

## Specification for the book of courses

|  |  |  |                                |                      |
|--|--|--|--------------------------------|----------------------|
| <b>Study program</b>   |  | Electrical Engineering and Computer Science            |                                |                      |
| <b>Module</b>  |  | Electronics - Electronic Circuits and Embedded Systems |                                |                      |
| <b>Type and level of studies</b>   |  | Undergraduate Academic Studies                         |                                |                      |
| <b>The name of the course</b>  |  | Analogue Integrated Circuits                           |                                |                      |
| <b>Lecturer (for lectures)</b>   |  | Petković M. Predrag                                    |                                |                      |
| <b>Lecturer/associate (for exercises)</b>  |  | Đorđević D. Srđan                                      |                                |                      |
| <b>Lecturer/associate (for OFE)</b>  |  | Đorđević D. Srđan                                      |                                |                      |
| <b>Number of ECTS</b>  | 5  | <b>Course status (obligatory/elective)</b>             | Elective                       |                      |
| <b>Prerequisites</b>   |  |  |                                |                      |
| <b>Course objectives</b>   |  |  |                                |                      |
| To give students an understanding of: the principle of operation, characteristics, analysis and design techniques of the basic building blocks used in analog and mixed signal electronic systems.   |  |  |                                |                      |
| <b>Course outcomes</b>   |  |  |                                |                      |
| Students will gain competence in the recognition and understanding of the basic building blocks used in analog and mixed signal electronic systems. It is expected for students to learn how to simulate circuits on system level, select topology of the circuits according to the given specifications as well as to implement analog functions in the analog and mixed signal electronic systems.   |  |  |                                |                      |
| <b>Course outline</b>  |  |  |                                |                      |
| <b>Theoretical teaching</b>  |  |  |                                |                      |
| Linear and non-linear applications of the operational amplifiers. Comparators. Instrumentation amplifiers. Programmable-gain amplifiers. Operational transconductance amplifiers - OTA. Current feedback amplifiers. current conveyors - CCII. Voltage-to-Frequency converters. Frequency-to-voltage converter. Chopper Amplifiers. Lock-in amplifiers. True RMS to DC convertors. Sample/Hold amplifiers. Analog-to-digital converter. Digital-to-analog converter. Mixers. Phase locked loop - PLL. Lock-in amplifiers. Wide Band Amplifiers. Isolation amplifiers. Noise in electronic circuits: source, types, evaluation of noise, noise in BJT and FET, techniques to reduce the influence of noise. Low noise amplifiers. |  |  |                                |                      |
| <b>Practical teaching (exercises, OFE, study and research)</b>   |  |  |                                |                      |
| Calculation, simulation and implementation of the most important analog blocks.<br>The program envisages the following laboratory exercises: 1. Inverter regenerative comparator, 2. Function generator, 3. Phase locked loop, 4. Automatic gain control, 5. Amplifier with digital gain control, 6. Digital programmable function generator.  |  |  |                                |                      |
| <b>Textbooks/references</b>  |  |  |                                |                      |
| 1  | P. Petković, Presentacija sa predavanja <a href="http://leda.elfak.ni.ac.rs/?page=education">http://leda.elfak.ni.ac.rs/?page=education</a>  |  |                                |                      |
| 2  | Sergio Franco: „Design With Operational Amplifiers And Analog Integrated Circuits“, McGraw-Hill Education; 4 edition, ISBN-10: 9780078028168, 2014.  |  |                                |                      |
| 3  | Miona Andrejevic Stosovic, Srdjan Djordjevic, Predrag Petkovic: "Laboratory Practicum in Analogue Electronics and Analog Electronic Circuits", (in Sernian) Faculty of Electronic Engineering, Nis, ISBN, 978-86-6125-201-3, 2018. |  |                                |                      |
| 4  | S. Salivahanan „Linear Integrated Circuits“,Tata McGraw-Hill Education,ISBN 0070648182, 2008   |  |                                |                      |
| 5  |  |  |                                |                      |
| <b>Number of classes of active education per week during semester/trimester/year</b>   |  |  |                                |                      |
| <b>Lectures</b>  | <b>Exercises</b>   | <b>OFE</b>   | <b>Study and research work</b> | <b>Other classes</b> |
| 2  | 1  | 1  | 0                              | 0                    |
| <b>Teaching methods</b>  |  |  |                                |                      |
| Lectures (PPT); Practical exercises; Laboratory exercises with the use of computer and evaluation kit system; Consultations; Individual projects.  |  |  |                                |                      |
| <b>Grade (maximum number of points 100)</b>  |  |  |                                |                      |
| <b>Pre-exam duties</b>   |  | <b>Points</b>  | <b>Final exam</b>              | <b>Points</b>        |
| <b>Activity during lectures</b>  |  | 5  | <b>Written exam</b>            | 20                   |
| <b>Exercises</b>   |  | 5  | <b>Oral exam</b>               | 20                   |
| <b>Colloquia</b>   |  | 25   |                                |                      |
| <b>Projects</b>  |  | 25   |                                |                      |