SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Field of study	**Computers and Information Technology**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Information Engineering**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)	**Operating Systems** Sisteme de Operare						
2.2 Course coordinator	**Assoc. Prof. PhD. Sanda-Maria Avram**						
2.3 Seminar coordinator	**Assoc. Prof. PhD. Sanda-Maria Avram**						
2.4. Year of study	**2**	2.5 Semester	**4**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Compulsory DD**
2.8 Code of the discipline	**MLE5007**						

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	**5**	Of which: 3.2 course	**2**	3.3 seminar/laboratory	**2 LP 1 S**
3.4 Total hours in the curriculum	**70**	Of which: 3.5 course	**28**	3.6 seminar/laboratory	**42**
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					23
Additional documentation (in libraries, on electronic platforms, field documentation)					18
Preparation for seminars/labs, homework, papers, portfolios and essays					19
Tutorship					10
Evaluations					10
Other activities:					

3.7 Total individual study hours	**80**

3.8 Total hours per semester	**150**
3.9 Number of ECTS credits	**6**

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competencies	• Basic programming skills in C standard.

5. Conditions (if necessary)

5.1. for the course	• A lecture class with video projector.
5.2. for the seminar /lab activities	• Laboratory with computers connected to the Intenet and UNIX/LINUX-like operating systems or access to an UNIX/LINUX cerver.

6. Specific competencies acquired

Professional competencies	C2.1 Describing the structure and operation of hardware, software and communication components

C2.2 Explaining the role, interaction and operation of hardware, software and communication components

C2.3 Construction of hardware and software components of computing systems using design methods, languages, algorithms, data structures, protocols and technologies

C2.4 Metric based evaluation of functional and non-functional characteristics of computing systems

C2.5 Implementation of hardware, software and communication components

C3.1 Identifying classes of problems and solving methods that are specific to computing systems

C3.2 Using interdisciplinary knowledge, solution patterns and tools, making experiments and interpreting their results

C3.3 Applying solution patterns using specific engineering tools and mehods

C3.4 Comparatively and experimentaly evaluation of the alternative solutions for performance optimization

C3.5 Developing and implementing information system solutions for concrete problems |
| **Transversal competencies** | CT1 Honorable, responsible, ethical behavior, in the spirit of the law, to ensure the professional reputation

CT3 Demonstrating initiative and pro-active behavior for updating professional, economical and organizational culture knowledge |

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Uptake of the leraner on the main concepts underlying operating systems.
7.2 Specific objective of the discipline	• Acquiring main facilities offered by the UNIX operating systems. • Acquiring skills in shell programming and processing text files under UNIX. • Management of multitasking applications using UNIX processes.

8. Content

8.1 Course	Teaching methods	Remarks

1-3 Unix OS: external interfaces
  - The general structure of an operating system
  - Regular expressions to specify files; generic specification
  - Filters; general principles: sort, awk, sed, grep
  - Unix Shells: sh, csh, ksh, bash; overview
  - Useful Shell commands and external processes management
  - Shell programming;
  - The structure of directories in Unix system
  - The mount-ing concept
  - Symbolic and hard links
	Exposure: description, explanation, examples, discussion of case studies	

4-7 Unix operating system: system calls, internal structures
  - Files and processes under Unix
  - I / O using handle: open, close, lseek, read, write, after, dup2
  - File Protection
  - Processes in Unix; process structure
  - Calls process management system: fork, wait, exit, exec *
  - Communications between processes: pipe, popen, FIFO
  - POSIX Threads
	Exposure: description, explanation, examples, discussion of case studies	

8-9 Filesystems
  - General management issues disk and file systems
  - Planning disk access
  - The internal structure of the disk and DOS file system; FAT
  - The internal structure of the disk and file system Windows NT & 2000; NTFS mechanism, MFT file
  - The internal structure of the disk and Unix file system; i-node mechanism
	Exposure: description, explanation, examples, discussion of case studies	

10-14 General Theory of operating systems
    - Types of computers and operating systems.
      Classifications
    - I/O Channel, multiple buffers.
      Multiprogramming.
    - General structure and functions of an
      operating system
    - The concept of process: specification,
      competition, semaphores, deadlock
    - Process Scheduling
    - Problems with memory management
    - Planning exchange between the internal
    memory and secondary
	Exposure: description,
	explanation,
	examples, discussion
	of case studies	

Bibliography

In English:
1.   **Albing, C., Vossen, J.P., Newhman, C.,** bash Cookbook: Solutions and Examples for bash Users, O'Reilly, USA, 2007.
2.   **Kernighan, B.W., Dennis, R.M.,** The C Programming Language, Prentice Hall, Massachusetts, 2012.
3.   **Stallings, W.,** Operating Systems: Internals and Design Principles, Pearson Education Limited, Essex, 2015.
4.   **Raymond, E.S.,** The Art of UNIX Programming, Addison-Wesley, Pearson Education Limited, USA, 2004.
5.   **Tanenbaum, A., Herbert, B.,** Modern Operating Systems, Pearson Education Limited, Essex, 2015.

In Romanian:
6.   **Boian, F., Vancea, A., Boian, R., Bufnea, D., Sterca, A., Cobarzan, C., Cojocar, D.,** Sisteme de operare, Ed. Risoprint, Cluj-Napoca, 2006.

8.2 Laboratory	Teaching methods	Remarks
1-2. Unix commands for working with files	Dialogue, debate, case studies, examples, proofs	
3. Shell 1	Dialogue, debate, case studies, examples, proofs	
4. sed and grep utilities	Dialogue, debate, case studies, examples, proofs	
5. awk utility	Dialogue, debate, case studies, examples, proofs	

6. shell Programs	Dialogue, debate, case studies, examples, proofs	
7-8. C programs; working with Unix files	Dialogue, debate, case studies, examples, proofs	
9. UNIX Processes	Dialogue, debate, case studies, examples, proofs	
10. Communications between Unix processes: pipe	Dialogue, debate, case studies, examples, proofs	
11. Communications between Unix processes: FIFO	Dialogue, debate, case studies, examples, proofs	
12. Unix-Threads	Dialogue, debate, case studies, examples, proofs	
13. Closing lab activities	Dialogue, debate, case studies, examples, proofs	
14. Practical exam	Dialogue, debate, case studies, examples, proofs	

Bibliography

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1.   **Albing, C., Vossen, J.P., Newhman, C.,** bash Cookbook: Solutions and Examples for bash Users, O'Reilly, USA, 2007.
2.   **Kernighan, B.W., Dennis, R.M.,** The C Programming Language, Prentice Hall, Massachusetts, 2012.
3.   **Raymond, E.S.,** The Art of UNIX Programming, Addison-Wesley, Pearson Education Limited, USA, 2004.

In Romanian:
4.   **Boian, F., Vancea, A., Boian, R., Bufnea, D., Sterca, A., Cobarzan, C., Cojocar, D.,** Sisteme de operare, Ed. Risoprint, Cluj-Napoca, 2006.

8.3 Seminar	Teaching methods	Remarks
1-2. Unix commands for working with files. Shell	Dialogue, debate, case studies, examples, proofs	

3. sed and grep utilities. awk utility	Dialogue, debate, case studies, examples, proofs	
4. shell Programs ,C programs; working with Unix files	Dialogue, debate, case studies, examples, proofs	
5. UNIX Processes	Dialogue, debate, case studies, examples, proofs	
6. Communications between Unix processes: pipe. Communications between Unix processes: FIFO	Dialogue, debate, case studies, examples, proofs	
7. Unix-Threads.	Dialogue, debate, case studies, examples, proofs	

Bibliography

In English:
    4.   **Albing, C., Vossen, J.P., Newhman, C.,** bash Cookbook: Solutions and Examples for bash Users, O'Reilly, USA, 2007.
    5.   **Kernighan, B.W., Dennis, R.M.,** The C Programming Language, Prentice Hall, Massachusetts, 2012.
    6.   **Raymond, E.S.,** The Art of UNIX Programming, Addison-Wesley, Pearson Education Limited, USA, 2004.

In Romanian:
    5.   **Boian, F., Vancea, A., Boian, R., Bufnea, D., Sterca, A., Cobarzan, C., Cojocar, D.,** Sisteme de operare, Ed. Risoprint, Cluj-Napoca, 2006.

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- This course exists in the curriculum in all major universities in Romania and abroad.
- This course provides the basic knowledge that any administrator or developer must posses.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course			

	- know the basic principle of the domain	Final exam	40%
10.5 Seminar/lab activities	- application of these concepts in solving problems	Lab assignments	20%
	- writing shells and creating Unix processes	Practical exam	40%

10.6 Minimum performance standards
➢ At least grade 5 (from a scale of 1 to 10) for all types of examination.

Date   Signature of course coordinator   Signature of seminar coordinator

18.05.2022   Assoc.Prof.PhD. Sanda-Maria Avram   Assoc.Prof.PhD. Sanda-Maria Avram

Date of approval   Signature of the head of department

Prof. PhD. Laura DIOȘAN

24.05.2022