**A. Course Handout | Prepared on 20th October, 2023**

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|---|---|---|---|
| Institute/School Name | Chitkara University Institute of Engineering & Technology | | |
| Department Name | Computer Science & Engineering | | |
| Programme Name | Bachelor of Engineering, Computer Science & Engineering | | |
| Course Name | Linux System Administration | Session | 2023-2024 |
| Course Code | 22CS009 | Semester/Batch | 3rd/ 2022 |
| L-T-P (Per Week) | 3-0-2 | Course Credits | 04 |
| Course Coordinator | Dr. Shikha | | |

## 1. Objectives of the Course

Linux System Administration course is designed to help the student to become a Linux Admin Expert. Also designed to shape the student as a Linux professional & help run applications, perform desired functions on system and networks, create a network configuration, and maintain security administration. The course provides a wide scope of learning and understanding of the subject. The objectives of the course are:

- To use Linux operating system knowledge for solving real world problem statements.
- To get familiar with the design, architecture and installation of Linux OS.
- To understand concepts of booting process, File system, working with files and directories, Editors and Filters/ Text processing commands of Linux OS.
- To understand basic concepts to manage the user, group of user's accounts on a system or on a network.
- To get familiar with shell scripting or program Linux system.

## 2. Course Learning Outcomes

On completion of the course, students will be able to:

**CLO1.** Understand fundamental concepts of Linux operating system.

**CLO2.** Apply concepts of Linux operating system in order to solve the real-life problems.

**CLO3.** Analyze the processes, file system and system directories in Linux operating system.

**CLO4.** Understand the working of Linux based system to manage the user or group of users in a network.

**CLO5.** Construct solutions for engineering problems by using shell script programming in Linux.

**CLO-PO mapping grid |Program outcomes (POs) are available as a part of Academic Program Guide (APG)**

| Course Learning Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLO1 | | M | | | M | | | M | | | | M |
| CLO2 | M | | M | M | | M | M | M | M | | M | M |
| CLO3 | | | | | | M | M | | M | | | M |
| CLO4 | M | M | | M | M | M | | H | H | M | H | H |
| CLO5 | H | H | H | M | H | | H | H | | | H | H |

## 3. Recommended Books (Reference Books/Text Books):

**RB1:** Linux the Complete Reference, John Purcell, 7th edition, Walnut Creek, 1999.

**RB2:** Linux Command Line and Shell Scripting Bible, Richard Blum, 4rd edition, Wiley, 2021.

**RB3:** Your Unix - The Ultimate Guide, Sumitabha Das, 4th Edition, Tata McGraw-Hill, 2008.

**RB4:** Linux Programming Bible, John Goerzen, 8th Edition, IDG Books, 2001.

**RB5:** A Practical Guide to Linux, Mark G. Sobell, 3rd Edition by Pearson Education, 2013.

**RB6:** Unix Shell programming, Yashwant kanetkar, 1st Edition, BPB Publications, 20034.

**4. Other readings and relevant websites:**

| S. No. | Link of Journals, Magazines, websites and Research Papers |
|---|---|
| 1. | https://www.techtarget.com/searchdatacenter/definition/Linux-operating-system |
| 2. | https://www.geeksforgeeks.org/introduction-to-linux-operating-system/ |
| 3. | https://resources.infosecinstitute.com/topic/installing-configuring-centos-7-virtualbox/ |
| 4. | https://ubuntu.com/tutorials/install-ubuntu-server#1-overview |
| 5. | https://techlog360.com/basic-ubuntu-commands-terminal-shortcuts-linux-beginner/ |
| 6. | https://www.redhat.com/sysadmin/vim-commands |
| 7. | https://learning.edx.org/course/course-v1:LinuxFoundationX+LFS101x+1T2017/home |
| 8. | https://onlinecourses.swayam2.ac.in/aic20_sp24/course |
| 9. | https://www.redhat.com/sysadmin/linux-command-basics-7-commands-process-management |
| 10. | https://www.tutorialspoint.com/unix/unix-file-system.htm |

**5. Recommended Tools and Platforms:**

- RedHat Enterprise Linux 8
- Ubuntu 6.1
- VM VirtualBox 7.0

**6. Course Plan**

| Lecture Number | Topics | Recommended Book / Other reading material |
|---|---|---|
| 1-4 | **Introduction:** History, Linux Foundation, H/W Requirements, Linux Components, Distributions, Features, Choosing a suitable Linux distribution | RB1<br>RB2 |
| 5-9 | **Linux Architecture:** Kernel, Architectural differences between Windows and Linux. Configuration & customizations of Linux, Linux structure, and Installation. | RB1<br>RB2 |
| 10-14 | **Installation:** Different ways to install Linux, Linux installation (CentOS7 - Recommended), CentOS vs. CentOS stream, Take a snapshot of VM. | RB1<br>RB3 |
| 15-19 | **Boot Process:** The boot process, Partitioning, dual boot, Virtual memory and swap space disk partition (df, fdisk), Adding swap space. | RB2<br>RB3 |
| 20-27 | **File System & Storage Management:** File system structure, Navigation commands (cd, ls and pwd), Absolute and relative Paths, Creating files and directories (touch, cp, mkdir), Disk partitions and file systems, Mounting and unmounting file systems (mount, umount), Managing disk space (df, du) | RB2,<br>RB3 |
| 28-32 | **Working with Files & Directories:** Linux file types, find, locate, Changing Password, cp, rm, mv, mkdir, rmdir) | |
| 33-37 | **File Display Commands:** cat, less, more, head, tail) redirection, Files and directory permissions (chmod), File ownership commands (chown, chgrp) | RB1<br>RB3 |
| 38-43 | **Editors:** Linux file editor (vi), Difference between vi and vim editors, nano, pico and other linux editors,"sed" command. | RB1<br>RB4 |
| 44-48 | **Filters / Text Processing Commands:** cut, awk, grep/egrep, sort/uniq, wc, compare files (diff and cmp), Compress and uncompress (tar, gzip, gunzip). | RB4<br>RB5 |
| 49-54 | **User Account Management:** useradd, groupadd, usermod, userdel, groupdel, Switch users and sudo access (su, sudo), Monitor users (who, last, w, id). | RB5<br>RB6 |

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|---|---|---|
| 55-57 | **System Utility Commands:** date, uptime, hostname, uname, which, cal, bc. | RB4<br>RB5 |
| 58-60 | **Process Management & System Monitoring:** ps, bg, fg, nice commands. | RB2,<br>RB6 |
| 61-63 | **Troubleshooting:** ifconfig, ping, traceroute, DNS troubleshooting tools etc. | RB1,<br>RB2 |
| 64-73 | **Web and Database Services:** Configuring web servers (Apache, Nginx), Setting up databases (MySQL, PostgreSQL), Managing web applications, Automation and Scripting, Introduction to shell scripting (Bash), Automating tasks with scripts, Using configuration management tools (Ansible) | RB1,<br>RB3 |
| 74-83 | **Shell Scripting:** Shell scripting basics, Types of shells, starting a shell, Create your first script - Hello world, Conditions/If else statements Scripts, Case statements script, Conditions/If else statements, Scripts, Case statements script, for loop script, do-while scripts, Exit status, Script, For loop script, do-while scripts, Exit status | RB4<br>RB5 |
| 84-90 | **Introduction to GCC compiler:** Basics of GCC, Compilation of program, Execution of program, Time stamping. | RB5<br>RB6 |

**7. Delivery/Instructional Resources**

| Lecture Number | Topics | Web References | Audio-Video |
|---|---|---|---|
| 1-4 | **Introduction:** History, Linux Foundation, H/W Requirements, Linux Components, Distributions, Features, Choosing a suitable Linux distribution | https://www.redhat.com/en/topics/linux/what-is-linux | https://www.techtarget.com/searchdatacenter/definition/Linux-operating-system |
| 5-9 | **Linux Architecture:** Kernel, Architectural differences between Windows and Linux. Configuration & customizations of Linux, Linux structure, and Installation. | https://www.geeksforgeeks.org/introduction-to-linux-operating-system/ | https://www.geeksforgeeks.org/introduction-to-linux-operating-system/ |
| 10-14 | **Installation:** Different ways to install Linux, Linux installation (CentOS7 - Recommended), CentOS vs. CentOS stream, Take a snapshot of VM. | https://resources.infosecinstitute.com/topic/installing-configuring-centos-7-virtualbox/ | https://www.youtube.com/watch?v=wSVA-VOwKgE |
| 15-19 | **Boot Process:** The boot process, Partitioning, dual boot, Virtual memory and swap space disk partition (df, fdisk), Adding swap space. | https://learning.edx.org/course/course-v1:LinuxFoundationX+LFS101x+1T2017/home | https://onlinecourses.swayam2.ac.in/aic20_sp24/course |
| 20-27 | **File System & Storage Management:** File system structure, Navigation commands (cd, ls and pwd), Absolute and relative Paths, Creating files and directories (touch, cp, mkdir), Disk partitions and file systems, Mounting and unmounting file systems (mount, umount), Managing disk space (df, du) | https://www.tutorialspoint.com/unix/unix-file-system.htm | https://www.geeksforgeeks.org/linux-file-hierarchy-structure/ |
| 28-32 | **Working with Files & Directories:** Linux file types, find, locate, Changing Password, cp, rm, mv, mkdir, rmdir) | https://www.geeksforgeeks.org/absolute-relative-pathnames-unix/ | https://linuxconfig.org/linux-commands |

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|---|---|---|---|
| 33-37 | **File Display Commands:** cat, less, more, head, tail) redirection, Files and directory permissions (chmod), File ownership commands (chown, chgrp) | https://www.edureka.co/blog/linux-commands/ | https://www.youtube.com/watch?v=snoVPKX1I4g |
| 38-43 | **Editors:** Linux file editor (vi), Difference between vi and vim editors, nano, pico and other linux editors,"sed" command. | https://learning.edx.org/course/course-v1:LinuxFoundationX+LFS101x+1T2017/home | https://onlinecourses.swayam2.ac.in/aic20_sp24/course |
| 44-48 | **Filters / Text Processing Commands:** cut, awk, grep/egrep, sort/uniq, wc, compare files (diff and cmp), Compress and uncompress (tar, gzip, gunzip). | https://www.tutorialspoint.com/top-5-best-linux-text-editors | https://ru.coursera.org/lecture/linux-fundamentals/editing-text-files-xkv0S |
| 49-54 | **User Account Management:** useradd, groupadd, usermod, userdel, groupdel, Switch users and sudo access (su, sudo), Monitor users (who, last, w, id). | https://docs.fedoraproject.org/en-US/fedora/latest/system-administrators-guide/basic-system-configuration/Managing_Users_and_Groups/ | https://onlinecourses.swayam2.ac.in/aic20_sp24/course |
| 55-57 | **System Utility Commands:** date, uptime, hostname, uname, which, cal, bc. | https://learning.edx.org/course/course-v1:LinuxFoundationX+LFS101x+1T2017/home | https://www.youtube.com/watch?v=FtwRe8w2kWI |
| 58-60 | **Process Management & System Monitoring:** ps, bg, fg, nice commands. | https://learning.edx.org/course/course-v1:LinuxFoundationX+LFS101x+1T2017/home | https://onlinecourses.swayam2.ac.in/aic20_sp24/course |
| 61-63 | **Troubleshooting:** ifconfig, ping, traceroute, DNS troubleshooting tools etc. | https://learning.edx.org/course/course-v1:LinuxFoundationX+LFS101x+1T2017/home | https://onlinecourses.swayam2.ac.in/aic20_sp24/course |
| 64-73 | **Web and Database Services:** Configuring web servers (Apache, Nginx), Setting up databases (MySQL, PostgreSQL), Managing web applications, Automation and Scripting, Introduction to shell scripting (Bash), Automating tasks with scripts, Using configuration management tools (Ansible) | https://learning.edx.org/course/course-v1:LinuxFoundationX+LFS101x+1T2017/home | https://onlinecourses.swayam2.ac.in/aic20_sp24/course |
| 74-83 | **Shell Scripting:** Shell scripting basics, Types of shells, starting a shell, Create your first script - Hello world, Conditions/If else statements Scripts, Case statements script, Conditions/If else statements, Scripts, Case statements script, for loop script, do-while scripts, Exit status, Script, For loop script, do-while scripts, Exit status | https://linuxhint.com/30_bash_script_examples/<br><br>https://www.softwaretestinghelp.com/unix-shell-loops/ | https://linuxhint.com/30_bash_script_examples/<br>https://www.softwaretestinghelp.com/unix-shell-loops/ |
| 84-90 | **Introduction to GCC compiler:** Basics of GCC, Compilation of program, Execution of program, Time stamping. | https://learning.edx.org/course/course-v1:LinuxFoundationX+LFS101x+1T2017/home | https://onlinecourses.swayam2.ac.in/aic20_sp24/course |

**8. Action plan for different types of learners**

| Slow Learners | Average Learners | Fast Learners |
|---|---|---|
| Remedial Classes | Doubt-sessions | Advance Practical assignments |

**9. Evaluation Scheme & Components**

| Evaluation Component | Type of Component | No. of Assessments | Weightage of Component | Mode of Assessment |
|---|---|---|---|---|
| Component 1 | Subjective Test/Sessional Tests (STs) | 02* | 40% | Offline/Online |
| Component 2 | End Term Examinations | 01 | 60% | Offline/Online |
| Total | | 100% | | |

*Out of 01 STs, the ERP system automatically picks the best 01 ST marks for evaluation of the STs as final marks.

**10. Details of Evaluation Components**

| Evaluation Component | Description | Syllabus Covered (%) | Timeline of Examination | Weightage (%) |
|---|---|---|---|---|
| Component 01 | ST 01 | Upto 40% | Week 3 | 40% |
| | ST 02 | 41% - 80% | Week 7 | |
| Component 02 | End Term Examination* | 100% | To be notified by Dean Examination | 60% |
| Total | | | | 100% |

* As per Academic Guidelines minimum 85% attendance is required to become eligible for appearing in the End Semester Examination.

**11. Syllabus of the Course**

| S. No. | Topic | No. of Lectures | Weightage % |
|---|---|---|---|
| 1 | **Introduction:** History, Linux Foundation, H/W Requirements, Linux Components, Distributions, Features, Choosing a suitable Linux distribution. **Linux Architecture:** Kernel, Architectural differences between Windows and Linux. Configuration & customizations of Linux, Linux structure, and Installation. **Installation:** Different ways to install Linux, Linux installation (CentOS7 - Recommended), CentOS vs. CentOS stream, Take a snapshot of VM. | 14 | 15% |
| 2 | **Boot Process:** The boot process, Partitioning, dual boot, Virtual memory and swap space disk partition (df, fdisk), Adding swap space. **File System & Storage Management:** File system structure, Navigation commands (cd, ls and pwd), Absolute and relative Paths, Creating files and directories (touch, cp, mkdir), Disk partitions and file systems, Mounting and unmounting file systems (mount, umount), Managing disk space (df, du) | 13 | 14% |
| 3 | **Working with Files & Directories:** Linux file types, find, locate, Changing Password, cp, rm, mv, mkdir, rmdir) File Display **Commands:** cat, less, more, head, tail) redirection, Files and | 16 | 18% |

| | | | |
|---|---|---|---|
| | directory permissions (chmod), File ownership commands (chown, chgrp) Editors: Linux file editor (vi), Difference between vi and vim editors, nano, pico and other linux editors,"sed" command. | | |
| 4 | **Filters / Text Processing Commands:** cut, awk, grep/egrep, sort/uniq, wc, compare files (diff and cmp), Compress and uncompress (tar, gzip, gunzip). **User Account Management:** useradd, groupadd, usermod, userdel, groupdel, Switch users and sudo access (su, sudo), Monitor users (who, last, w, id). System Utility Commands: date, uptime, hostname, uname, which, cal, bc. | 14 | 16% |
| 5 | **Process Management & System Monitoring:** ps, bg, fg, nice commands. **Troubleshooting:** ifconfig, ping, traceroute, DNS troubleshooting tools etc. Web and **Database Services:** Configuring web servers (Apache, Nginx), Setting up databases (MySQL, PostgreSQL), Managing web applications, Automation and Scripting, Introduction to shell scripting (Bash), Automating tasks with scripts, Using configuration management tools (Ansible) | 16 | 18% |
| 6 | **Shell Scripting:** Shell scripting basics, Types of shells, starting a shell, Create your first script - Hello world, Conditions/If else statements Scripts, Case statements script, Conditions/If else statements, Scripts, Case statements script, for loop script, do-while scripts, Exit status, Script, For loop script, do-while scripts, Exit status | 10 | 11% |
| 7 | **Introduction to GCC compiler:** Basics of GCC, Compilation of program, Execution of program, Time stamping | 7 | 8% |

**This Document is designed and approved by:**

| **Designation** | **Name** | **Signature** |
|---|---|---|
| **Course Coordinator** | Dr. Shikha | |
| **Head Academic Delivery** | Dr Vikas Khullar | |
| **Dean** | Dr. Rishu Chhabra | |
| **Date** | **20.10.2023** | |