**Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti**
**Facultatea de Electronică, Telecomunicaţii şi**
**Tehnologia Informaţiei**

# COURSE DESCRIPTION

## 1. Program identification information

| | |
|---|---|
| 1.1 Higher education institution | **National University of Science and Technology Politehnica Bucharest** |
| 1.2 Faculty | **Electronics, Telecommunications and Information Technology** |
| 1.3 Department | **Telecommunications** |
| 1.4 Domain of studies | Electronic Engineering, Telecommunications and Information Technology |
| 1.5 Cycle of studies | Bachelor/Undergraduate |
| 1.6 Programme of studies | Technologies and Telecommunications Systems |

## 2. Date despre disciplină

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 Course name (ro)<br>(en) | | | | Componente și circuite pasive | | | |
| 2.2 Course Lecturer | | | | Conf. Dr. Andrei Drumea | | | |
| 2.3 Instructor for practical activities | | | | Conf. Dr. Andrei Drumea | | | |
| 2.4 Year of studies | 2 | 2.5 Semester | I | 2.6. Evaluation type | E | 2.7 Course regime | Ob |
| 2.8 Course type | | D | 2.9 Course code | 04.D.03.O.004 | | 2.10 Tipul de notare | Nota |

## 3. Total estimated time (hours per semester for academic activities)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | 3.5 | Out of which: 3.2 course | 2.00 | 3.3 seminary/laboratory | 1.5 |
| 3.4 Total hours in the curricula | 49.00 | Out of which: 3.5 course | 28 | 3.6 seminary/laboratory | 21 |
| Distribution of time: | | | | | hours |
| Study according to the manual, course support, bibliography and hand notes<br>Supplemental documentation (library, electronic access resources, in the field, etc)<br>Preparation for practical activities, homework, essays, portfolios, etc. | | | | | 47 |
| Tutoring | | | | | 0 |
| Examinations | | | | | 4 |
| Other activities (if any): | | | | | 0 |

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| 3.7 Total hours of individual study | 51.00 |
| 3.8 Total hours per semester | 100 |
| 3.9 Number of ECTS credit points | 4 |

## 4. Prerequisites (if applicable) (where applicable)

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| 4.1 Curriculum | Physics, Mathematical Analysis, Basic Electrotechnics. |
| 4.2 Results of learning | Not needed. |

**5. Necessary conditions for the optimal development of teaching activities** (where applicable)

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|---|---|
| 5.1 Course | The course takes place in a room with a videoprojector and screen. |
| 5.2 Seminary/ Laboratory/Project | The laboratory will take place in a room with equipment specific to an electronics laboratory, e.g. RLC-meter, oscilloscope, digital multimeter, signal generator, power supplies, computer. |

**6. General objective** *(Reffering to the teachers' intentions for students and to what the students will be thought during the course. It offers an idea on the position of course in the scientific domain, as well as the role it has for the study programme. The course topics, the justification of including the course in the currcula of the study programme, etc. will be described in a general manner)*

The general objective of the discipline "Passive Components and Circuits" is the acquiring by future electronic engineers of knowledge about discrete and integrated passive components. The course has a strong application character considering the characterization, design, modeling, simulation, measurement and use of passive electronic components in accordance with the modern discrete and integrated technologies that are the basis for the creation of electronic products in the "high tech" field. It is desired to familiarize students with the types of modern passive components and their main parameters. It is also desired to create the skills to design and simulate circuits where it is necessary to identify and choose the appropriate passive components specific to the application. It is also desired to learn the methods of simulating the behavior of passive components based on the models from the data sheets.

**7. Competences** *(Proven capacity to use knowledge, aptitudes and personal, social and/or methodological abilities in work or study situations and for personal and proffesional growth. They refflect the empolyers requirements.)*

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| **Specific Competences** | Demonstrates basic/advanced knowledge of passive components.<br>Correlate knowledge Apply knowledge in practice<br>It applies standardized methods and tools, specific to the field, to carry out the evaluation and diagnosis process of a situation, depending on the identified/reported problems, and identifies solutions.<br>Oral and written communication in Romanian: uses the scientific vocabulary specific to the field, in order to communicate effectively, in writing and orally. Oral and written communication in a foreign language (English): demonstrates understanding of subject-related vocabulary in a foreign language. |
| **Transversal (General) Competences** | Team work and efficient communication skills, to coordinate efforts with others to solve typical problems of medium complexity.<br>Analysis and synthesis skills – can present in a concise manner the acquired knowledge.<br>Respect the academic ethic principles – cite and copyright rules. |

**8. Learning outcomes** *(Synthetic descriptions for what a student will be capable of doing or showing at the completion of a course. The learning outcomes reflect the student's acomplishments and to a lesser extent the teachers' intentions. The learning outcomes inform the students of what is expected from them with respect to performance and to obtain the desired grades and ECTS points. They are defined in concise terms, using verbs similar to the examples below and indicate what will be required for evaluation. The learning outcomes will be formulated so that the correlation with the competences defined in section 7 is highlighted.)*

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|---|---|
| **Knowledge** | *The result of knowledge aquisition through learning. The knowledge represents the totality of facts, priciples, theories and practices for a given work or study field. They can be theoretical and/or factual.*<br>Familiarization of students with the main types of linear passive components (resistors, capacitors, inductors) and non-linear (thermistors, varistors).<br>Carrying out measurements and experiments specific to these components.<br>Familiarizing students with the method of identifying information specific to passive components based on the study of catalog sheets. Using this information to choose a specific component for a particular application.<br>The study of the behavior of passive components through simulation methods based on mathematical models and SPICE type simulators. |
| **Skills** | *The capacity to apply the knowledge and use the know-how for completing tasks and solving problems. The skills are described as being cognitive (requiring the use of logical, intuitive and creative thinking) or practical (implying manual dexterity and the use of methods, materials, tools and intrumentation).*<br>Cognitive skills<br>-Formulates conclusions to the experiments carried out.<br>-Elaborate a scientific text.<br>Practical skills<br>Through its pragmatic side, being strongly oriented towards application, the laboratory of the discipline develops skills regarding the characterization by measuring the parameters of passive components. Skills are also developed to choose the components specific to an application and create the BOM file (list of components) in order to purchase the components. |
| **Responsability and autonomy** | *The student's capacity to autonomously and responsably apply their knowledge and skills.*<br>Select and analyze suitable references<br>Respect principles of ethic in academia by citing the sources used.<br>Colaborate with coleagues in teaching activities.<br>Demonstrates real-life situation management skills (collaborative vs. conflict time management). |

**9. Teaching techniques** *(Student centric techniques will be considered. The means for students to participate in defining their own study path, the identification of eventual fallbacks and the remedial measures that will be adopted in those cases will be described.)*

The teaching is based on the use of the video projector (covering the communication and demonstration function); the oral communication methods used are the expository method and the problematization method, used head-on. Course materials are: course notes and presentations, various materials of the course holder (with deepening of theoretical elements and advanced design elements of some real modules). All materials are available in electronic format, through the database provided by the course holders.

**10. Contents**

| **COURSE** | | |
|---|---|---|
| **Chapter** | **Content** | **No. hours** |

| | | |
|---|---|---|
| 1 | General properties of passive electronic components. General facts. Definitions. Classification. Characteristic quantities. Determining the parameter tolerances of electronic circuits as function of passive components tolerances. Determining the temperature variation coefficient of electronic circuits as function of passive components temperature variation coefficients. Determining the global tolerance of circuit parameters as function of passive components deviation. Thermal loading of passive components. | 6 |
| 2 | Resistors. Fixed resistors. Definition. Classification. Resistor characteristics. Internal noise of resistors. Maximum electric loading of resistors. Determining the maximum admissible values of electric quantities. Equivalent schematics. Resistor impedance as function of frequency. Description of the main types of resistors (braided, carbon film, thick and thin film, metal oxide, metallic foil). Resistive nets. Choosing the resistor type and determining its parameters as function of the used electronic circuit. Variable resistors (potentiometers). Definition. Classification. Potentiometer characteristics. Applications. Digital potentiometers (electronic).<br>Nonlinear resistors. NTC and PTC thermistors, characteristics and applications. Varistors, principles, construction, applications. Surge arresters, principles, applications. | 8 |
| 3 | Parametric resistors - thermistors and varistors. Characteristic quantities. Applications | 2 |
| 4 | Capacitors. Definition, classification. Capacitor parameters. Capacitor marking. Description of the main types of capacitors (ceramic, with paper, with polyester, with polystyrene, with polycarbonate, with polypropylene). Electrolytic capacitors. Variable capacitors. Equivalent schematics. Capacitor impedance as function of frequency. Maximum electric load of capacitors, in continuous and impulse regime. Choosing the type and determining the parameters of the capacitor to be used in an electronic circuit, as function of its parameters.<br>Supercapacitors, principles, construction, parameters. Problems in charging phase, balancing circuits. | 6 |
| 5 | Inductors. Definition, classification. Parameters. Constructive structure. Type of inductors, applications. Equivalent circuits. Inductor impedance as function of frequency. Maximum electric load of inductors. | 4 |
| 6 | Dedicated electronic components and circuits. Resistor as electric current sensor. Decoupling capacitors. Capacitors and inductors for net filtering. Shock inductors, ferrite pearls. Power capacitors. Decade dividers. Attenuators. RC filters. Planar transformers. | 2 |
| | **Total:** | 28 |

**Bibliography:**

1. Drumea Andrei, Componente şi circuite pasive, https://archive.curs.upb.ro/2024/course/view.php?id=3893.
2. P. Svasta, V. Golumbeanu, C. Ionescu, A. Vasile, Rezistoare, Editura Cavallioti, 2007.
3. P. Svasta, V. Golumbeanu, s.a, Componente electronice pasive - probleme, editura Cavallioti, 2009.
4. P. Svasta, V. Golumbeanu, Componente electronice pasive – Condensatoare, UPB, editura Cavallioti 2010.

**LABORATORY**

| Crt. no. | Content | No. hours |
|---|---|---|
| 1 | Fixed Linear resistors. | 3 |
| 2 | Capacitors. | 3 |

| | | |
|---|---|---|
| 3 | Nonlinear resistors – thermistors, varistors. | 3 |
| 4 | Inductors. | 3 |
| 5 | Introduction in simulation of resistive circuits - PSPICE. | 3 |
| 6 | Simulation of resistive and capacitive structures. | 3 |
| 7 | Final lab. examination (colloquy) | 3 |
| | **Total:** | 21 |

**Bibliography:**
1. Drumea Andrei, Componente şi circuite pasive, https://archive.curs.upb.ro/2024/course/view.php?id=3893.

**11. Evaluation**

| Activity type | 11.1 Evaluation criteria | 11.2 Evaluation methods | 11.3 Percentage of final grade |
|---|---|---|---|
| 11.4 Course | - knowledge of the fundamental theoretical notions related to the parameters of the passive components. Comparative analysis/differential choice of components specific to a certain application. | Oral. | 40% |
| | knowing how to apply the theory to solving problems. | Written. | 10% |
| 11.5 Seminary/laboratory/project | Home work. | Written report. | 20% |
| | Lab. data processing. | Written report. | 15% |
| | Final lab. test. | Oral. | 15% |
| 11.6 Passing conditions | | | |
| Achieve 50% from the total number of points. | | | |

**12. Corroborate the content of the course with the expectations of representatives of employers and representative professional associations in the field of the program, as well as with the current state of knowledge in the scientific field approached and practices in higher education institutions in the European Higher Education Area (EHEA)**

Through the activities of choosing passive components by looking for parameters in the catalog sheets, the development of the graduate's skills to manage practical situations that he may face in real life as an engineer is considered, in order to increase his contribution to improving technical and economic performances of the electronics industry.

| Date | Course lecturer | Instructor(s) for practical activities |
|---|---|---|
| 21.09.2025 | Conf. Dr. Ing. Andrei DRUMEA | Conf. Dr. Ing. Andrei DRUMEA |

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|---|---|
| Date of department approval | Head of department<br><br>Conf. Dr. Ing. Marian VLĂDESCU |
| Date of approval in the Faculty Council | Dean<br><br>Prof. Dr. Ing. Mihnea-Radu UDREA |