FACULTY OF COMPUTER SCIENCE AND ENGINEERING

CURRICULUM

Approved:
Dean:

CS 202

OPERATING SYSTEMS

Approved: #13 / 11.03.2020
Lecturer: Assoc. Prof. Dr. Dimitar Minchev

ANNOTATION

Operating systems are an integral part of computer systems. Their knowledge is important in the installation, maintenance and configuration of computers with different purposes. Modern operating systems are distinguished by their great complexity, given the hardware they manage. Fundamental concepts in the construction of operating systems are discussed in the discipline. Issues related to the implementation of security and safety of individual systems are addressed.

MAIN OBJECTIVES

The main goal of the discipline is to form knowledge about how the operating system works as a whole. A major focus is on how students will master the individual elements of operating systems such as:

- resource management;
- definition of processes and their interaction;
- memory management as an integral part of the computer system;
- management of individual devices that have a specific structure.

After studying the discipline, individual learners are expected to master the basics of creating operating systems, without being tied to a specific type, and to apply their knowledge to different situations, implementing operating systems of different sizes and functionality.

PREREQUISITES

The discipline is very important to understand how computer systems work. Students are expected to have solid knowledge of programming, theory of algorithms, discrete mathematics, computer architectures, and computer networks.

STATUS AND STRUCTURE

Specialty	Status	Credits	Full-time study				Part-time study			
			L	S	P	Total	L	S	P	Total
Software Engineering	Mandatory	7	40	30		70	25	15		40
Computer Systems and Technologies	Mandatory	7	40	30		70	25	15		40

COURSE CONTENT

Topic 1: Operating systems. Types of operating systems: early, batch, multi-program and modern operating systems: Unix, Linux, Windows.

Topic 2: Structure of operating systems. System components. Operating system services. System calls. System structure. Layered operating system model. Structure of operating systems. Operating system kernel. Handling the interruptions. System programs.

Topic 3: Structural organization of operating systems. Implementation of operating systems. Structure of operating systems. Structural organization of Unix, Linux, Windows.

Processes and interaction between processes. Parallel and synchronous systems. Synchronization and communication between processes.

Topic 4: Deadlock: conditions for occurrence, resource allocation graph. Strategies for fighting the deadlock Communication deadlock. Processor Management: High-Level Scheduling in Batch Systems. Planning in Unix, Linux, Windows.

Topic 5: Processes. Concept of processes. Allocation of processes. Process operations. Mechanisms for implementing programs. Subprograms, characterization and implementation. Inter-processor communication. Client-server communication.

Topic 6: Memory Management: Basic Principles. Memory management methods. Memory Management in Unix.

Topic 7: Virtual memory: essence, strategies for input, output, and paging. Single and multiple virtual memory, Intel x86 . Virtual memory management in Unix, Linux, Windows.

Topic 8: Device management: I/O subsystem organization, devices and processes, I/O buffering, disk scheduling, hardware performance enhancements, scheduling algorithms. Disk cache and virtual disk. Input-output systems of the Unix, Linux, Windows.

Topic 9: File management: file system structure, file organization and access methods, directories, secondary memory management, file access management. Increase the performance of the file system. Manage the files in c Unix, Linux, Windows.

Topic 10: Operating systems for multiprocessor systems and networks: multiprocessor systems, operating systems, resource management.

Topic 11: Networks: types of networks, organization of networks, operating systems for networks.

Topic 12: Distributed Systems. Nature and characteristics. Topologies. Types of networks. Communications. Communication protocols. distributed file systems. Remote access to file information. Synchronization in distributed systems.

Topic 13: Protection of operating systems. Purpose of protection. Domains for protect. Access Matrix. Implementation compatibility. User Submission and Verification. Authorization. System processes. User processes. Cryptography. Classification of security in computer systems.

Topic 14: Linux. History. Concepts in construction. Kernel and kernel modules. Process management. Processor allocation. Memory management. Intra-process communication. Network structure. System security.

Windows. Historical development. Principles of construction. System components. Components of the environment. File systems. Network structure. Program interfaces.

SEMINAR EXERCISES

Topic 1. Management of operational memory: introduction, organization and strategy of management.

Topic 2 . Related RAM allocation.

Topic 3 . Allocation of RAM into contiguous fixed partitions.

Topic 4 . Allocation of RAM to continuous variable sections.

Topic 5 . Unlinked RAM Allocation: Introduction, Virtual memory, blocks and their memory image.

Topic 6 . Processor Management: Scheduling and Service Disciplines.

Topic 7. Process management: concept of process in operating systems, process state, process operations, stopping and resuming processes.

Topic 8 Process management: parallelism, mutual exclusion of processes, sync ..

Topic 9 . Process management: collisions - introduction, necessary conditions for occurrence, prevention.

Topic 10 . Process management: interprocessor connections - subprograms, co-programs, linking.

Topic 11 . Device management: control devices, intermediaries (channels), connection.

Topic 12 . Device management: handling I/O requests operations, drivers.

Topic 13 . Device management: I/O actions operations - buffering, blocking/unblocking, error handling.

Topic 14 . File System: Introduction, File Organization.

Topic 15 . File system: access methods, functions.

COURSEWORK

A list of individual tasks is offered for each student, which are developed during the semester. The defense takes place at the end of the semester.

ASSESSMENT METHODS

Each student's work during the semester is evaluated with a running grade. When forming this assessment, the results of the exercises and developed course assignment are also taken into account. The semester exam is written and It is comprised of a test with opened and closed questions. In forming the final grade, in addition to the result of the semester exam, the current grade is also taken into account.

To have their assessment formed, the student collects points, the maximum value of which is 100. The distribution of points by evaluated activities is as follows:

1. Auditorial attendance..... .... **34 points**
   - 1.1. Current control of lectures, control tests 14 points
   - 1.2. Current control of seminar, laboratory exercises 20 points
     (attendance, courseworks, participation in exercises, homework, etc.)

2. Outside-classroom activities..... .... 12 points
   - 2.1. Course assignments, term papers, projects, protocols, etc. 12 points

3. Examination procedure..... .... 54 points

The overall grade is determined by the sum of the points during the semester and by the examination procedure:

36-50 pt. - Middle (3); 51-65 pt. – Good (4); 66-80 pt.– Verry Good (5); Over 81 pt. – Excellent (6).

The student must have a minimum of 14 points from the control during the semester and a minimum of 22 points from the examination procedure in order to form a final grade.

RECOMMENDED LITERATURE

1. Л. Николов. Операционни системи, Сиела, София, 2009
2. Л. Николов. Системно програмиране, Сиела, София, 2005
3. Kalfa, W., Betriebsysteme. Akademie Verlag Berlin, 1990
4. Solomon d., Rosinovich m., Inside Microsoft Windows 2000, Microsofty Press, Redmont 3th Edition, 2000
5. Stevens R., Adwanced Programng in the UNIX Environment. Professional Computing Series. Addison Wesley 1993
6. Tanenbaum A., Modern Operating Systems, Hanser 1995
7. Silberschatz G., Operating System Concepts, 6th Edition, John Wiley & Sons, Inc. 2003
8. Николов Л., Операционни системи, четвърто издание, Сиела 2005
9. Coulouris G., Distributed Systems. Concepts and Design, 4th Edition Addison Wesley, 2002
10. Baumgartl R., Betriebssyteme, TU-Chemnitz, 2003
11. Chapell D., Understanding Windows 2000 Distributed Service, Microsoft Press 2000
12. Vahalia, U., UNIX Internals, The new Frontiers, Prentice Hall 1996
13. Иванов И.,Стойков П., Операционни системи, част 1,2,София,2016
14. D.K. Academy, Командите в Linux, Асеневци, 2019
15. Linux Document Project, http://www.linux.org
16. http://www.personal.kent.edu/~rmuhamma/OpSystems/os.html
17. http://www.operating-system.org/betriebssystem/_english/bs-riscos.htm
18. http://www.cpp-home.com/archives/355.html