Program Content

Semester	V		
Course Code:	IT5406		
Course Name:	Systems and Network Administration		
Credit Value:	3 (2L + 1P)		
Core/Optional	Core		
Hourly Breakdown	**Theory**	**Practical**	**Independent Learning**
	30 Hrs	30 Hrs	90 Hrs

Course Aim:

- Develop systems and network administration skills such as planning, creating, building, and troubleshooting on GNU/Linux-based systems and services, ethical and professional practices, and technological awareness to meet software industry requirements.

Intended Learning Outcomes:

After following this course, students should be able to

- Plan installation and configuration of GNU/Linux operating systems and related network services to fulfill application requirements.
- Build security controls for a given set of access and process control/management requirements.
- Explain the root cause of issues in operating systems and network services based on theoretical and practical aspects.
- Select optimal software infrastructure solution for a given problem based on hosting, storage, file systems, backup, automation, access control, logging, etc.
- Planning, configuring, and building web hosting solutions considering load, security, resource optimization, access control, etc.
- Build automation scripts for recurrent and trigger driven events and applications.
- Create operating system and network services best practices guidelines to manage and maintain resilient software infrastructure.
- Explain code of ethics to maintain professional practices in system administration.

Course Content: (Main Topics, Sub topics)

Topic	Theory (Hrs)	Practical (Hrs.)
1. Introduction to System & Network Administration	01	00
2. Installing an Operating System	03	02
3. Host Management	08	08
4. Network Administration	10	10
5. Automating System Administration	04	05
6. Virtualization and Cloud Computing	04	05
Total	**30**	**30**

Students are expected to have practical work to complete their learning in these topics.
The recommended operating system that should use for this module is CentOS 6 or better.

1. **Introduction to System & Network Administration (1 hour) [Ref 1: Pg. (3-29)]**
   - 1.1. Essential duties of a System Administrator
   - 1.2. Linux distributions
   - 1.3. Man pages and Other on-line Documentation
   - 1.4. Ways to find and Install Software
   - 1.5. Specialization and Adjacent Disciplines
   - 1.6. Ethics [Ref 2:]

2. **Installing an Operating System (3 hours) [Ref 1: Pg. (30-64)]**
   - 2.1. The Boot Process and Boot Loaders
   - 2.2. The Grand Unified Boot Loader
   - 2.3. System Management Daemons
   - 2.4. Reboot and Shutdown Procedure
   - 2.5. Stratagems for a non-booting System
   - 2.6. Drivers and the Kernel [Ref 1: Pg. (325-359)]

3. **Host Management (08 hours)**
   - 3.1. Access Control and Rootly Powers [Ref 1: Pg. (65-89)]
     - 3.1.1. Standard UNIX Access Control
     - 3.1.2. Management of Root Account
     - 3.1.3. Extensions to the Standard Access Control Model
     - 3.1.4. Modern Access Control
   - 3.2. Process Control [Ref 1: Pg. (90-119)]
     - 3.2.1. Components of a Process
     - 3.2.2. The Life Cycle of a Process
     - 3.2.3. Monitoring Processes
     - 3.2.4. Runaway Processes
     - 3.2.5. Periodic Processes
   - 3.3. File System [Ref 1: Pg. (120-152)]
     - 3.3.1. Introduction to File System – Pathnames, Mounting, unmounting and Organization
     - 3.3.2. File Types
     - 3.3.3. File Attributes
     - 3.3.4. Access Control Lists
   - 3.4. Software Installation and Management [Ref 1: Pg. (153-181)]
     - 3.4.1. Managing Packages and Linux Package Management Systems
     - 3.4.2. High-Level Linux Packages Management Systems
     - 3.4.3. Software Localization and Configuration
   - 3.5. User Management [Ref 1: Pg. (243-269)]
     - 3.5.1. The /etc/passwd File
     - 3.5.2. The /etc/shadow File
     - 3.5.3. The /etc/group File
     - 3.5.4. Adding Users – Manual and via Scripts
     - 3.5.5. Removing Users

3.5.6. User Login Lockout
3.5.7. Risk Reduction with PAM
3.5.8. Centralized Account Management
3.6. Logging [Ref 1: Pg. (294-324)]
3.6.1. Log Locations
3.6.2. The system Journal
3.6.3. Syslog
3.6.4. Kernel and Boot-time Logging
3.6.5. Management and Rotation of Log Files
3.6.6. Logging Policies
3.7. Storage [Ref 1: Pg. (717-790)]
3.7.1. Storage Hardware and Interfaces
3.7.2. Disk Partitioning
3.7.3. Logical Volume Management
3.7.4. Redundant Arrays of Inexpensive Disks
3.7.5. Traditional File Systems
3.7.6. Next Generation File Systems
3.7.7. Data Backup Strategies

4. Network Administration (10 hours)

4.1. Networking [Ref 1: Pg. (417-458)]
4.1.1. Linux Networking
4.1.2. Network Troubleshooting
4.1.3. Network Monitoring
4.1.4. Firewalls and NAT
4.1.5. Cloud Networking
4.2. The Domain Name System [Ref 1: Pg. (498-551)]
4.2.1. DNS Architecture
4.2.2. DNS Namespace
4.2.3. How DNS Works
4.2.4. DNS Database
4.2.5. Bind Software Configuration
4.2.6. Zone File Updating
4.3. Single Sign-On [Ref 1: Pg. (578-593)]
4.3.1. Core SSO Elements
4.3.2. LDAP Service
4.3.3. Using Directory Service for Login
4.4. Web Hosting [Ref 1: Pg. (674-714)]
4.4.1. Hypertext Transfer Protocol (HTTP)
4.4.2. Web Software Basics
4.4.3. Web Hosting in the Cloud
4.4.4. Apache Configuration
4.4.5. NGINX Configuration
4.4.6. Load Balancing with HAProxy

5. Automating System Administration (4 hours) [Ref 1: Pg. (182-222)]

- 5.1. Scripting Philosophy
- 5.2. Shell Basics
- 5.3. Shell Scripting
- 5.4. Regular Expressions
- 5.5. Python Scripting
- 5.6. Revision Control with GIT [Ref 1: Pg. (235-240)]

6. Virtualization and Cloud Computing (4 hours)

- 6.1. Cloud Computing [Ref 1: Pg. (270-293)]
  - 6.1.1. Cloud Platform Choices
  - 6.1.2. Cloud Service Fundamentals
  - 6.1.3. Clouds – Amazon, Google, Digital Ocean
  - 6.1.4. Cost Control
- 6.2. Virtualization [Ref 1: Pg. (900-910)]
  - 6.2.1. Virtual Vernacular
  - 6.2.2. Virtualization with Linux
- 6.3. Containers [Ref 1: Pg. (915-948)]
  - 6.3.1. Background and Core Concepts
  - 6.3.2. The Open Source Container Engine – Docker
  - 6.3.3. Containers in Practice
  - 6.3.4. Container Clustering a Management

Teaching /Learning Methods:

You can access all learning materials and this syllabus in the VLE: http://vle.bit.lk/, if you are a registered student of the BIT degree program.

Assessment Strategy:

In the course, case studies/Lab sheets will be introduced, and students have to participate in the learning activities.

The final exam of the course will be held at the end of the semester. This course is evaluated using a two-hour question paper consisting of 4 Structured Questions.

References/ Reading Materials:

- **Ref 1.** Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley and Dan Mackin "UNIX and Linux System Administration Handbook" (5th Edition), Pearson Education, Inc., 2018.
- **Ref 2.** https://lopsa.org/CodeOfEthics