SYLLABUS

1. Program information

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Bases of Electronics
1.4 Field of study	Electronic engineering, telecommunications and information technologies
1.5 Cycle of study	Bachelor of Science
1.6 Study program / Qualification	Electronic engineering, telecommunications and information technologies/ Engineer
1.7 Form of education	IF – full-time education

2. Course information

2.1 Course title	Electronic Devices				Course code	12.00
2.2 Course coordinator	Assoc.prof. Laura-Nicoleta IVANCIU, PhD laura.ivanciu@bel.utcluj.ro					
2.3 Seminar/ laboratory/ project/ practical activity coordinator	Assoc.prof. Laura-Nicoleta IVANCIU, PhD laura.ivanciu@bel.utcluj.ro Assoc.prof. Emilia ȘIPOS, PhD emilia.sipos@bel.utcluj.ro					
2.4 Year of study	I	2.5 Semester	2	2.6 Type of assessment		E
2.7 Course status	Formative category					DF
	Optionality					DOB

3. Estimated total time

3.1 Hours per week	4	of which:	3.2 Lecture	2	3.3 Seminar	0	3.3 Laboratory	2	3.3 Project	0	3.3 Practical training	0
3.4 Hours per semester	56	of which:	3.5 Lecture	28	3.6 Seminar	0	3.6 Laboratory	28	3.6 Project	0	3.3 Practical training	0

3.7 Time distribution (hours per semester) for individual study and assessment:	
(a) Assessment	3
(b) Study using textbook, course materials, bibliography, and notes	35
(c) Additional documentation in the library, on specialized electronic platforms, and in the field	
(d) Preparation for seminars/laboratories, assignments, reports, portfolios and essays	28
(e) Tutoring	3
(f) Other activities	
3.8 Total hours of individual study and assessment (sum of (3.7(a)...3.7(f))	69

3.9 Total hours per semester (3.4+3.8)	125
3.10 Number of credits	5.0

4. Prerequisites (where applicable)

4.1 curriculum	Passive Components and Circuits, Physics
4.2 competencies	Electrical signals, connection of passive components, relations and theorems for electric circuits, time and frequency behavior of capacitors and inductors, frequency response representation.

5. Requirements (where applicable)

5.1. for the development of the lecture	Amphitheater, Cluj-Napoca
5.2. for the development of the seminar/ laboratory/ project	Electronic Devices and Circuits Lab, Cluj-Napoca

6. Specific competencies acquired

Professional competencies	C1. Use of fundamental elements related to electronic devices, circuits, systems, instrumentation and technology C1.1 Description of the operation of electronic devices and circuits and of the fundamental methods for measuring electrical quantities. C1.2 Analysis of low-/medium-complexity electronic circuits and systems for their design and measurement. C1.3 Diagnosis/troubleshooting of electronic circuits, equipment and systems. C1.4 Use of electronic instruments and specific methods to characterize and evaluate the performance of electronic circuits and systems. C1.5 Design and implementation of low-/medium-complexity electronic circuits using CAD-CAM technologies and standards in the field. C4. Design and use of low-complexity hardware and software applications specific to applied electronics C4.1 Definition of the concepts, principles and methods used in : computer programming, high-level and specific languages, CAD techniques for creating electronic modules, microcontrollers, computer-system architecture, programmable electronic systems, graphics and reconfigurable hardware architectures. C4.2 Explanation and interpretation of the requirements specific to hardware and software structures in the fields of : computer programming, high-level and specific languages, CAD techniques for creating electronic modules, microcontrollers, computer-system architecture, programmable electronic systems, graphics and reconfigurable hardware architectures. C4.3 Identification and optimization of hardware and software solutions for problems related to industrial electronics, medical electronics, automotive electronics, automation, robotics and consumer-goods production.

Professional competencies	C4.4 Use of appropriate performance criteria to evaluate, including simulation, the hardware and software of dedicated systems or service activities using microcontrollers or low-/medium-complexity computer systems. C4.5 Design of dedicated equipment in the fields of applied electronics, using microcontrollers, programmable circuits or computer systems with a simple architecture, including the related programs. C5. Application of basic knowledge, concepts and methods from: power electronics, automatic systems, electrical energy management and electromagnetic compatibility C5.1 Definition of the specific elements that characterize electronic devices and circuits in the fields of: power electronics, automatic systems, electrical energy management, medical electronics, automotive electronics and consumer goods. C5.2 Qualitative and quantitative interpretation of the operation of circuits in the fields of: power electronics, automatic systems, electrical energy management, medical electronics, automotive electronics and consumer goods; analysis of operation from the standpoint of electromagnetic compatibility. C5.3 Preparation of technical specifications, installation and operation of equipment in the fields of applied electronics: power electronics, automatic systems, electrical energy management, medical electronics, automotive electronics and consumer goods. C5.4 Evaluation, based on technical quality and environmental impact criteria, of equipment in the fields of applied electronics: power electronics, automatic systems, electrical energy management, medical electronics, automotive electronics and consumer goods. C5.5 Design, using established principles and methods, of low-complexity subsystems in the fields of applied electronics: power electronics, automatic systems, electrical energy management, medical electronics, automotive electronics and consumer goods.C5.6 Solving an installation and maintenance problem for a communications system with low/ medium complexity.
Transversal competencies	

7. Expected learning outcomes

Knowledge	- The student/graduate describes, identifies and summarizes elementary concepts and methods related to electronic devices, circuits and instrumentation, as well as their application in concrete problems.

Skills	- The student/graduate uses fundamental methods for measuring electrical quantities and assesses electronic devices and circuits, as well as linear and digital integrated circuits of low/medium complexity. - The student/graduate designs, measures, evaluates performance, diagnoses and troubleshoots functional blocks composed of low/medium-complexity electronic devices and/or circuits.
Responsibility and autonomy	- The student/graduate carries out project management processes in electronics, telecommunications and information technologies, taking on different team roles and clearly and concisely describing the results, both orally and in writing.

8. Course objectives (based on the grid of specific competencies acquired)

8.1 General objective of the course	Developing the competences regarding the use of electronic devices.
8.2 Specific objectives	1. Recognizing and understanding basic concepts specific to electronic devices. 2. Developing skills and abilities necessary for the use of electronic devices in simple electronic circuits 3. Developing skills and abilities for the analysis and (re)design of electronic circuits.

9. Contents

9.1 Lecture	**No. of hours**	**Teaching methods**	**Remarks**
Presentation of course structure. Review: electrical signals, relations and theorems for electric circuits, RC circuits, frequency response representation	2	Presentation, euristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
Diodes. Models for switching diode. DR circuits.	2		
DC switching circuits. Single-phase rectifiers with capacitive filter.	2		
Diodes in permanent conduction. The exponential model. Analysis of DR circuits. Zener diodes. LEDs.	2		
Operational amplifiers (OpAmps). OpAmp operation. Ideal OpAmp. Modes of use.	2		
Simple op-amp comparators. Inverting and noninverting comparators. Voltage transfer characteristic. Waveforms.	2		
Positive feedback OpAmp comparators. Inverting and noninverting comparators. Voltage transfer characteristic. Waveforms.	2		
Electronic amplifiers: definition, power supply, voltage transfer characteristic, modeling, performance evaluation. Negative feedback op-amp amplifiers. Non-inverting and inverting amplifier.	2		
Summing amplifiers. Differential amplifiers.	2		
Applications with OpAmp: voltage domain conversion circuits, capacitively coupled amplifiers, amplifiers operated from a single power supply, integrators and differentiators.	2		

9.1 Lecture	No. of hours	Teaching methods	Remarks
Transistors. Types. Operating principle and operating regions. Use in circuits. Transfer characteristics. BJTs: symbol, internal structure	2		
BJTs operating principle and equations, transistor characteristics, operating regions, saturation. Switching MOS transistor: analog switch, CMOS inverter. Noise margins.	2		
MOS transistors: symbol, physical structure, operating principle and equations, static characteristics, operating regions.	2		
Recapitulation. Preparation for the final exam.			

Bibliography

On-line references

1. Ivanciu, Laura-Nicoleta. Electronic devices (course slides, laboratories, problem examples, exam subjects), http://www.bel.utcluj.ro/dce/didactic/ed/
2. Ivanciu, Laura, Sipos, Emilia, Electronic Devices, UTPress, Cluj-Napoca, ISBN 978-606-737-639-5, 2023
3. Sipos, Emilia, Ivanciu, Laura, Dispozitive Electronice. Probleme rezolvate, 2016
4. Ivanciu, Laura, Sipos, Emilia, Electronic Devices Laboratory Manual , Editura UTPRESS, Cluj Napoca, 2022, ISBN 978-606-737-579-4

Offline references

1. Emilia ȘIPOȘ, Laura IVANCIU, Dispozitive electronice, Cluj-Napoca, editura UTPRESS, ISBN 978-606-737-576-3, 2022, 250 pag.
2. Oltean, G., Dispozitive și circuite electronice. Dispozitive electronice, Editura Risoprint, Cluj-Napoca, ISBN 973-656-433-9, 2003, retipărită 2004, 316 pag.
3. Oltean, G., Şipos, Emilia, Miron, C., Ivanciu, Laura, Dispozitive electronice. Îndrumător de laborator, Cluj-Napoca, U.T. Press, ISBN 978-973-662-541-1, 105 pag, 2010.
4. Miron,C., Oltean, G., Gordan, Mihaela, Dispozitive și circuite electronice, Culegere de probleme, Editura Casa Cărţii de Ştiinţă, Cluj-Napoca, 1999.
5. Thomas Floyd, Dispozitive electronice, Ed. Teora, 2007
6. Boylestad Robert L., Electronic Devices and Circuit Theory

9.2 Laboratory	No. of hours	Teaching methods	Remarks
1. Introductory lab. Workplace safety.	2	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, smart board
2. Lab instrumentation. Voltage divider.	2		
3. DR switching circuits, two-port and multi-port networks.	2		
4. DC switching two-port networks	2		
5. Voltage doubler and rectifiers with capacitive filter	2		
6. Seminar - Circuits with diodes, Zener diodes and LEDs	2		
7. Circuits with Zener diodes and LEDs	2		

9.2 Laboratory	No. of hours	Teaching methods	Remarks
8. Voltage comparators with OpAmp - simple comparators	2		
9. Optical indicator for voltage level with OpAmp	2		
10. Voltage comparators with OpAmp - hysteresis comparators	2		
11. Rail-to-rail amplifiers with differential and unipolar supply	2		
12. Lab test	2		
13. Seminar - Circuits with OpAmp	2		
14. Lab do-overs. Finalization of lab activity.	2		

Bibliography

On-line references

1. Ivanciu, Laura-Nicoleta. Electronic devices (course slides, laboratories, problem examples, exam subjects), http://www.bel.utcluj.ro/dce/didactic/ed/
2. Ivanciu, Laura, Sipos, Emilia, Electronic Devices, UTPress, Cluj-Napoca, ISBN 978-606-737-639-5, 2023
3. Sipos, Emilia, Ivanciu, Laura, Dispozitive Electronice. Probleme rezolvate, 2016
4. Ivanciu, Laura, Sipos, Emilia, Electronic Devices Laboratory Manual , Editura UTPRESS, Cluj Napoca, 2022, ISBN 978-606-737-579-4

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1. Emilia ȘIPOȘ, Laura IVANCIU, Dispozitive electronice, Cluj-Napoca, editura UTPRESS, ISBN 978-606-737-576-3, 2022, 250 pag.

10. Alignment of the course contents with the expectations of the epistemic community, professional associations, and representative employers in the field related to the program

The course content and the teaching-learning-assessment methods are aligned with the current requirements of the Electronics, Telecommunications, and Information Technology Engineering field, considering the expectations of the academic and professional community, representative employers, as well as the national quality assurance standards in higher education. The course helps prepare students in line with employer expectations and the quality requirements set for engineering study programs.

11. Assessment

Activity type	11.1 Assessment criteria	11.2 Assessment methods (and type of assessment: continuous/ summative)	11.3 Weight in final grade
11.4 Lecture	The level of acquired theoretical knowledge and practical skills	- 10 homework activities - optional (problem solving) - Summative evaluation written exam (problem solving)	70%
11.5 Laboratory	The level of acquired abilities	- Continuous formative evaluation	30%

		- Laboratory test (practical evaluation)	

11.6 Minimum performance standard

Qualitative level:

Minimum knowledge:

1. Knowing the operating principle of RC circuits, in time and frequency domain
2. Knowing the operating principle of diodes and diode circuits
3. Knowing the operating principle of operational amplifiers
4. Knowing the operating principle of BJTs and MOSFETs

Minimum competencies:

1. To be able to determine the performance of simple circuits with electronic devices
2. To be able to use electronic devices in switching or permanent conduction regime
3. To be able to use the lab instrumentation and experimental boards.

Quantitative level:

1. Full laboratory attendance
2. Minimum grade for exam and lab - 5
3. Final grade computed as: Grade = 0.7*Exam + 0.3*Lab

Completion date:	**Course coordinators**	**teaching rank, title First name LAST NAME**	**Signature**
23.06.2026	Lecture	Assoc.prof. Laura-Nicoleta IVANCIU, PhD	
	Applications	Assoc.prof. Laura-Nicoleta IVANCIU, PhD	
		Assoc.prof. Emilia ȘIPOȘ, PhD	

Approval of the Head of the Department coordinating the course, only if this differs from the department organizing the study program	Head of the ..... Department teaching rank, title First name LAST NAME

Date of approval by the Council of the Department of Bases of Electronics 26.06.2026	Head of the Bases of Electronics Department Prof. Sorin HINTEA, Ph.D.
Date of approval by the Council of the Faculty of Electronics, Telecommunications and Information Technology 30.06.2026	Dean, Prof. Ovidiu POP, Ph.D.