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| **Department name** | BIOMEDICAL ENGINEERING |

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| **COURSE INFORMATON** | | | | | |
| **Course Title** | *Code* | *Semester* | *T+P+L Hour* | *Credits* | *ECTS* |
| BIOLOGICAL AND MEDICAL PHYSICS | BME 211 | 3 | 2+2+0 | 3 | 11 |

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| **Prerequisites** | - |

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| **Language of Instruction** | English |
| **Course Level** | Bachelor's Degree (First Cycle Programmes) |
| **Course Type** | Compulsory |
| **Course Coordinator** |  |
| **Instructors** | Assist.Prof.Dr.Andaç HAMAMCI |
| **Assistants** |  |
| **Goals** | The aim of this course is to provide student with knowledge of biological and medical physics. |
| **Content** | Oscillations, waves, acoustics, ultrasonography, photoelectric experiment and photon, electromagnetic spectrum, ionizing radiations, production of X-Rays, interaction of X-Rays with matter; radioactive decay; radioactivity, activity and half-life calculations; and biological effects of ionizing radiation. |

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| **Learning Outcomes** | **Program**  **Outcomes** | **Teaching**  **Methods** | **Assessment**  **Methods** |
| Describe the concept of a wave |  | 1,2,4 | A |
| Plot the graph of given wave equation and write wave equation from a given graph |  | 1,2,4 | A,C |
| Perform calculations on wave interference |  | 1,2,4 | A,C |
| Perform calculations on the propagation of acoustic waves (including the Doppler effect) |  | 1,2,4 | A,C |
| Explain wave-particle duality and the photon concept |  | 1,2,4 | A,C |
| Associate the bands of the electromagnetic spectrum with their respective wavelengths |  | 1,2,4 | A |
| Explain the operation of the X-Ray tube, as well as its parts and functions, using diagrams; estimate the effect of parameters on the spectrum |  | 1,2 | A,C |
| Explain the interaction mechanisms of X-Rays with matter and calculate attenuation |  | 1,2 | A,C |
| Perform binding energy calculations by matter-energy conversions. |  | 1,2 | A,C |
| Describe the modes of radioactive decay |  | 1,2 | A,C |
| Perform calculations on radioactive decay and radiopharmaceuticals |  | 1,2 | A,C |

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| **Teaching**  **Methods:** | 1: Lecture, 2: Question-Answer, 3: Laboratory, 4: Simulation, 5: Case Study |
| **Assessment**  **Methods:** | A: Testing, B: Experiment, C: Homework |

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| **COURSE CONTENT** | | |
| **Week** | **Topics** | **Study Materials** |
| 1 | Review of the Trigonometric Functions and Plots | Textbooks & course notes |
| 2 | Vibrations and Simple Harmonic Motion | Textbooks & course notes |
| 3 | Concepts of Waves, Wave Equation, Wavelength, and Frequency | Textbooks & course notes |
| 4 | Review of Exponential Functions | Textbooks & course notes |
| 5 | Acoustics, Sonography | Textbooks & course notes |
| 6 | Electromagnetic Waves | Textbooks & course notes |
| 7 | Photoelectric Effect, Photon and Electromagnetic Spectrum | Textbooks & course notes |
| 8 | Midterm |  |
| 9 | Production of X-Rays | Textbooks & course notes |
| 10 | Interaction of X-Rays with Matter | Textbooks & course notes |
| 11 | Attenuation | Textbooks & course notes |
| 12 | Radioactivity and decay modes | Textbooks & course notes |
| 13 | Activity Calculations | Textbooks & course notes |
| 14 | Radiation Risks and Biological Effects | Textbooks & course notes |

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| **RECOMMENDED SOURCES** | |
| **Textbook** | INTERMEDIATE PHYSICS FOR MEDICINE AND BIOLOGY, 4TH EDITION, RUSSEL K. HOBBIE, BRADLEY J. ROTH, SPRINGER, 2007.  THE ESSENTIAL PHYSICS OF MEDICAL IMAGING, 3RD EDITION, J. T. BUSHBERG |
| **Additional Resources** | “NUCLEAR MEDICINE PHYSICS”, INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA) (FREE-ONLINE) |

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| **MATERIAL SHARING** | |
| **Documents** | Course Notes and Textbook |
| **Assignments** | - |
| **Exams** | - |

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| **ASSESSMENT** | | |
| **IN-TERM STUDIES** | **NUMBER** | **PERCENTAGE** |
| Midterm | 1 | 40 |
| Homework | 6 | 10 |
| **Total** |  | 50 |
| **CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE** |  | 50 |
| **CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE** |  | 50 |
| **Total** |  | **100** |

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| **COURSE CATEGORY** | Expertise/Field Courses |

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| **COURSE'S CONTRIBUTION TO PROGRAM** | | |
| **No** | **Program Learning Outcomes** | Contribution |
| **1** | Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems. | √ |
| **2** | Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modelling methods for this purpose. | √ |
| **3** | Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose. | √ |
| **4** | Ability to devise, select, and use modern techniques and tools needed for analyzing and solving complex problems encountered in ​engineering practice; ability to employ information technologies effectively. | √ |
| **5** | Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems. | √ |
| **6** | Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually |  |
| **7** | Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language. |  |
| **8** | Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself. |  |
| **9** | Awareness of professional and ethical responsibility. |  |
| **10** | Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development. |  |
| **11** | Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions. |  |

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| **ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION** | | | |
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (Including the exam week: 14x Total course hours) | 14 | 4 | 56 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 7 | 98 |
| Mid-terms | 1 | 20 | 20 |
| Homework | 6 | 10 | 60 |
| Final examination | 1 | 30 | 30 |
| **Total Work Load** |  |  | 264 |
| **Total Workload / 25 (h)** |  |  | 10.56 |
| **ECTS Credit of the Course** |  |  | 11 |