

SYLLABUS

1. Information about the study program

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	Computers and Information Technology
1.5 Study cycle	Bachelor
1.6 Study program / Qualification	Information Engineering

2. Information about the course

2.1 Title of the course		Electronic devices and analog electronics					
2.2 Teacher in charge of the lecture			Dr. ThuHang Bui				
2.3 Teacher in charge of the seminar			Dr. ThuHang Bui				
2.4 Study year	2	2.5 Semester	3	2.6. Examination type	E	2.7 Course type	Compulsory

3. Estimated total time (number of hours of teaching activities per semester)

3.1 Number of hours per week	4	out of which: 3.2 lecture	2	3.3 seminar / laboratory	2 LP
3.4 Total number of hours in the curriculum	56	out of which: 3.5 lecture	28	3.6 seminar / laboratory	28
Distribution of the allocated amount of time:					hours

Individual study (textbook, course support, bibliography, and notes)	32
Supplementary documentation at the library using specialized electronic platforms in the field	
Preparing for seminars / laboratories, homework, papers, portfolios, and essays	10
Tutoring	
Evaluations	2
Other activities: research activities	
3.7 Total number of hours of individual study	44
3.8 Total number of hours per semester	100
3.9 Number of credits (ECTS)	4

4. Prerequisites (if applicable)

4.1 Curriculum	- Knowledge of basic electronics components
4.2 Competencies	- Familiarity with linear algebra and differential equations

5. Requirements (if applicable)

5.1 For the lecture	<ul style="list-style-type: none"> • Classroom with at least 100 seats, computer and video projector / Online course conducted through the MS Teams platform. • Also equipped with blackboard and beamer
5.2 For the seminar / laboratory	<ul style="list-style-type: none"> • Room with at least 30 seats, computer and video projector / Online seminar conducted through the MS Teams platform. • Also equipped with blackboard and beamer

6. Specific skills acquired

<p>Professional skills</p>	<p>Knowledge and understanding</p> <ul style="list-style-type: none"> ● C5.1 Appropriate use of the operating principles of electronic devices and circuits, as well as methods of measuring electrical quantities ● C5.2 Analysing, designing, executing and measuring of electronic circuits of low/ medium complexity ● C5.3 Diagnosis / troubleshooting of electronic circuits and instruments
<p>Transversal skills</p>	<ul style="list-style-type: none"> ● 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 course (based on the grid of acquired competencies)

<p>7.1 General objective</p>	<ul style="list-style-type: none"> ● This subject includes analogue electronic components and circuits (such as diodes, transistors, JFETs, op-amps, and basic analog circuit design as applied to audio and radio frequency circuits) which are used for electronic device used in industries or in daily life. ● This course helps students understand clearly the principles and functioning of the basic analogue components and circuits. ● Practical exercises would enable students to maintain such circuits and in turn maintain equipment having such circuits
<p>7.2 Specific objectives</p>	<p>After this course, students are able to</p> <ul style="list-style-type: none"> ● To learn different biasing techniques and behavior of BJT, FET at low and high frequencies. ● To understand the principle of operation of different amplifier circuits like feedback amplifiers, power amplifiers. ● To understand the principle of operation of different oscillators circuits.

8. Content

8.1 Lecture	Teaching strategies	Remarks
-------------	---------------------	---------

<p>1-2. Semiconductor diode</p> <ol style="list-style-type: none"> 1. Diodes, diode equation 2. Diode models 3. Zener diodes 4. Diode applications <p>3-4. Bipolar junction transistors</p> <ol style="list-style-type: none"> 1. Transistor fundamentals 2. Transistor configurations 3. DC operating point 4. BJT characteristics and parameters 5. Fixed bias, emitter bias with and without emitter resistance <p>5-6. Junction Field-Effect Transistors (JFET)</p> <ol style="list-style-type: none"> 1. Operation 2. Background and V-I characteristic: JFET 3. FET switch, chopper, MUX 4. Low frequency incremental model 5. Biasing 6. JFET current source <p>7-8-9. Two-Transistors Amplifier</p> <ol style="list-style-type: none"> 1. Differential emitter-coupled pair 2. Complementary emitter-follower (Class B, AB) 3. Amplifier classes 4. Power amplifiers <p>10-11-12. Feedback & Oscillator Circuits</p> <ol style="list-style-type: none"> 1. Effect of positive and negative 	<p>Exposure: description, explanation, examples, discussion of case studies</p>	
---	---	--

<p>feedbacks</p> <ol style="list-style-type: none">2. Basic feedback topologies and their properties3. Analysis of practical feedback amplifiers4. Sinusoidal Oscillators (RC, LC and Crystal),5. Multivibrators,6. The 555 timer <p>13-14. Operational Amplifiers</p> <ol style="list-style-type: none">1. Overview2. Basic linear op-amp circuits<ol style="list-style-type: none">a. Inverting, non-inverting, addition, subtractionb. AC amplifiers, inverting, and non-invertingc. Cascading; Ideal impedancesd. I-V conv, V-I conv, difference amp, instrument amp3. Integrator, differentiator4. Lossy integrator5. Negative feedback6. Non-linear op-amp circuits		
--	--	--

Mandatory references:

1. Daniel A. Steck (2015), Analog and Digital Electronics, Open Publication License
2. D. Crecraft and S. Gergely, (2002), Analog Electronics: Circuits, Systems and Signal Processing, Elsevier Science.
3. Neamen, Donald. Microelectronic Circuit Analysis and Design. 3rd ed. New York, NY: McGraw-Hill, 2006. ISBN: 9780073285962.

Optional references:

1. Jerry Luecke, (2005) Analog and Digital Circuits for Electronic Control System Applications: Using the TI MSP430 Microcontroller, Elsevier.
2. Cathey, Jimmie J. Schaum's Outlines Electronic Devices and Circuits. 2nd ed. New York, NY: McGraw-Hill, 2002. ISBN: 9780071362702.
3. Johnson, D. E., and V. Jayakumar. Operational Amplifier Circuits. Upper Saddle River, NJ: Prentice Hall, 1982. ISBN: 9780136374473.
4. Horowitz, Paul, and Winfield Hill. The Art of Electronics. 2nd ed. Cambridge, UK: Cambridge University Press, 1989. ISBN: 9780521370950.

8.2 Seminar / laboratory	Teaching strategies	Remarks
Diodes, Transistor BJT	Explanation, dialogue, debate, group work	
Cascade amplifiers Observe the amplitude and frequency responses of common amplification circuits and utilize the data for designing	Explanation, dialogue, debate, group work	
Transistor FET – FET Switch	Explanation, dialogue, debate, group work	
JFET, determine r_d , g_m , μ for JFET amplifier. Build and test MOSFET as an amplifier	Explanation, dialogue, debate, group work	

Voltage series feedback amplifier	Explanation, dialogue, debate, group work	
RC phase shift oscillator	Explanation, dialogue, debate, group work	
Linear applications of Op-Amp (Operational Amplifiers)	Explanation, dialogue, debate, group work	
<p>Mandatory references:</p> <ol style="list-style-type: none"> 1. Daniel A. Steck (2015), Analog and Digital Electronics, Open Publication License 2. D. Crecraft and S. Gergely, (2002), Analog Electronics: Circuits, Systems and Signal Processing, Elsevier Science. <p>Optional references:</p> <ol style="list-style-type: none"> 3. Jerry Luecke, (2005) Analog and Digital Circuits for Electronic Control System Applications: Using the TI MSP430 Microcontroller, Elsevier. 4. Cathey, Jimmie J. Schaum's Outlines Electronic Devices and Circuits. 2nd ed. New York, NY: McGraw-Hill, 2002. ISBN: 9780071362702. 5. Johnson, D. E., and V. Jayakumar. Operational Amplifier Circuits. Upper Saddle River, NJ: Prentice Hall, 1982. ISBN: 9780136374473. 		

9. Correlations between the content of the course and the expectations of the representatives of the epistemic community, professional associations and representative employers in the field related to the program

The proposed lecture and seminar offer central topics in fundamental and applied research in the field, and their approach is based on the most recent results found in the literature. The course also offers state of the art research skills that are transferable to any scientific and applied field of knowledge.

10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final grade
10.4 Lecture	- know the basic components, chips and typical analog circuits; - apply and understand course concepts	Written exam	60%
10.5 Seminar / laboratory	- be able to read, implement components, chips and understand meaning of components in practical analog circuits	Project	40%
10.6 Minimum passing score			
The final grade consists of: a. score obtained in the written exam in proportion of 60% b. project 40%			

Date 12.05.2022

Signature of the teacher in charge of the lecture.

Dr. ThuHang Bui



Signature of the teacher in charge of the seminar.

Dr. ThuHang Bui



Approval date in the department

24.05.2022

Signature of the Head of the department /director

