Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Department of Applied Radio Electronics

[RE-125] LINUX SOFTWARE INTERFACE

Work program of the academic discipline (Syllabus)

Course details

Level of higher education	First (bachelor's)
Field of knowledge	17 - Electronics, Automation, and Electronic Communications
Specialization	172 - Electronic Communications and Radio Engineering
Educational program	All educational programs
Discipline status	Elective (F-catalog)
Form of higher education	Full-time
Year of training, semester	Available for selection starting from the 2nd year, spring semester
Scope of the discipline	4 credits (Lectures 18 hours, Practical classes 36 hours, Laboratory work 36 hours, Independent work 66 hours)
Semester Control/control measures	Credit
Class schedule	https://schedule.kpi.ua
Language of instruction	Ukrainian / English
Information about the course leader / lecturers	Lecturer: V. S. Mosiychuk, Lab: V. S. Mosiychuk, SRC: V. S. Mosiychuk
Course location	https://sylabus.online/print/3h-prohramnyi_interfeis_linux

Curriculum

1. Description of the course, its purpose, subject matter, and learning outcomes

The purpose of the academic discipline "**Linux Software Interface**" is to develop the ability to understand the structure and features of the Linux operating system; understand the syntax and rules of OS control commands; understand the file system and access rights hierarchy; understand the need for and capabilities of basic operations in the Linux OS; create software with the ability to exchange data at the level of different software interfaces of the Linux OS.

2. Prerequisites and post-requisites of the discipline (place in the structural-logical scheme of training under the relevant educational program)

Before starting the course, it is necessary to complete the discipline "Computer Science", in particular the basics of programming in C

3. Contents of the course

Section 1. *Introduction to the Linux operating system and command line*

Topic 1.1: "History of Linux and standards"

The emergence of BSD and System-V. A brief history of Linux. The GNU project. The Linux kernel, DSD versions, Linux distributions, hardware architectures and OS porting, standardization, the first POSIX standards, the development of UNIX standards, Linux standards and regulatory framework.

Topic 1.2: "Installing the Ubuntu OS distribution"

Configuring virtualization and installing Linux on a virtual machine, working with the command line, checking the OS version, installing and updating software, package managers.

Topic 1.3: "Linux commands"

Navigation, commands, file and directory manipulation, redirection, hotkey combinations, access rights, processes.

Topic 1.4: "Configuring the Work Environment."

Work environment settings and variables, *startup files, using text editors, using comments, activating changes.*

Topic 1.5: "Working with the vi editor"

Starting and exiting the editor, compatibility modes, editing, saving data, moving the cursor, basic editing capabilities, adding and deleting text, copying, cutting and pasting text, search and replace, editing multiple files, switching between files, copying text from one file to another, saving information.

Topic 1.6: "*Working with storage media"*

Mounting and unmounting storage devices, viewing a list of mounted file systems, determining device names, creating new file systems, manipulating partitions using fdisk, creating a new file system using mkfs, testing and restoring file systems, fsck, moving data directly to and from devices, creating CD images, creating a copy of a CD image, defining an image from a set of files, a program with any other name, writing CD-ROM images, installing an ISO image directly from vi.

Topic 1.7: "*Network Configuration"*

Checking and monitoring the network, ping, traceroute, ip, netstat, transferring files over the network, ftp/lftp, wget, secure communication with remote hosts, ssh, tunneling with SSH, scp, and sftp.

Topic 1.8: "*Archiving and Backups"*

File compression, gzip, bzip2, file archiving tar, zip, file and directory synchronization, using rsync over a network, vii.

Topic 1.9: "Regular expressions"

What are regular expressions, grep, metacharacters and literals, any character pattern, anchors,

*expressions in parentheses and character classes, negation, traditional character ranges, POSIX character classes, returning to traditional collation order, basic and advanced regular expressions, alternation, quantifiers ? * + { }, working with regular expressions, checking a list of phone numbers with grep, searching for file names with find, searching for files with location, searching for text with less and vim editors.*

Topic 1.10: "Text processing and output formatting**"**

Documents, program source code, cat, text, sort, uniq, pagination, cut, paste, join, text comparison, comm, viii, diff, patch, on-the-fly editing, tr, sed, aspell. Simple formatting tools, nl – number of lines, fold – wrapping each line to a specified length, fmt – simple text formatting, pr – text formatting for printing, printf – formatting and printing data, document formatting systems, groff.

Topic 1.11: "Compiling programs*"*

Compiling C programs, obtaining source code, studying the source tree, building programs, ix, installing programs.

Section 2. *System programming*

Topic 2.1 "Basic concepts and ideas of system programming"

File input/output model, programs, processes, memory mapping, static and dynamic libraries, interprocess communication and synchronization, signals, threads, real-time execution. System calls, library functions, error handling, system data types. Program porting issues.

4. Teaching materials and resources

Supplementary literature

1. The Linux Programming Interface: A Linux and UNIX System Programming Handbook / Michael Kerrisk. - San Francisco, 2010. - 1556 p.
2. The Linux Command Line: Fifth Internet Edition / William Shotts. - 2019. - 555 p.

Information resources

1. Official Linux website. - Access mode: www.linux.org
2. Linux Documentation Project. - Access mode: www.tldp.org
3. Linux Kernel Archives. - Access mode: www.kernel.org
4. LinuxCommand.org project. - Access mode: http://linuxcommand.org

Educational content

5. Methodology for mastering the academic discipline (educational component) Teaching methods:

- Lectures
- Laboratory classes
- Independent work
- Group projects (DCR)

List of lectures

1. **Introduction to Linux and its architecture**

○ History and evolution of Linux.
○ Fundamentals of Linux operating system architecture. ○ Comparison with other operating systems.

2. **Basics of the command shell**

○ Introduction to Bash and other shells.
○ Basic commands and file system navigation. ○ Using pipelines and redirections.

3. **The Linux file system**

○ File system structure and hierarchy. ○ Access rights and file management.
○ Mounting and unmounting file systems.

4. **Processes in Linux**

○ Creating and terminating processes.
○ Process management: priorities, signals, and monitoring. ○ Using ps, top, kill, and other commands.

5. **Linux networking capabilities**

○ Basics of network configuration.
○ Using tools for network configuration (ifconfig, netstat, ping). ○ Network security basics.

6. **Scripting and automation**

○ Basics of Bash scripting.
○ Variables, loops, and conditions.
○ Automating tasks with cron and at.

7. **Application Programming Interface (API)**

○ Introduction to system calls and software interfaces. ○ Using APIs to work with files and processes.
○ Interprocess communication (IPC).

8. **Security and access control**

○ User and group management.
○ Introduction to SELinux and AppArmor. ○ Encryption and data protection.

9. **Development and debugging tools**

○ Using compilers and linkers.
○ Debugging programs with gdb.
○ Introduction to the Git version control system.

List of lab assignments

1. **Introduction to the Linux command line**

○ Basics of working with the command line.
○ Executing basic commands: ls, cd, pwd, cp, mv, rm. ○
Working with the man help system.

2. **Linux file system**

○ File system structure.
○ Access rights to files and directories: chmod, chown, chgrp. ○
Using symbolic and hard links.

3. **Text editing in Linux**

○ Comparison of text editors: nano, vim, gedit. ○
Basics of working with the vim editor.
○ Automating editing with sed and awk.

4. **Text data processing**

○ Using grep to search for text.
○ Sorting and processing data using sort, uniq, cut, paste. ○
Practice with regular expressions.

5. **Process management**

○ Viewing and managing processes: ps, top, htop. ○
Using kill, nice, renice commands.
○ Scheduling tasks using cron and at.

6. **Linux network tools**

○ Basics of network commands: ping, netstat, traceroute, ifconfig, ip. ○
Using ssh for remote access.
○ Configuring a basic firewall using iptables.

7. **Bash scripts**

○ Basics of writing Bash scripts.
○ Variables, loops, and conditions in Bash scripts. ○
Automating tasks using scripts.

8. **Package management**

○ Using package managers: apt, yum, dnf.
○ Installing, updating, and removing software. ○
Working with repositories and PPAs.

9. **Security and backup in Linux**

○ Security basics: configuring users and groups. ○
Creating backups using tar, rsync.
○ Configuring and using sudo.

6. Independent work by students

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Policy and control

7. Academic discipline policy (educational component)

Requirements for students:

- Active participation in discussions and laboratory classes • Independent preparation for classes
- Timely completion of all assigned tasks

Rules for attending classes (both lectures and practical/laboratory classes)

Laboratory work is mandatory. If these classes are missed, they must be made up during consultations or with other groups. If lectures are missed, tests on the material covered in the missed class must be taken and passed. Lecture materials and videos are posted on the LMS.

Defense of laboratory work

Laboratory work is defended on the day the laboratory work is completed. The student receives two grades. The first is for activity and initiative during the laboratory work and individual classes. The second is for the defense and answers to control questions.

Defense of individual assignments

As part of their independent work, students complete assignments based on lecture materials. Based on the results of the assessment, course participants receive feedback from the instructor and a grade. Individual assignments cannot be retaken.

Incentive and penalty points and academic integrity policy

The most active students and students who complete individual assignments in an exemplary manner can receive up to 10 points towards their semester grade.

Penalty points are applied in cases of passing off someone else's work as one's own, with mandatory reworking of the work.

Deadline and retake policy

If the deadlines for submitting assignments are missed, the maximum score for the assignments is reduced by 10%.

8. Types of control and the learning outcomes assessment rating system (LOAS)

Learning outcomes assessment rating system

- Lectures/webinars - 18 hours; (2 *MCR x 15 points*)
- SRS (6 assignments x 5 points)
- Laboratory work - 36 hours; (*8 labs x 5 points*)
- Homework assignment (*30 points*)

Table of correspondence between rating points and university scale grades

Number of points	Grade
10	Excellent
94	Very good
84	Good
74-65	Satisfactory
64-60	Sufficient
Less than 60	Unsatisfactory
Admission requirements not met	Not admitted

9. Additional information on the discipline (educational component)

Consultations

- The instructor provides consultations by appointment through the academic discipline community.

Description of material, technical, and informational support for the discipline

Computer lab with 12 workstations with the ability to use virtualization.

Work program for the academic discipline (syllabus):
Compiled by V. S. Mosiychuk;
Approved by the PRE Department (Minutes No. 06/2024 dated 06/27/2024)
Approved by the methodological commission of the faculty/research institute (protocol No. 06/2024 dated 28.06.2024)