COURSE FILE

For

Linux and Shell Programming (ECSE223L)

Faculty Name : Akash Yadav

Course Type : Core

Semester and Year: III Semester / II Year

L-T-P : 3-0-2

Credits : 4

Department : Computer Science Engineering

Course Level : UG

School of Engineering and Applied Sciences
Department of Computer Science Engineering

Bennett University
Greater Noida, Uttar Pradesh

1. Detailed Syllabus of the Course

Course Type:	Core

L	T	P	Credits
3	0	2	4

Pre-requisites: NA

Course Learning Outcomes:

CLO1: Use various Linux commands that are used to manipulate system operations at admin level.

CLO2: Write Shell Programming using Linux commands. write Shell Programming using Linux commands.

CLO3: Design and write application to manipulate internal kernel level Linux File System.

Module 1 (Contact hours: 8)

Introduction to LINUX and LINUX utilities: A brief history of LINUX, architecture of LINUX, features of LINUX, introduction to vi editor. Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text Processing utilities and backup utilities , tail, head , sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio.

Module 2 (Contact hours: 10)

Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.

Module 3 (Contact hours: 9)

Grep: Operation, grep Family, Searching for File Content. Sed: Scripts, Operation, Addresses, commands, Applications, grep and sed.UNIX FILE STRUCTURE: Introduction to UNIX file system, inode (Index Node), file descriptors, system calls and device drivers.File Management: File Structures, System Calls for File Management – create, open, close, read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown, Directory API – opendir, readdir, closedir, mkdir, rmdir, umask.

Module 4 (Contact hours: 9)

PROCESS AND SIGNALS: Process, process identifiers, process structure: process table, viewing processes, system processes, process scheduling, starting new processes: waiting for a process, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals

functions, unreliable signals, interrupted system calls, kill, raise, alarm, pause, abort, system, sleep functions, signal sets.File locking: creating lock files, locking regions, use of read and write with locking, competing locks, other lock commands, deadlocks.

Module 5 (Contact hours: 6)

Inter Process Communication: Pipe, process pipes, the pipe call, parent and child processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands.Introduction to Sockets: Socket, socket connections -socket attributes, socket addresses, socket, connect, bind, listen, accept, socket communications.

Lab Experiments

Students will use LINUX / UBUNTU to gain hands-on experience on LINUX and Shell programming.

TEXTBOOKS/LEARNING RESOURCES:

a) M. Ebrahim and A Mallett, Mastering Linux Shell Scripting: A Practical Guide to Linux Command-Line, Bash Scripting, and She (2 nd ed.), Packt Publication, 2018. ISBN 978-1788990554.

b) R. Blum and C. Bresnahan, Linux Command Line and Shell Scripting Bible (3 rd ed.), Wiley, 2016. ISBN 978-1118983843.

REFERENCE BOOKS/LEARNING RESOURCES:

a) R. Love, Linux System Programming (2 nd ed.), O'Reilly, 2013. ISBN 978-1449339531.

b) W.R. Stevens, Advanced Programming in the UNIX Environment (2 nd ed.), Pearson Education, 2017. ISBN 978-9332575905.

c) W.R. Stevens, UNIX Network Programming (3 rd ed.), PHI Publications, 2017. ISBN 978-8120307490.

MOOC COURSE REFERENCE:

A) **Linux programming and scripting.**
https://nptel.ac.in/courses/117/106/117106113/

B) **Operating systems. https://nptel.ac.in/courses/106/108/106108101/**

2. Evaluation policy of the course

Components of Course Evaluation	Percentage
Mid Term Examination	20
End Term Examination	35
Assignment	05
Quiz	15
Lab Continuous Evaluation	10
Project	15

3. Lecture wise Plan

Lecture Wise Plan

Lecture No.	Content Planned
1	Introduction to linux and linux utilities: A brief history of linux
2	Architecture of linux, features of linux, introduction to vi editor
3	Linux commands- path, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip
4	File handling utilities, security by file permissions, process utilities, disk utilities
5	Networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin
6	Text processing utilities and backup utilities
7	Tail, head , sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio
	Assignment
8	Assisgnment discussion and revision
9	Introduction to shells
10	Linux session, standard streams, redirection, pipes
	Quiz 1
11	Tee command, command execution, command-line editing
12	Quotes, command substitution, job control, aliases, variables, predefined variables
13	Options, shell/environment customization
14	Filters and pipes, concatenating files, display beginning and end of files
15	Cut and paste, sorting, translating characters
16	Files with duplicate lines
17	Count characters, words or lines, comparing files
	Expert talk 1
18	Grep: Operation, grep family
19	Searching for file content. Sed: Scripts, operation
20	Addresses, commands, applications, grep and sed
21	Unix file structure: Introduction to unix file system,
	Project kick-off
22	Node (index node), file descriptors
23	System calls and device drivers
24	File management: File structures,
25	System calls for file management – create, open, close, read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown
26	Directory api – opendir, readdir, closedir, mkdir, rmdir, umask.
27	Revision and discussion
	Quiz 2
	Expert talk 2
28	Process and signals:
29	Process, process identifiers, process structure: Process table
30	Viewing processes, system processes, process scheduling, starting new Processes
31	Waiting for a process, zombie processes, orphan process
32	Fork, vfork, exit, wait, waitpid, exec,
33	Signals functions, unreliable signals, interrupted system calls,
34	Kill, raise, alarm, pause, abort, system, sleep functions
35	Signal sets.file locking: Creating lock files, locking regions, use of read and write with locking, competing locks,

36	Deadlocks.
	Expert talk 3
37	Inter process communication: Pipe, process pipes, the pipe call, parent and child processes, and named pipe
38	Fifos, semaphores: Semget, semop, semctl, message queues: Msgget, msgsnd, msgrcv, msgctl, shared memory shmget, shmat, shmdt, shmctl, ipc status commands.
39	Introduction to sockets: Socket
40	Socket, socket connections - socket attributes, socket addresses
41	Socket, connect, bind, listen, accept
42	Socket communications. Udp and tcp
	Project Evaluation

4. Lab Plan:

Lab Wise Plan

Lab No.	Content Planned
1.	Installation of Linux and its various distros
2	Linux commands, their uses and practice, editors: vi, nano etc
3	Introduction to Shell, Shell basic commands, variables
4	Shell programming environments- filters and pipe
5	Shell programming File handling
6	Grep its use and commands. Using of Grep with pipe and filters
7	Unix file structuring, inodes and related system calls. File handling commands and API
8	Network Penetration testing tools, wireshark, Nmap, Hashcat
9	Process management, creation, termination and other useful commands, Process scheduling. Parent, zombie and orphan process
10	Process system calls. Fork, exec, wait and signal, Dead lock
11	Inter Process communication via pipes and shared memory, various commands. Basics of Socket Programming via UDP socket

5. Lab Software:

Linux (any distribution)
Wireshark, Nmap, Hashcat
Gcc
Google Colab

6. Suggest at least 3 innovations how this will enhance learning outcome of the course.

a. Students should be encouraged to actively use the Open source software.
b. Students should be encouraged to use version control systems like Git for their codes.
c. We should have a open source club for our students, where they can get exposure to various development activities.
d. They should encouraged to develop their own linux destro.

7. **Tentative date/speaker for industry talk**.

Expert talk 1 : 12 September 2021

Expert talk 2: 20 October 2021

8. **List tools (teaching and lab) that can be used in course.**

a. Acadly
b. Mentimeter
c. Git

9. **You Tube Playlist**

https://www.youtube.com/channel/UCLi9YOMEQtfcu4RWqFdhw/videos