice command	8	9
M8	Shell programming: Introduction of shell and types of shell, use of shell, system variables and user defined varible, use of single and double quote and backslash, command substitution, let: assigning and evaluationg the expression, take input from the user, Command line parameters, use of if statement, use of for, while and until loop, Observe the exit status.	8	10
	INTERNAL EXAMINATION	3	30
	TOTAL	48	100

Practical:

SUBJECT NAME: Unix and Shell Programming Lab **Credit: 2**
SUBJECT CODE: BCAC692

The practical sessions shall, with due diligence, reflect and reinforce the theoretical syllabus, and shall moreover include the undertaking of a modest yet purposeful project, designed to furnish the student with a sound comprehension of foundational principles, and to cultivate the capacity to apply such learning to the resolution of real-world exigencies.

List of Sample question for Unix and shell programming Lab:

Direct Lab Questions

1. **Basic Unix Commands**

   List all files in a directory along with their permissions and ownership.
   Display the top 10 largest files in a directory using `du` and `sort`.
   Find and replace a specific word in a file using `sed`.

2. **File and Directory Management**
   Write a shell script to create a directory structure for a project (e.g., `Project/Docs`, `Project/Src`, `Project/Bin`) and verify the structure.
   Create a script to back up all `.txt` files in the current directory into a new directory named `Backup_<date>`.
3. **Process Management**
   Write a script to list all processes owned by the current user.
   Create a script to monitor CPU usage and alert the user if it exceeds a specific threshold.
4. **Text Processing**
   Use `awk` to extract and display the second and fourth columns from a CSV file.
   Use `grep` to find all lines in a file that contain a specific pattern and count the occurrences.
5. **Shell Scripting Basics**
   Write a shell script to calculate the factorial of a number entered by the user.
   Create a script to check if a given file exists and whether it is readable, writable, or executable.

Case Study-Based Lab Questions

System Monitoring Tool

Scenario:

Build a shell script-based tool to monitor and report system performance, including disk usage, memory usage, and active processes.

Lab Questions:

1. Write a script to display the following system details:
   Total and free memory.
   Disk usage percentage of each mounted partition.
   Number of active processes.
2. Implement a feature to save the report to a file with a timestamp in the filename (e.g., `System_Report_<date>.txt`).
3. Extend the script to alert the user if disk usage exceeds 80% or memory usage goes below 10%.

SUGGESTED READING:

- Yashavant Kanetkar, Unix Shell Programming, BPB Publications, 1st Edition
- Sumitabha Das, UNIX: Concepts and Applications, Tata McGraw-Hill Education, 4th Edition
- Vikas Chawla, Unix and Shell Programming, Oxford University Press, 1st Edition
- M. G. Venkatesh, Advanced Unix Programming, Wiley India, 1st Edition
- Stephen G. Kochan, Unix Shell Programming, Pearson Education India, 2nd Edition
- S. R. Rajesh, UNIX Shell Programming, Pearson Education India, 1st Edition
- Brian W. Kernighan, The UNIX Programming Environment, Prentice Hall, 1st Edition