

Course description

Course abbreviation:	KE/RPEO	Page:	1 / 3
Course name:	Advanced Electronic Circuits		
Academic Year:	2023/2024	Printed:	06.06.2024 00:00

Department/Unit /	KE / RPEO			Academic Year	2023/2024
Title	Advanced Electronic Circuits			Type of completion	Examination
Accredited/Credits	Yes, 4 Cred.			Type of completion	Combined
Number of hours	Seminar 24 [Hours/Semester]				
Occ/max	Status A	Status B	Status C	Course credit prior to	YES
Summer semester	0 / -	0 / -	0 / -	Counted into average	YES
Winter semester	1 / -	0 / 0	0 / 0	Min. (B+C) students	not determined
Timetable	Yes			Repeated registration	NO
Language of instruction	Czech			Semester taught	Winter semester
Optional course	Yes			Internship duration	0
Evaluation scale	A B C D E F			Ev. sc. – cred.	S N
No. of hours of on-premise	0				
Auto acc. of credit	No				
Periodicity	K				
Substituted course	KE/NPEO				
Preclusive courses	N/A				
Prerequisite courses	N/A				
Informally recommended courses	N/A				
Courses depending on this Course	N/A				

Course objectives:

This course follows Linear Electric Circuits and Computer Simulation of Electronic Circuits courses. The aim of the course (Analysis and Design of Electronic Circuits) is to prepare students for study of advanced analog and digital circuits, and to study the circuits on the boundary between analog and digital area. The emphasis is on analysis and design (synthesis) of electronic circuits.

Requirements on student

Good knowledge of linear electric circuits and computer simulation of electronic circuits is needed. A particular part of the study (besides the lectures and exercises) is the design of a chosen electronic circuit with written report.

Content

1. Operational amplifier: differential stage, current mirror, Darlington pair, output stage, protective circuits. Conversion characteristic, voltage asymmetry.
2. Frequency response in open loop, overflow rate, GBW, influence of final value of input and output resistance. Influence of input capacities.
3. Circuits in current mode: properties of circuits in current mode. Basic circuits: conveyor, transimpedance amplifier, transconductance amplifier. Analysis of circuits in current mode.
4. Electric filters: approximation of transfer function, design relations. Synthesis of ARC filters by comparison with transmission functions.
5. Synthesis of LC filters: frequency and impedance standardization. Determination of filter order, cutoff frequencies and bandwidth.
6. LC oscillators: Oscillators with negative resistance, reflex. Feedback oscillators: nonlinear and quasilinear interpretation of oscillator operation. Meisner, Reinartz, Hartley and Colpitt connection.
7. Stable LC oscillators: Clapp connection, crystal controlled oscillator. Methods of stabilization amplitude of oscillations, voltage

controlled oscillator.

8. Astable, bistable and monostable flip-flops.

9. Mixers: nonlinear or additive mixers and parametric or multiplicative amplifiers. Symmetrized systems. Determination of the polarity of the combination component.

10. Power ratios during mixing, mixers with nonlinear resistance and storage element. Mirror suppressed mixers. Gilbert's cell.

11. Quadrature modulators

12. Phase and frequency detectors

13. Phase-locked loop, ALK loop, Costas loop.

Prerequisites - other information about course preconditions

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Competences acquired

After the study of this subject the student will be able to analyse electronic circuits characteristics and will be able to design electronic circuits with required electric characteristics (parameters). The emphasis is on circuit design.

Fields of study

Základní: Žalud, V., Dobeš, J.: Moderní radiotechnika, BEN - technická literatura, Praha 2006, ISBN 80-7300-132-2.

Bičák, J., Lajprt, M., Vlček, M. Lineární obvody a systémy. ČVUT Praha, 2007, ISBN 978-800-103-6495.

Hájek, K., Sedláček, J.: Kmitočtové filtry. BEN - technická literatura, Praha 2005.

Dostál, J.: Operační zesilovače. BEN - technická literatura, Praha 2005. ISBN 80-7300-049-0.

V případě mimořádných opatření bude výuka probíhat vzdáleně s využitím programu MS Teams v době dle rozvrhu. Účast na schůzkách skupiny v MS Teams je ekvivalentní účasti na přednáškách a cvičeních.

In the case of distance learning, lessons will be taught through MS Teams. Lessons will be at the time shown in the timetable. MS Teams is equivalent to participation and or attendens in lectures and excersises.

Doporučená: Brtník, B.: Analogové soustavy. BEN-technická literatura, Praha 2010. ISBN 80-7300-110-1.

Mancini, R.: Op Amps For Everyone - Design Reference, Texas Instruments, 2002.

Guarantors and lecturers

- **Guarantors:** Ing. Bohumil Brtník, Dr.
- **Seminar lecturer:** Ing. Bohumil Brtník, Dr. (100%), Ing. Bc. David Matoušek, Ph.D. (100%)

Literature

- **Recommended:** Brtník, B. *Analogové soustavy*.
- **Recommended:** Hájek, K., Sedláček, J. *Kmitočtové filtry*.
- **Recommended:** Bičák, J., Lajprt, M., Vlček, M. *Lineární obvody a systémy*.
- **Recommended:** Mancini, R. *Op Amps For Everyone . Design Reference*.
- **Recommended:** Dostál, J. *Operační zesilovače*.

Teaching methods

Work with text (with textbook, with book)

Methods of individual activities

Assessment methods

Written examination

Home assignment evaluation

Self project defence

Course is included in study programmes:

Study Programme	Type of	Form of	Branch	Stage	St. plan v.	Year	Block	Status	R.year	R.
Communication and Radar Systems	Follow-up study	Part-time	Communication and Radar Systems	1	2022	2023	Povinné 1. ročník	A	1	ZS
Communication and Radar Systems	Follow-up study	Part-time	Communication and Radar Systems	1	2023	2023	Povinné 1. ročník	A	1	ZS
Communication and Radar Systems	Follow-up study	Part-time	Communication and Radar Systems	1	2021	2023	Povinné 1. ročník	A	1	ZS