Politehnica University of Bucharest

Faculty of Electronics, Telecommunications and Information Technology

**COURSE DESCRIPTION**

**1. Program identification information**

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| 1.1 Higher education institution | Politehnica University of Bucharest |
| 1.2 Faculty | Faculty of Electronics, Telecommunications and Information Technology |
| 1.3 Department | Physics |
| 1.4 Domain of studies | Electronic Engineering and Telecommunications |
| 1.5 Cycle of studies | License |
| 1.6 Program of studies/Qualification | Electronic Engineering and Telecommunications |

**2. Course identification information**

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| 2.1 Name of the course | | | | Physics 2 | | | |
| 2.2 Lecturer | | | | Prof. Dr. Ecaterina C. NICULESCU | | | |
| 2.3 Instructor for practical activities | | | | Conf. Dr. Adrian RADU  Ş.l. Dr. Georgiana VASILE  Ş.l. Dr. Ing. Adrian DUCARIU | | | |
| 2.4 Year of studies | I | 2.5 Semester | 2 | 2.6 Evaluation type | Examination | 2.7 Course choice type | Required |

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

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 3.1 Number of hours per week, out of which | 4 | | 3.2 course | 3 | 3.3 seminars/laboratory | | 0/1 |
| 3.4 Total hours in the curricula, out of which | 56 | | 3.5 course | 42 | 3.6 practical activities | | 0/14 |
| Distribution of time | | | | | | | hours |
| Study according to the manual, course support, bibliography and hand notes | | | | | | | 30 |
| Supplemental documentation (library, electronic access resources, in the field, etc) | | | | | | | 6 |
| Preparation for practical activities, homework, essays, portfolios, etc. | | | | | | | 6 |
| Tutoring | | | | | | | 3 |
| Examinations | | | | | | | 3 |
| Other activities | | | | | | |  |
| 3.7 Total hours of individual study | | 48 | | | |  |  |
| 3.9 Total hours per semester | | 104 | | | |  |  |
| 3. 10 Number of ECTS credit points | | 4 | | | |  |  |

**4. Prerequisites (if applicable)**

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| 4.1 curricular | Physics 1 |
| 4.2 competence-based | Derivation, integration, vectors, matrices, partial derivatives, wave equation |

**5. Requisites (if applicable)**

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| 5.1 for running the course | Possibility to use video projector |
| 5.2 for running of the applications | Specialized laboratory from the Physics Department. Students must attend all the experiments. |

**6. Specific competences**

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| Professional competences | Understanding methods and results from physics and apply them in particular cases, in particular from electronics.  Ability to build and apply mathematical and physical models.  Application of mathematics in various situations.  Course develops abilities to measure physical quantities, to accumulate and treat experimental data, to compute errors and to present final results of an experiment. |  |
| Transversal  competences | Students acquire efficient methods of learning, combine theoretical and experimental results and begin to work together in teams.  They learn how to find basic points and bring them to light.  Pupils discover how to defend an idea and how to sustain an argument. |  |

**7. Course objectives (as implied by the grid of specific competences)**

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| --- | --- |
| 7.1 General objective of the course | Students understand modern physics and learn how to apply it in engineering.  They study the confirmation of theory by experiment and learn how to solve problems from optics, quantum mechanics, atomic physics, semi-conductor physics. |
| 4.2 Specific objectives | Students study applied mathematics and physics and learn how to solve various problems from science and engineering.  They apply models in simple situations and initiate scientific research. |

**8. Content**

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| 8.1 Lectures | Teaching techniques | Remarks  (No. of hours) |
| Interference, diffraction. Applications. | Presentation on the black-board, worked examples, questions, discussions, slide presentations. | 7 |
| Experimental foundation of quantum physics.  Characteristics of quantum objects. | 4 |
| Principles of quantum mechanics. Schrödinger equation. | 3 |
| Simple applications of quantum laws. | Presentation on the black-board, worked examples, questions, discussions, slide presentations. | 2 |
| One-dimensional applications: potential well, potential barrier, tunnel effect, quantum harmonic oscillator. Applications. | 8 |
| Hydrogen atom. Atoms in magnetic fields. Electronic spin. Introduction to atomic spectroscopy. | 6 |
| Identical micro-particles. Classical and quantum statistics. Bose-Einstein condensation. Statistics of carriers in semi-conductors. | 8 |
| Emission and absorption of radiation. | 2 |
| Initiation in laser physics. | 2 |
| References:  1. Lectures on the site of the Department of Physics.  2. E. C. Niculescu, Fizica, vol.2. Ed. Matrix Rom, Bucuresti, 2004  3. I. M. Popescu, Fizica, Vol. II, Ed. Didactica si Pedagogica, Bucuresti, 1983  4. R. Feynman, Fizica Moderna, vol. III, Ed. Tehnica, Bucuresti, 1972.  5. R. Bena, Fizica cuantica, Ed. Credis, Bucuresti, 2001.  6. Halliday & Resnick, Fundamentals of Physics, 8-th ed. Wiley India Pvt. Limited, 2008 | | |
| 8.2 Practical applications | Teaching techniques | Remarks  (No. of hours) |
| Measurement of the electron specific charge by the magnetron method. |  |  |
| Experimental determination of Rydberg’s constant. |  |  |
| Experimental determination of Planck’s constant. |  |  |
| Poisson and Gaussian statistics. |  |  |
| Electron diffraction (Debye – Scherrer experiment). |  |  |
| Heisenberg’s uncertainty principle experiment. |  |  |
| Measurement of the current – voltage characteristics of a tunnel diode. |  |  |
| Bibliography:  1. Presentation of experiments from the Physics Laboratory.  2. Laboratory sheets from the Physics Laboratory. | | |

**9. Bridging the course content with the expectations of the epistemic community representatives, professional associations and employers representatives for the domain of the program**

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| The course Physics 1 is a fundamental topic having an important role in the creation of the attitude of a future researcher-engineer. Lectures facilitate the passage from high-school to university subjects.  Physics creates a link between mathematical and physics models and methods applied to engineering.  One begins to put the foundations of matters such as semi-conductor physics, microwaves, lasers and opto-electronics.  Students begin preparation for scientific research during master years.  They are initiated in several modern physics theories: quantum mechanics and its applications.  During the course pupils do experiments, measure physical quantities, compute errors and give final results. |

**10. Evaluation**

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| Type of activity | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Weight in the final mark |
| 10.4 Lectures |  | -involvement during lectures, - partial examination  - final examination | 70% |
|  | | | |
| 10.5 Practical applications (laboratory) |  | - involvement during classes  - final colloquium | 30% |
| 10.6 Minimal performance standard | | | |
| * knowledge of basic quantities and laws for the submitted chapters of Physics * solving of simple problems * understanding problems involved in physics experiments | | | |

Date Lecturer Instructor for practical activities

01. 10. 2013. Prof. Dr. Ecaterina C. Niculescu Ş. L. Dr. Ing. Georgiana Vasile

Ş. L. Dr. Ing. Adrian Ducariu

Date of department approval Director of Department,

04. 10. 2013. Prof. Dr. Gheorghe Căta-Danil