SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeș-Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Field of study	**Computer Science**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Artificial Intelligence - English**

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	**1**	2.5 Semester	**2**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**mandatory**
2.8 Code of the discipline			**MLE5007**				

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

3.1 Hours per week	**4**	Of which: 3.2 course	**2**	3.3 seminar/laboratory	**3**
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					18
Additional documentation (in libraries, on electronic platforms, field documentation)					13
Preparation for seminars/labs, homework, papers, portfolios and essays					9
Tutorship					8
Evaluations					7
Other activities:					

3.7 Total individual study hours	**55**
3.8 Total hours per semester	**125**
3.9 Number of ECTS credits	**5**

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competencies	• Minimum knowledge of standard C programming.

5. Conditions (if necessary)

5.1. for the course	• Class room equipped with video projector.
5.2. for the seminar /lab activities	• Laboratory with computers connected to the Internet and UNIX operating system or access to a UNIX server

6. Specific competencies acquired

Professional competencies	C6.1. Identify basic concepts and models for computing systems. C6.2. Identify and explain the basic architectures for systems organization and management. C6.3. Use techniques for installing, configuring and managing systems. C6.4. Establish performance metrics for response times and resource consumption; Configure access rights.
Transversal competencies	CT1. Applying the rules of organized and efficient work, responsible attitudes towards the didactic-scientific field, for the creative use of one's own potential, respecting the principles and rules of professional ethics. CT3. Use of efficient methods and techniques for learning, information, research and development of skills to capitalize on knowledge, to adapt to the requirements of a dynamic society and to communicate in Romanian and in an international language.

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

7.1 General objective of the discipline	• Assimilation by the student of the main concepts underlying operating systems.
7.2 Specific objective of the discipline	• Learning the main facilities offered by the Unix operating system. • Shell programming and text file processing skills under Unix. • Managing multitasking applications using Unix processes.

8. Content

8.1 Course	Teaching methods	Remarks

1-3 Unix OS: external interfaces • General operating system structure • Regular expressions, file specification, generic specification • Filters; general principles sort, awk, sed, sed, grep • sh, csh, ksh, bash; general introduction • Useful shell commands and external process management • Shell programming; shell applications • The structure of directories in Unix system • 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 in C POSIX: open, close, lseek, read, write, dup, dup2 • File protection • Processes under Unix; structure of a process • Process management system calls: fork, wait, exit, exec* • Communication between processes: pipe, popen, FIFO • POSIX threads	Exposure: description, explanation, examples, discussion of case studies	
8-9 Filesystems • General disk management and file systems • Scheduling magnetic disk access • DOS disk and file system internal structure; FAT table • WindowsNT & 2000 disk and file system internal structure; NTFS mechanism, MFT file • Unix disk and file system internal structure; i-node mechanism	Exposure: description, explanation, examples, discussion of case studies	
10-14 General Theory of operating systems • Types of computer systems and operating systems. • I/O channel, multiple buffers. Multiprogramming. • General structure and functions of an operating system • Processes: specification, concurrency, semaphores, deadlock • Process scheduling • Memory management • Scheduling swap between internal and secondary memory	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 Seminar / laboratory	Teaching methods	Remarks
week 1-2. Unix commands for working with files	Dialogue, debate, case studies, examples, proofs	
week 3. Shell 1	Dialogue, debate, case studies, examples, proofs	
week 4. sed and grep utilities	Dialogue, debate, case studies, examples, proofs	
week 5. awk utility	Dialogue, debate, case studies, examples, proofs	
week 6. shell Programs	Dialogue, debate, case studies, examples, proofs	
week 7-8. C programs; working with Unix files	Dialogue, debate, case studies, examples, proofs	
week 9. UNIX Processes	Dialogue, debate, case studies, examples, proofs	
week 10. Communications between Unix processes: pipe	Dialogue, debate, case studies, examples, proofs	
week 11. Communications between Unix processes: FIFO	Dialogue, debate, case studies, examples, proofs	
week 12. Unix-Threads	Dialogue, debate, case studies, examples, proofs	
week 13. Closing lab activities	Dialogue, debate, case studies, examples, proofs	
week 14. Practical exam	Dialogue, debate, case studies, examples, proofs	

Bibliography
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 Desing 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.

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 study program of all major universities in Romania and abroad.
- This course provides the basic knowledge that any system administrator or programmer must have.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share of grade (%)
10.4 Course	- knowledge of the basic principles of the field	Final exam (regular session)	40%
10.5 Seminar/lab activities	- applying these concepts in problem-solving	Lab assignments (during the semester)	20%
	- developing shells and creating Unix processes	Practical exam (last week of the semester)	40%

10.6 Minimum performance standards

- At least grade 5 (from a scale of 1 to 10) for all types of examination.
- Seminar attendance of minimum 75% (at least 5 seminars out of 7)
- Lab attendance of minimum 90% (at least 12 out of 14 labs)
- Knowledge of theoretical and practical aspects of **shell** concepts and **processes**:
  - **shell**: working with files, control structures (especially for), access to command line parameters;
  - **processes**: one-way communication via *pipe* or *FIFO*.

Date	Signature of course coordinator	Signature of seminar coordinator
8.02.2025	PhD.Assoc.Prof. Sanda-Maria AVRAM	PhD.Assoc.Prof. Sanda-Maria AVRAM

Date of approval	Signature of the head of department
.....	PhD.Assoc.Prof. Adrian STERCA