Course Title: System Administration using Linux
Course No.: ICT. Ed. 487 Nature of course: Theoretical + Practical
Level: Bachelor
Program: B.Ed. ICTE Credit Hour: 3 hours (2T+1P)
Semester: Eight Teaching Hour: 80hours (32+48)

1. Course Description

This course aims at providing a skills to the student to install, configure, and troubleshoot a computer network and system administration using linux. The course will provide skill to the students to the different tools and technology such as server/client installation and configuration, IP, DHCP, Name Server, DNS, Web server, file, print and mail server configuration and troubleshooting.

2. General Objectives

The general objectives of this course are as follows:

- To make a student able to knowledgeable to system administration and computer networks, to include components features and architecture.
- To explore the differentiate network standards, protocols, and access methods for implement the network system.
- To make student skill able to installation, configuration, and management of IP, DHCP, Name Server, DNS, Web server, file, print and mail server configuration and troubleshooting within the network operating system.
- Describe the specific actions that can be taken to enforce network level security.

3. Course Outlines:

Specific Objectives	Contents
• Describe the basic concept of Linux and Unix Architecture • Familiarizing with basic linux command	**Unit 1: Familiarizing with Linux and CLI Commands (30)** I. Introduction to free and open source software, Unix System Architecture, Unix Philosophy, Introduction to Linux. How is Linux different? The X windows system. Run level or system initialization levels. Virtual consoles (terminals), Command prompt, using a Linux System, Linux Command Line, Logging Out, Command Syntax, Files, Creating Files with cat, Displaying Files' Contents with cat, Deleting Files with rm, Copying and Renaming Files with cp and mv, Command History. II. Files and Directories, Examples of Absolute Paths, Current Directory, Making and Deleting Directories, Relative Paths, Special Dot Directories, Using Dot Directories in Paths, Hidden Files, Paths to Home Directories, Looking for Files in the System, Running Programs, Specifying Multiple Files(with rm, mkdir, cat), Finding Documentation for Programs, Specifying Files with Wildcards, Chaining

		Programs Together, Graphical and Text Interfaces, Text Editors
	III.	Shells, The Bash Shell, Shell Commands, Command-Line Arguments, Syntax of Command-Line Options, Examples of Command-Line Options, Setting Shell Variables, Environment Variables, Where Programs are Found, Bash Configuration Variables, Using History , Reusing History Items, Retrieving Arguments from the History, Bash Editing Keys, Combining Commands on One Line, Repeating Commands with for, Command Substitution, Finding Files with locate, Finding Files with find, find Criteria, find Actions: Executing Programs
	IV.	Process Text Streams Using Text Processing with less, wc, sort, uniq, cut, expand, fmt, head, tail, nl, cat, od, pr, split, tac, tr command
	V.	Perform Basic File Management: Filesystem Objects, Directory and File Names, File Extensions, wildcard patterns, cp, mv, rm, mkdir, rmdir, touch command, Searching Files with grep,
	VI.	Job Control and Processes: Job Control, jobs, fb, bg, Process, Process properties, Parent and child Processes, ps, ps options, process monitoring with pstree, top, Signaling Processes, Common Signals for Interactive Use, Sending Signals: kill, Sending Signals to Daemons: pidof, Modifying process execution priorities with nice and renice. Job Scheduling with cron, crontab, anacron and system log
	VII.	Filesystem Concepts: Filesystems, The Unified Filesystem, File Types, Inodes and Directories
	VIII.	Create and Change Hard and Symbolic Links, Working with compression utilities, Archiving files.
	IX.	Manage File Ownership and Permissions : Users and Groups, The Superuser: Root, Changing File Ownership with chown, Changing File Group Ownership with chgrp, Changing the Ownership of a Directory and Its Contents, Changing Ownership and Group Ownership Simultaneously, Basic Concepts: Permissions on Files, Permissions on Directories, Permissions for Different Groups of People, Examining Permissions: ls -l ,Preserving Permissions When Copying Files, Changing File and Directory Permissions: chmod, Specifying Permissions for chmod, Special Directory Permissions: 'Sticky' and setgid, Special File Permissions: Setgid and Setuid
	X.	Create and control Partitions and Filesystems: Concepts: Disks and Partitions, Disk Naming, Using fdisk, Making New Partitions, Changing Partition Types, Making Filesystems with mkfs, Mounting Filesystems, Mounting a Filesystem: mount, Mounting Other Filesystems, Unmounting a Filesystem: umount, Configuring mount: /etc/fstab, Filesystem Types, Mount Options, Mounting/unmounting a File, flash drive, cd drive .
	XI.	Package management: Install, remove, upgrade package

• Observing boot process • Learn to install linux OS	**Unit 2: Installation and Boot Process (7)** i. Installation: Client and server linux installation, Network based Installation ii. Boot Sequence, Kernel Initialization, INIT Process, Boot Loaders, LILO, Selecting What to Boot, Boot loader components, GRUB and grub.conf ,Starting the boot process: GRUB, Specifying Kernel Parameters, Boot Messages, Kernel initialization, init initialization, Kernel Modules
• Know how to add/ remove/ modify users • Setting permissions	**Unit 3:User Administration (7)** i. Adding new user account, user private group, modifying/ deleting user accounts, group administration, password aging policies, switching accounts, network users, authentication configuration, Default file permission, access control lists.
• Implementing quota • Managing disk and logical volumes	**Unit 4: Set and View Disk Quotas: (6)** i. What are Quotas, Hard and Soft Limits, Per-User and Per-Group Quotas, Block and Inode Limits ,Displaying Quota Limits: quota, Options in /etc/fstab, Enabling Quota: quotaon ,Changing Quota Limits: setquota, edquota and repquota, Software RAID implementation, Creating Logical volumes with LVM.
• Know to configure IPV4 and IPV6 addresses • Troubleshooting and configuring network	**Unit 5:Network Configuration : (5)** i. Introduction to IPv4 and IPv6 address, Dynamic and static IP address configuration, Network Interface Configuration, verifying IP connectivity, Defining a localhost name, Setting Default gateway, routes, Diagnosing Network startup issues, Network troubleshooting commands
• Configure DHCP and DNS	**Unit 6: Organizing Network system (6)** i. Configuring DNS: Host name resolution, The Stub resolver, DNS-Specific Resolvers, Trace a DNS query, Forward lookups, Reverse Lookups, Implementing a DNS server, Adding data to the Name server, adding slave DNS. ii. Configuring DHCP: Services of DHCP, Configuring an IPv4 DHCP server.
• To understand cross platform implementation for file sharing	**Unit 7: Network File Sharing Services (6)** i. Introduction to FTP server, NFS server, Client-side NFS, Samba.

	ii. Implementation of: File transport protocol (FTP) services, Network File Sharing (NFS) services, Samba server. iii. Providing access to a group directory
• Configure and implement web mail and database services	**Unit 8: Web, Email and database Services (7)** i. Implementing web (HTTP and HTTPS) services: Introduction to Apache, HTTPD, Server installation and basic configuration, using .htaccess files ,Using CGI, Securing Access website. ii. Email: Essential of Email operation, SMTP protocol, MTA, Implementation and configuration email: Sendmail configuration (incoming and outgoing), Postfix(incoming and outgoing) Procmail MTA configuration, Dovecot setup. iii. Setting up and Administering Database Server (MySQL)
• Assessing network security and securing data in network	**Unit 9: Securing Data and Network (6)** i. Introduction to cryptography, symmetric encryption, asymmetric encryption, PKI, Digital certificates, generation of Digital certificates, Open SSH overview, SSH authentication, using SSH keys with/without passphrase, using an SSH tunnel ii. Configuring a Firewall, Applying ACL

9 Instructional Techniques

The instructional techniques for this course are divided into two groups. First group consists of general instructional techniques applicable to most of the units. The second group consists of specific instructional techniques applicable to particular units.

4.1 General Techniques

Reading materials will be provided to students in each unit. Lecture, Discussion, use of multi-media projector, brain storming are used in all units.

4.2 Specific Instructional Techniques

Demonstration is an essential instructional technique for all units in this course during teaching learning process. Specifically, demonstration with practical works will be specific instructional technique in this course.

5. Evaluation :

Internal Assessment	External Practical Exam/Viva	Semester Examination	Total Marks
40 Points	20 Points	40 Points	100 Points

***Note**: Students must pass separately in internal assessment, external practical exam and semester examination.*

5.1 Internal Evaluation (40 Points):

Internal evaluation will be conducted by subject teacher based on following criteria:

1)	Class Attendance	5 points
2)	Learning activities and class performance	5 points
3)	First assignment (written assignment)	10 points
4)	Second assignment (Case Study/project work with presentation)	10 points
5)	Terminal Examination	10 Points
	Total	40 points

5.2 Semester Examination (40 Points)

Examination Division, Dean office will conduct final examination at the end of semester.

1)	Objective question (Multiple choice 10 questions x 1mark)	10 Points
2)	Subjective answer questions (6 questions x 5 marks)	30 Points
	Total points	40

5.3 External Practical Exam/Viva (20 Points):

Examination Division, Dean Office will conduct final practical examination at the end of semester.

10 Recommended books and References materials (including relevant published articles in national and international journals)

Recommended books:

- Limoncelli, T., Hogan, C. J., & Chalup, S. R. (2007). The practice of system and network administration (2nd ed., Updated and rev). Upper Saddle River, NJ: Addison-Wesley.
- Tony Bautts, Terry Dawson, Gregor N. Purdy,O'Reilly (2005). Linux Network Administrator's Guide, Third Edition,
- Æleen Frisch (2002), Essential System Administration: Tools and Techniques for Linux and Unix Administration, 3rd Edition, O'Reilly

References materials:

- Rankin, K., & Hill, B. M. (2010). The official Ubuntu server book (2nd ed). Upper Saddle River, NJ: Prentice Hall.
- Wale Soyinka (2009).Linux Administration: A Beginners Guide. Mcgraw Hill.

- Richard Fox. Linux with Operating system concepts
- Roderick W. Smith (2002). Advanced Linux Networking, Addison-Wesley Professional (Pearson Education)
- Christopher Negus (2015), Linux Bible (10th Ed.), Wiley
- Æleen Frisch (2002), Essential System Administration: Tools and Techniques for Linux and Unix Administration, 3rd Edition, O'Reilly