**Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti**

**Facultatea de Electronică, Telecomunicaţii şi**

**Tehnologia Informaţiei**

# FIŞA DISCIPLINEI

## 1. Date despre program

| | |
|---|---|
| 1.1 Instituţia de învăţământ superior | **Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti** |
| 1.2 Facultatea | **Electronică, Telecomunicaţii şi Tehnologia Informaţiei** |
| 1.3 Departamentul | **Electronică Aplicată şi Ingineria Informaţiei** |
| 1.4 Domeniul de studii | Inginerie Electronică, Telecomunicaţii şi Tehnologii Informaţionale |
| 1.5 Ciclul de studii | Licenţă |
| 1.6 Specializarea | Electronică aplicată |

## 2. Date despre disciplină

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|---|---|---|---|---|---|---|---|
| 2.1 Denumirea disciplinei (ro)<br>(en) | | | | Electronică şi informatică medicală<br>Medical Electronics and Informatics | | | |
| 2.2 Titularul activităţilor de curs | | | | Conf. dr. ing. Dragoş Daniel ŢARĂLUNGĂ | | | |
| 2.3 Titularul activităţilor de seminar / laborator | | | | Conf. dr. ing. Dragoş Daniel ŢARĂLUNGĂ | | | |
| 2.4 Anul de studiu | 4 | 2.5 Semestrul | I | 2.6. Tipul de evaluare | E | 2.7 Regimul disciplinei | Ob |
| 2.8 Tipul disciplinei | | S | 2.9 Codul disciplinei | 04.S.07.O.104 | | 2.10 Tipul de notare | Nota |

## 3. Timpul total estimat (ore pe semestru al activităţilor didactice)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Număr de ore pe săptămână | 4 | Din care: 3.2 curs | 2.00 | 3.3 seminar/laborator | 2 |
| 3.4 Total ore din planul de învăţământ | 56.00 | Din care: 3.5 curs | 28 | 3.6 seminar/laborator | 28 |
| Distribuţia fondului de timp: | | | | | ore |
| Studiul după manual, suport de curs, bibliografie şi notiţe<br>Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate<br>Pregătire seminarii/ laboratoare/proiecte, teme, referate, portofolii şi eseuri | | | | | 40 |
| Tutorat | | | | | 0 |
| Examinări | | | | | 4 |
| Alte activităţi (dacă există): | | | | | 0 |

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| 3.7 Total ore studiu individual | 44.00 |
| 3.8 Total ore pe semestru | 100 |
| 3.9 Numărul de credite | 4 |

## 4. Precondiţii (acolo unde este cazul)

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| 4.1 de curriculum | Completion of the following subjects:<br>Fundamental Electronic Circuits<br>Signals and Systems<br>Digital Signal Processing<br>Information Transmission Theory |

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| 4.2 de rezultate ale învățării | Accumulation of the following knowledge:<br>signal acquisition and processing,<br>decision and estimation, as well as<br>programming |

**5. Condiții necesare pentru desfășurarea optimă a activităților didactice** (acolo unde este cazul)

| | |
|---|---|
| 5.1 Curs | The course will take place in a room equipped with a video projector and a computer. |
| 5.2 Seminar/ Laborator/Proiect | The laboratory will be held in a room with specific equipment, which must include: a sufficient number of computers for a semi-group, Acqknowledge software for the acquisition and processing of signals acquired in the laboratory, biopotential acquisition system and biomedical parameters (specific amplifiers, specific sensors, etc.)<br>Mandatory presence in laboratories (according to the regulations of undergraduate studies at UPB). |

**6. Obiectiv general** *(Se referă la intențiile profesorilor pentru studenți, la ceea ce studenții vor fi învățați în timpul cursului. Oferă o orientare cu privire la locul cursului în cadrul domeniului științific abordat, precum și la rolul pe care acesta îl are în cadrul specializării studiate. Vor fi descrise de o manieră generală tematicile abordate, justificarea includerii cursului în planul de învățământ al specializării studiate etc.)*

This course is studied within the Applied Electronics specialization and aims to familiarize students with the main approaches, models, and explanatory theories regarding the application of electronics in the field of medicine.

The course specifically addresses advanced notions, concepts, and principles related to electronics and signal processing, used in understanding, developing, researching, and using electronic systems in practical medical applications.

**7. Competențe** *(Capacitatea dovedită de a utiliza cunoștințe, aptitudini și abilități personale, sociale și/sau metodologice în situații de muncă sau de studiu și pentru dezvoltarea profesională și personală. Reflectă cerințele angajatorilor.)*

| | |
|---|---|
| **Specifice** | Solves electronics and computer science problems in medical electronic equipment and systems.<br>Uses fundamental elements related to electronic devices, circuits, and instrumentation.<br>Identifies needs and applies field-specific methods and tools to develop technical solutions.<br>Argues and analyzes coherently and correctly the context for applying basic knowledge in the field, using key concepts of the discipline and the specific methodology.<br>Oral and written communication in Romanian: uses the scientific vocabulary specific to the field for effective written and oral communication.<br>Ability to make decisions in order to solve routine or unpredictable problems that arise in the operation of medical electronic devices.<br>Use of fundamental elements related to electronic devices, circuits, and instrumentation.<br>Application, in typical situations, of basic methods for processing electrical and non-electrical signals; implementation of medium-complexity procedures on signal processors.<br>Understanding and use of fundamental concepts in the field of communications and information transmission.<br>Application of elementary knowledge, concepts, and methods related to computer system architecture, microcontrollers, programming languages, and programming techniques.<br>Flexibility in using new systems and technologies within a team in which the members work together to achieve a well-defined objective, while assuming different roles or tasks. |
| **Transversale (generale)** | Works in a team and communicates effectively, coordinating their efforts with others to solve problem situations of medium complexity.<br>Autonomy and critical thinking: the ability to think in scientific terms, to search for and analyze data independently, as well as to draw and present conclusions / identify solutions.<br>Ability to act as the leader of a team that may include people with different specializations and qualification levels, for example a team made up of physicians and engineers.<br>Ability to communicate and collaborate with specialists from fields other than electronics, in order to provide an interface between the technical problems they encounter and the solutions to those problems.<br>Analytical and synthesis skills: presents the acquired knowledge synthetically, following a process of systematic analysis.<br>Observes the principles of academic ethics: in documentation activities, correctly cites the bibliographic sources used. |

**8. Rezultatele învăţării** *(Sunt enunţuri sintetice referitoare la ceea ce un student va fi capabil să facă sau să demonstreze la finalizarea unui curs. Rezultatele învăţării reflectă realizările studentului şi mai puţin intenţiile profesorului. Rezultatele învăţării informează studenţii despre ceea ce se aşteaptă de la ei din punct de vedere al performanţei, pentru a obţine notele şi creditele dorite. Sunt definite în termeni concreţi, folosind verbe similare exemplelor de mai jos şi indică ceea ce se va urmări prin evaluare. Rezultatele învăţării vor fi astfel redactate încât să fie evidenţiată clar relaţia faţă de competenţele definite la punctul 7.)*

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|---|---|
| **Cunoştinţe** | *Rezultatul asimilării de informaţii prin învăţare. Cunoştinţele reprezintă ansamblul de fapte, principii, teorii şi practici legate de un anumit domeniu de muncă sau de studiu. Pot fi teoretice şi/sau faptice.*<br><br>Defines concepts specific to Medical Electronics and Informatics.<br>Describes/classifies concepts related to biomedical signal acquisition systems.<br>Highlights consequences and relationships.<br>Identifies problems/needs in the medical field and proposes both hardware and software technical solutions. |
| **Aptitudini** | *Capacitatea de a aplica cunoştinţe şi de a utiliza know-how pentru a duce la îndeplinire sarcini şi a rezolva probleme. Aptitudinile sunt descrise ca fiind cognitive (implicând utilizarea gândirii logice, intuitive şi creative) sau practice (implicând dexteritate manuală şi utilizarea de metode, materiale, unelte şi instrumente).*<br>Selects and groups relevant information in a given context.<br>Uses specific principles in a reasoned manner in order to develop a technical solution with applications in the medical field.<br>Works productively in a team.<br>Prepares a scientific text.<br>Experimentally verifies identified solutions.<br>Solves practical applications.<br>Adequately interprets causal relationships.<br>Analyzes and compares abc.<br>Identifies solutions and develops resolution plans/projects.<br>Formulates conclusions based on the experiments carried out in the Medical Electronics and Informatics laboratory.<br>Justifies the identified solutions/methods of solving. |
| **Responsabilitate şi autonomie** | *Capacitatea cursantului de a aplica în mod autonom şi responsabil cunoştinţele şi aptitudinile sale.*<br>Selects appropriate bibliographic sources and analyzes them.<br>Observes the principles of academic ethics by correctly citing the bibliographic sources used.<br>Demonstrates receptiveness to new learning contexts.<br>Shows collaboration with fellow students and teaching staff in carrying out educational activities.<br>Demonstrates autonomy in organizing the learning situation/context or the problem situation to be solved.<br>Shows social responsibility through active involvement in student social life / involvement in events within the academic community.<br>Promotes/contributes new solutions related to the field of specialization in order to improve the quality of social life.<br>Recognizes the value of their contribution in the field of engineering to identifying viable/sustainable solutions that address problems in social and economic life, demonstrating social responsibility.<br>Applies principles of professional ethics/deontology in analyzing the technological impact of the proposed solutions in the field of specialization on the environment.<br>Analyzes and capitalizes on business opportunities / entrepreneurial development opportunities in the field of specialization.<br>Demonstrates skills in managing real-life situations, such as time management, collaboration, and conflict. |

**9. Metode de predare** *(Se vor avea în vedere metode care să asigure predarea centrată pe student. Se va descrie modul în care se asigură participarea studenților la stabilirea propriului parcurs de învățare, cum se identifică eventualele rămâneri în urmă și ce măsuri remediale se adoptă în astfel de cazuri.)*

Starting from the analysis of students' learning characteristics and their specific needs, the teaching process will explore both expository teaching methods, such as lectures and presentations, and conversational-interactive methods based on learning-through-discovery models facilitated by the direct and indirect exploration of reality, such as experiments, demonstrations, and modeling, as well as action-based methods, such as exercises, practical activities, and problem solving.

Teaching activities will include lectures based on PowerPoint presentations or various videos that will be made available to students. Each course will begin with a review of the chapters already covered, with an emphasis on the concepts addressed in the previous course.

The presentations use images and diagrams so that the information presented is easy to understand and assimilate.

This course covers information and practical activities designed to support students in their learning efforts and in developing optimal collaborative and communication relationships in a climate favorable to discovery-based learning.

The development of active listening and assertive communication skills will be considered, as well as mechanisms for constructing feedback, as ways of behavioral regulation in various situations and of adapting the pedagogical approach to students' learning needs.

Teamwork skills will be practiced in order to solve various learning tasks.

**10. Conţinuturi**

| **CURS** | | |
|---|---|---|
| **Capitolul** | **Conţinutul** | **Nr. ore** |
| 1 | Introduction in Medical Electronics and Informatics | 2 |
| 2 | Electrical phenomena in the human body. Generation of biopotentials. | 4 |
| 3 | Transducers for recording biopotentials | 4 |
| 4 | Amplifiers used in biomedical signals acquistion systems | 3 |
| 5 | Noise cancelling in biopotential recordings | 3 |
| 6 | Acquisition and processing of the electrocardiogram signal | 4 |
| 7 | Acquisition and processing of the fetal electrocardiogram signal | 2 |
| 8 | Acquisition and processing of the electroencephalogram signal | 2 |
| 9 | Electronic medical equipment for auditory system evaluation | 2 |
| 10 | Electrical stimulation of tissues | 2 |
| | **Total:** | 28 |

**Bibliografie:**
Ţarălungă Dragoş Daniel, Electronică şi Informatică Medicală, https://curs.upb.ro/2021/course/view.php?id=9120
Dragoş - Daniel Ţarălungă, Instrumentaţie Biomedicală: Măsurarea şi Analiza Biopotenţialelor, Editura Matrix Rom, ISBN 978-973-755-945-6, nr pagini. 311, 2013
Dragoş - Daniel Ţarălungă, G. Mihaela Ungureanu, Titlul cărţii: Compendium of New Techniques in Harmonic Analysis, Capitol: Cancelling Harmonic Power Line Interference in Biopotentials, eidtura InTech Publisher ISBN 978-1-78923-637-8, nr. pagini 20, DOI: 10.5772/intechopen.74579, 2018
Mihaela,Ungureanu, Ilinca Gussi, Werner Wolf, Dragos Taralunga, Sever Pasca and Rodica Strungaru, Titlul cărţii: Advances in telemedicine : applications in various medical disciplines and geographical regions, Titlu Capitol: Prenatal telemedicine - Advances in fetal monitoring, Editura InTech Publisher, ISBN 978-953-307-161-9 ,pagini: 97-120, 2011
Bioelectromagnetism – J. Malmivuo, R. Plonsey http://www.bem.fi/book/ --
European Virtual Campus for Biomedical Engineering http://www.evicab.eu/
Advances in Biomedical Engineering – P. Verdonck (ed), Elsevier, 2009.
Introduction to Biomedical Engineering, 3rd Edition – J. D. Enderle, Elsevier, 2012.

**LABORATOR**

| Nr. crt. | Conţinutul | Nr. ore |
|---|---|---|
| 1 | BIOPAC acquisition and processing system | 4 |
| 2 | Acquisition and processing of the electrocardiogram signal (ECG) | 4 |
| 3 | Acquisition and processing of the electromyogram signal (EMG) | 4 |
| 4 | Acquisition and processing of the photoplethysmogram (PPG) correlated with the electrocardiogram signal | 4 |
| 5 | Acquisition and processing of the blood pressure | 4 |
| 6 | Acquisition and processing of the electroencephalogram signal (EEG) | 4 |
| 7 | Final verification | 4 |
| | **Total:** | 28 |

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Dragoş - Daniel Ţarălungă, Instrumentaţie Biomedicală: Măsurarea şi Analiza Biopotenţialelor, Editura Matrix Rom, ISBN 978-973-755-945-6, nr pagini. 311, 2013
Dragoş - Daniel Ţarălungă, G. Mihaela Ungureanu, Titlul cărţii: Compendium of New Techniques in Harmonic Analysis, Capitol: Cancelling Harmonic Power Line Interference in Biopotentials, eidtura InTech Publisher ISBN 978-1-78923-637-8, nr. pagini 20, DOI: 10.5772/intechopen.74579, 2018
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Bioelectromagnetism – J. Malmivuo, R. Plonsey http://www.bem.fi/book/ --
European Virtual Campus for Biomedical Engineering http://www.evicab.eu/
Advances in Biomedical Engineering – P. Verdonck (ed), Elsevier, 2009.
Introduction to Biomedical Engineering, 3rd Edition – J. D. Enderle, Elsevier, 2012.

**11. Evaluare**

| Tip activitate | 11.1 Criterii de evaluare | 11.2 Metode de evaluare | 11.3 Pondere din nota finală |
|---|---|---|---|
| 11.4 Curs | * Knowledge of fundamental theoretical concepts;<br>* Knowledge of how to apply theory to problems specific to medical electronics and informatics; | Written exam | 50% |
| 11.5 Seminar/laborator/proiect | * Knowledge and use of the hardware and software components involved in creating an experimental setup for the acquisition and processing of biomedical signals. | Laboratory exam | 25% |
| | * Processing and interpretation of acquired data. | Continuous assessment. | 25% |
| 11.6 Condiţii de promovare | | | |
| Obtaining 50% of the total score.<br>Obtaining 50% of the score assigned to the activities carried out during the semester.<br>Full attendance at laboratory classes.<br>Obtaining 50% of the score assigned to the laboratory. | | | |

**12. Coroborarea conţinutului disciplinei cu aşteptările reprezentanţilor angajatorilor şi asociaţiilor profesionale reprezentative din domeniul aferent programului, precum şi cu stadiul actual al cunoaşterii în domeniul ştiinţific abordat şi practicile în instituţii de învăţământ superior din Spaţiul European al Învăţământului Superior (SEÎS)**

The medical field faces many issues of extreme importance for engineers, through the fundamental aspects of device and system analysis, design, and practical applications. These problems range from simple to complex, such as those raised by electrodes and transducers for monitoring specific physiological processes, to complex information systems implemented in hospitals and at national level.

The course syllabus specifically responds to current requirements for development and evolution, in line with the global service economy in the field of medical electronics and informatics. In the context of current technological progress, medical applications of electronics and medical informatics strongly require inventiveness.

Thus, graduates are provided with competencies appropriate to the needs of current qualifications, as well as high-quality and competitive scientific and technical training, enabling them to be employed immediately after graduation. The competencies fall within the policy of the Polytechnic University of Bucharest, both in terms of the course content and structure, and in terms of the skills and international openness offered to students.

| Data completării | Titular de curs | Titular(i) de aplicaţii |
|---|---|---|
| 25.09.2025 | Conf. dr. ing. Dragoş Daniel ŢARĂLUNGĂ | Conf. dr. ing. Dragoş Daniel ŢARĂLUNGĂ |

**Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti**

**Facultatea de Electronică, Telecomunicaţii şi**

**Tehnologia Informaţiei**

| | |
|---|---|
| Data avizării în departament | Director de departament |
| | Conf. dr. ing. Bogdan Cristian FLOREA |
| Data aprobării în Consiliul Facultăţii | Decan |
| | Prof. Dr. Mihnea Udrea |