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

# COURSE DESCRIPTION

## 1. Program identification information

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

## 2. Date despre disciplină

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|---|---|---|---|---|---|---|---|
| 2.1 Course name (ro)<br>(en) | | | | Televiziune<br>Television | | | |
| 2.2 Course Lecturer | | | | Conf. Dr. Ioan TACHE | | | |
| 2.3 Instructor for practical activities | | | | Conf. Dr. Ioan TACHE | | | |
| 2.4 Year of studies | 3 | 2.5 Semester | II | 2.6. Evaluation type | V | 2.7 Course regime | Op |
| 2.8 Course type | | D | 2.9 Course code | 04.D.06.A.414 | | 2.10 Tipul de notare | Nota |

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

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|---|---|---|---|---|---|
| 3.1 Number of hours per week | 3 | Out of which: 3.2 course | 2 | 3.3 seminary/laboratory | 1 |
| 3.4 Total hours in the curricula | 42 | Out of which: 3.5 course | 28 | 3.6 seminary/laboratory | 14 |
| 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. | | | | | 5 |
| Tutoring | | | | | 0 |
| Examinations | | | | | 3 |
| Other activities (if any): | | | | | 0 |

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| 3.7 Total hours of individual study | 8.00 |
| 3.8 Total hours per semester | 50 |
| 3.9 Number of ECTS credit points | 2 |

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

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| 4.1 Curriculum | Completion and/or passing of the following subjects:<br>Signals and Systems<br>Digital Integrated Circuits<br>Fundamental Electronic Circuits |

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| 4.2 Results of learning | Understanding the main characteristics of the human visual system and how these are used in television systems.<br>Understanding the colorimetric systems in which video cameras and display devices operate in different television systems.<br>Knowledge of the parameters of television systems.<br>Knowledge of the equipment in the television studio.<br>Knowledge of coding/decoding techniques and standards for spectrum compression of video signals.<br>Knowledge of methods for measuring parameters in digital television systems.<br>Knowledge of TV receivers for terrestrial, cable, satellite, or Internet transmission. |

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

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| 5.1 Course | The course will take place in a room equipped with a video projector and a computer |
| 5.2 Seminary/ Laboratory/Project | Mandatory attendance at laboratories (according to UPB bachelor's studies regulations) |

**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 discipline familiarizes students with digital television systems and video signal processing equipment. It presents elements of visual perception and notions of colorimetry. The construction and parameters of image capture and display devices are studied. Equipment for digital television studios is studied. The systems for transmitting the TV signal over terrestrial, cable, and satellite channels, as well as IPTV and OTT systems, are studied. Methods for measuring and monitoring quality in digital television systems are presented.
The applications familiarize students with video signals, digital television receivers, and equipment in digital television studios. In particular, the following are studied:
The way image signals are formed, analysis and measurement of the parameters of these signals;
The construction of digital receivers for terrestrial, cable, and satellite television, measurement of the parameters of these receivers;
Measurement of video quality in digital television systems.

**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** | Use of fundamental knowledge related to electronic devices, circuits, and instrumentation.<br>Application, in typical situations, of basic methods of processing electrical signals.<br>Understanding and use of fundamental concepts in the field of communications and information transmission.<br>Ability to plan and carry out measurements and tests on electronic devices, circuits, and modules by handling specific hardware instruments and dedicated automation software. |

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| **Transversal (General) Competences** | Ability to make decisions to solve current or unforeseen problems that arise in the process of designing electronic circuits.<br>Ability to ensure planning and project management in the field of electronics.<br>Ability to continuously inform and document oneself for personal and professional development by reading specialized literature.<br>Flexibility in using new systems and technologies within a team in which members jointly achieve a well-defined goal. |

**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>Understanding the main characteristics of the human visual system and how these are used in television systems.<br>Understanding the colorimetric systems in which video cameras and display devices operate in different television systems.<br>Knowledge of the parameters of television systems.<br>Knowledge of the equipment in the television studio.<br>Knowledge of coding/decoding techniques and standards for spectrum compression of video signals.<br>Knowledge of methods for measuring parameters in digital television systems.<br>Knowledge of TV receivers for terrestrial, cable, satellite, or Internet transmission. |
| **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>Analyzes analog and digital video signals.<br>Understands and interprets test signals and images.<br>Uses coding/decoding techniques and standards adapted to the parameters of the transmission channel.<br>Applies and understands how video signals are used for special effects and in the video editing process.<br>Works within the team of a television center coordinated with specialists from the artistic and economic fields.<br>Performs link budget analysis calculations on terrestrial, cable, and satellite communication channels.<br>Designs reception systems and equipment for terrestrial, cable, or satellite transmission of digital television signals.<br>Measures transmission parameters in digital television systems, analyzes and interprets results to ensure continuity of operations for television service operators.<br>Ensures adjustment, testing, and troubleshooting of equipment in the television studio and television center.<br>Determines through measurements the quality of video signals and images. |

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| **Responsability and autonomy** | *The student's capacity to autonomously and responsably apply their knowledge and skills.*<br>Searches for suitable bibliographic sources and analyzes them.<br>Correctly cites the bibliographic sources used.<br>Contributes with new solutions to the development of the specialty field.<br>Drafts scientific papers that present the results of their research.<br>Analyzes and capitalizes on new scientific solutions for business opportunities in their field of specialization. |

**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.)*

Teaching is based on lectures using a video projector, PowerPoint presentations (covering the communication and demonstration functions), and video presentations. The oral communication method is the expository method. Each course will begin with a recap of the previous chapter. All course materials are available on the Moodle platform.
The presentations use images and diagrams so that the information presented is easy to understand and assimilate. During the course, students may ask questions to quickly resolve any ambiguities.
Problems related to situations that occur in practice are used in each chapter so that students quickly discover the application area of the theoretical knowledge taught.
Practical laboratory activities allow the development of skills in using equipment in the field of television, as well as the development of collaborative and communication relationships among team members.
The instructor gives a short presentation of the concepts to be used in the respective work, then guides students in carrying out the practical application. Students independently test and evaluate the same problems using the specific equipment for each laboratory work. Teaching materials are available in the laboratory and on the Moodle platform.

**10. Contents**

| **COURSE** | | |
|---|---|---|
| **Chapter** | **Content** | **No. hours** |
| 1 | Characteristics of visual perception. Basic notions of colorimetry. | 2 |
| 2 | Color television systems. Formation of the video signal. Spectrum of the video signal. | 2 |
| 3 | Digital television systems. Spectrum compression of the video signal. Transmission and compression standards for the digital TV signal. | 4 |
| 4 | High-definition (HDTV) and ultra high-definition (UHDTV) digital television systems. Three-dimensional TV systems (3DTV). | 4 |
| 5 | Image capture and display devices. CCD and CMOS video capture devices. Display devices. | 2 |
| 6 | Transmission of the digital television signal. Terrestrial transmission (DVB-T2 standard). Cable transmission (DVB-C/C2 standards). Satellite transmission (DVB-S/S2 standards). | 4 |
| 7 | Digital television receiver for terrestrial and cable transmission. Reception installation for satellite TV transmission. | 4 |
| 8 | IPTV and OTT systems. | 2 |
| 9 | Digital TV studio. Video camera. Equipment in the TV studio. | 2 |
| 10 | Measurement and monitoring of video quality in digital television systems. | 2 |

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| | **Total:** | 28 |

**Bibliography:**

1. Tache Ioan, Televiziune, suport de curs electronic pe platforma Moodle, https://curs.upb.ro/2021/mod/folder/view.php?id=171054
2. S. Naicu, I. Tache - Receptoare moderne pentru TV în culori - Editura All Educational 1998, ISBN 973-9392-58-x
3. C. Miroiu, N. Drăgulănescu, I. Tache - Recepţia emisiunilor TV transmise prin satelit, Editura Tehnică, Bucureşti 1993, ISBN 973-31-0428-0
4. Ghid de practică TV Sigma – Practicanţii de azi, profesioniştii de mâine ai televiziunilor, Universitatea Politehnica Bucureşti, 2013
5. Gerard O'Driscoll - Next generation IPTV services and technologies, John Wiley & Sons, Inc. 2008, ISBN 978-0-470-16372-6
6. I. Voicu – Transmisia fluxului de date video – Editura Medro, Bucureşti, 2007, ISBN 978-973-8487-24-2
7. Handbook on digital terrestrial television broadcasting networks and systems implementation, International Telecommunication Union – Radiocommunication Sector (ITU-R) 2021 edition, https://www.itu.int/en/publications/ITU-R/pages/publications.aspx?parent=R-HDB-63-2021&media=electronic
8. ETSI EN 302 755 (2015-07), Digital Video Broadcasting DVB; Frame Structure Channel coding and modulation for a second generation digital terestrial television broadcasting system (DVB-T2), https://www.etsi.org/deliver/etsi_en/302700_302799/302755/01.04.01_60/en_302755v010401p.pdf
9. ETSI EN 302 307-1 (2014-11), Digital Video Broadcasting DVB; Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications; Part 1: DVB-S2, https://dvb.org/?standard=second-generation-framing-structure-channel-coding-and-modulation-systems-for-broadcasting-interactive-services-news-gathering-and-other-broadband-satellite-applications-part-1-dvb-s2
10. Rec. BT.500-14 (10/2019), Methodologies for subjective assesment of the quality of television images, International Telecommunication Union – Radiocommunication Sector, 2019, https://www.itu.int/rec/R-REC-BT.500-14-201910-I/en
11. Rec. BT 709-6 (06/2015), Parameter values for the HDTV standards for production and international programme exchange, International Telecommunication Union – Radiocommunication Sector, 2015, https://www.itu.int/rec/R-REC-BT.709-6-201506-I/en
12. Rec. BT.1790-0 901/2007), Requirements for monitoring of broadcasting chains during operation, International Telecommunication Union – Radiocommunication Sector, 2007, https://www.itu.int/rec/R-REC-BT.1790-0-200701-I/en
13. DVB Bluebook A176r2, DVB-MABR (Multicast Adaptive Bit Rate), 2022, https://dvb.org/?standard=adaptive-media-streaming-over-ip-multicast

**LABORATORY**

| Crt. no. | Content | No. hours |
|---|---|---|
| 1 | The video signal in color systems | 2 |
| 2 | Terrestrial digital television with the DVB-T2 standard | 2 |
| 3 | Television studio | 2 |
| 4 | Video camera | 2 |
| 5 | Reception installation for the digital satellite TV signal | 2 |
| 6 | Measuring video quality in digital TV systems | 2 |
| 7 | Final laboratory colloquium | 2 |

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| | **Total:** | 14 |

**Bibliography:**


. Tache Ioan, Televiziune, suport de curs electronic pe platforma Moodle, https://curs.upb.ro/2021/mod/folder/view.php?id=171054
. S. Naicu, I. Tache - Receptoare moderne pentru TV în culori - Editura All Educational 1998, ISBN 973-9392-58-x
. C. Miroiu, N. Drăgulănescu, I. Tache - Recepţia emisiunilor TV transmise prin satelit, Editura Tehnică, Bucureşti 1993, ISBN 973-31-0428-0
. Ghid de practică TV Sigma – Practicanţii de azi, profesioniştii de mâine ai televiziunilor, Universitatea Politehnica Bucureşti, 2013
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. ETSI EN 302 755 (2015-07), Digital Video Broadcasting DVB; Frame Structure Channel coding and modulation for a second generation digital terestrial television broadcasting system (DVB-T2), https://www.etsi.org/deliver/etsi_en/302700_302799/302755/01.04.01_60/en_302755v010401p.pdf
. ETSI EN 302 307-1 (2014-11), Digital Video Broadcasting DVB; Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications; Part 1: DVB-S2, https://dvb.org/?standard=second-generation-framing-structure-channel-coding-and-modulation-systems-for-broadcasting-interactive-services-news-gathering-and-other-broadband-satellite-applications-part-1-dvb-s2
. Rec. BT.500-14 (10/2019), Methodologies for subjective assesment of the quality of television images, International Telecommunication Union – Radiocommunication Sector, 2019, https://www.itu.int/rec/R-REC-BT.500-14-201910-I/en
. Rec. BT 709-6 (06/2015), Parameter values for the HDTV standards for production and international programme exchange, International Telecommunication Union – Radiocommunication Sector, 2015, https://www.itu.int/rec/R-REC-BT.709-6-201506-I/en
0. Rec. BT.1790-0 901/2007), Requirements for monitoring of broadcasting chains during operation, International Telecommunication Union – Radiocommunication Sector, 2007, https://www.itu.int/rec/R-REC-BT.1790-0-200701-I/en
1. DVB Bluebook A176r2, DVB-MABR (Multicast Adaptive Bit Rate), 2022, https://dvb.org/?standard=adaptive-media-streaming-over-ip-multicast https://www.itu.int/rec/R-REC-BT.709-6-201506-I/en


**11. Evaluation**

| Activity type | 11.1 Evaluation criteria | 11.2 Evaluation methods | 11.3 Percentage of final grade |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 11.4 Course | - Knowledge of fundamental theoretical concepts;<br>- Specification of the video signal corresponding to test images (and vice versa), knowledge of how to apply theory to specific problems; | Written test with problems during the semester held on a date fixed at the beginning of the semester | 40% |
| | Application of theoretical concepts to specific problems in television signal transmission | Final written test<br>The subjects are problems that cover the entire material and provide a synthesis between the theoretical presentation and practical problems | 20% |
| 11.5 Seminary/laboratory/project | Knowledge of how to generate the video signal for various television systems;<br>Knowledge of methods for measuring parameters in digital television;<br>Knowledge of the construction and operation of the main television equipment | Final laboratory colloquium that includes the practical component.<br>The practical component is verified through a written test with problems from the laboratory works and by checking how a practical problem is solved (measuring parameters of video signals or television equipment) | 40% |
| 11.6 Passing conditions | | | |
| Obtaining 50% of the total score. Passing the laboratory. | | | |

**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)**

Television is a field with extremely rapid development in recent years. The large-scale introduction of terrestrial, cable, and satellite high-definition HDTV and ultra high-definition UHDTV digital television, of IPTV systems, and the spectacular development of OTT services has led to rapid evolution regarding television receivers and studio equipment. The integrated circuit industry, image capture and display devices, television equipment, television studios, terrestrial, cable, and satellite television service operators, IPTV and OTT services, and the video surveillance systems industry all have a significant demand for engineers specialized in digital television systems.
The course syllabus concretely responds to these current requirements for the development of television in the European and global context in the field of Electronic Engineering and Telecommunications. The targeted areas of activity cover a wide spectrum: integrated circuit industry, image sensors and display devices for digital television, studio equipment industry, digital television receiver industry and equipment for digital television transmission, television studios, terrestrial, cable, and satellite digital television service operators, IPTV and OTT services, the video surveillance systems industry, and other fields that use the transmission, storage, and processing of image signals.

In this way, graduates are provided with competencies appropriate to the current qualification needs of the labor market and a modern, high-quality, and competitive scientific and technical training that will allow them to be quickly employed after graduation, the course being perfectly aligned with the policy of the University Politehnica of Bucharest, both in terms of content and structure, and in terms of skills and international openness offered to students.
In developing the content of the discipline, knowledge described in the specialized literature as well as the authors' own published/presented research was taken into account.
The course has content similar to courses held at the following universities:
Birmingham City University, United Kingdom – Audio and Video Processing, Broadcast Technology
University of Surrey, United Kingdom – Video Fundamentals, Broadcast Engineering
Universidad de Málaga, España – Fundamentos de Video. Equipos de Video
Universitat Politècnica de València, España – TV and video systems

| Date | Course lecturer | Instructor(s) for practical activities |
|---|---|---|
| 24.09.2025 | Conf. Dr. Ioan TACHE | Conf. Dr. Ioan TACHE |

| Date of department approval | Head of department |
|---|---|
| | Prof. Dr. Claudius Dan |

| Date of approval in the Faculty Council | Dean |
|---|---|
| | Prof. Mihnea UDREA |