

SYLLABUS

Operating systems for computers

University year **2025-2026**

1. Information regarding the programme

| | |
|------------------------------------|---|
| 1.1. Higher education institution | Babeş-Bolyai University |
| 1.2. Faculty | Mathematics and Computer Science |
| 1.3. Department | Computer Science |
| 1.4. Field of study | Mathematics |
| 1.5. Study cycle | Bachelor |
| 1.6. Study programme/Qualification | Mathematics Computer Science |
| 1.7. Form of education | Full time |

2. Information regarding the discipline

| | | | | | | | | |
|-----------------------------|---|---------------------------------|---|-------------------------------------|---|------------------------|--|-----------|
| 2.1. Name of the discipline | | Operating systems for computers | | | | Discipline code | | MLE5238 |
| 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. Discipline regime | | mandatory |

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/project | 2 |
| 3.4. Total hours in the curriculum | 56 | of which: 3.5 course | 28 | 3.6 seminar/laboratory/project | 28 |
| Time allotment for individual study (ID) and self-study activities (SA) | | | | | hours |
| Learning using manual, course support, bibliography, course notes (SA) | | | | | 14 |
| Additional documentation (in libraries, on electronic platforms, field documentation) | | | | | 5 |
| Preparation for seminars/labs, homework, papers, portfolios and essays | | | | | 12 |
| Tutorship | | | | | 3 |
| Evaluations | | | | | 8 |
| Other activities: | | | | | 2 |
| 3.7. Total individual study hours | 44 | | | | |
| 3.8. Total hours per semester | 100 | | | | |
| 3.9. Number of ECTS credits | 4 | | | | |

4. Prerequisites (if necessary)

| | |
|-------------------|--|
| 4.1. curriculum | |
| 4.2. competencies | <ul style="list-style-type: none"> • Minimum knowledge of standard C programming. |

5. Conditions (if necessary)

| | |
|--------------------------------------|--|
| 5.1. for the course | <ul style="list-style-type: none"> • Class room equipped with video projector. |
| 5.2. for the seminar /lab activities | <ul style="list-style-type: none"> • Laboratory with computers connected to the Internet and UNIX operating system or access to a UNIX server |

6. Specific competencies acquired ¹

| | |
|--|--|
| Professional/essential competencies | <ul style="list-style-type: none"> • development and analysis of algorithms for solving problems • analysis, testing and using of software system |
| Transversal competencies | <ul style="list-style-type: none"> • application of rigorous and efficient work rules, manifestation of responsible attitudes towards the didactic-scientific field, to bring optimal and creative values to own potential in specific situations, with respect to professional ethics principles and norms |

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

| | |
|---|---|
| 7.1 General objective of the discipline | <ul style="list-style-type: none"> • Assimilation by the student of the main concepts underlying operating systems. |
| 7.2 Specific objective of the discipline | <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 | |

¹ One can choose either competences or learning outcomes, or both. If only one option is chosen, the row related to the other option will be deleted, and the kept one will be numbered 6.

| | | |
|---|--|----------------|
| 4-7 Unix operating system: system calls, internal structures <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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: <ol style="list-style-type: none"> Albing, C., Vossen, J.P., Newhman, C., bash Cookbook: Solutions and Examples for bash Users, O'Reilly, USA, 2007. Kernighan, B.W., Dennis, R.M., The C Programming Language, Prentice Hall, Massachusetts, 2012. Stallings, W., Operating Systems: Internals and Design Principles, Pearson Education Limited, Essex, 2015. Raymond, E.S., The Art of UNIX Programming, Addison-Wesley, Pearson Education Limited, USA, 2004. Tanenbaum, A., Herbert, B., Modern Operating Systems, Pearson Education Limited, Essex, 2015. In Romanian: <ol style="list-style-type: none"> 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 | | |
| week 4. sed and grep utilities | | |
| week 5. awk utility | | |
| week 6. shell Programs | | |
| week 7-8. C programs; working with Unix files | | |
| week 9. UNIX Processes | | |
| week 10. Communications between Unix processes: pipe | | |

| | |
|--|--|
| week 11. Communications between Unix processes: FIFO | |
| week 12. Unix-Threads | |
| week 13. Closing lab activities | |
| week 14. Practical exam | |
| Bibliography <ol style="list-style-type: none"> 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. | |

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

| Activity type | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of final grade |
|---|--|--|--------------------------------|
| 10.4 Course | - knowledge of the basic principles of the field | Final exam (regular session) | 40% |
| 10.5 Seminar/ laboratory | - 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 standard of performance | | | |
| <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • shell: working with files, control structures (especially for), access to command line parameters; • processes: one-way communication via <i>pipe</i> or <i>FIFO</i>. | | | |

11. Labels ODD (Sustainable Development Goals)²

² Keep only the labels that, according to the [Procedure for applying ODD labels in the academic process](#), suit the discipline and delete the others, including the general one for *Sustainable Development* – if not applicable. If no label describes the discipline, delete them all and write „Not applicable.“

Not applicable.

Date:

15.04.2025

Signature of course coordinator

Assoc. prof. phd. Sanda-Maria AVRAM

Signature of seminar coordinator

Assoc. prof. phd. Sanda-Maria AVRAM

Date of approval:

...

Signature of the head of department

Assoc. prof. phd. Adrian STERCA