| COURSE INFORMATON | | | | | |
|---|---|---|---|---|---|
| **Course Title** | ***Code*** | ***Semester*** | ***L+P Hour*** | ***Credits*** | ***ECTS*** |
| **Advanced Biomaterials for Imaging and Radiology** | **BME531** | | (3+0+0) | 3 | 10 |

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| **Prerequisites** | |

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| **Language of Instruction** | English |
| **Course Level** | Master's Degree |
| **Course Type** | Technical Elective |
| **Course Coordinator** | Prof. Dr. Ali Ümit Keskin |
| **Instructors** | Assist. Prof. Feride Şermin UTKU |
| **Assistants** | |
| **Goals** | To provide students knowledge on types, application and production of biomaterials used in radiology and imaging. |
| **Content** | Basics of nanomaterials, biomaterials used in radiology and imaging, as well as light emitting/detecting and conducting/insulating systems, such as photonic crystals, nanowire heterostructure photodetectors, self-assembled nano-dielectrics, organic light emitting diodes and photovoltaics, transparent conducting thin films, plasmonics, single-molecule electronics. The polymeric biomaterials, proteins and tags used in delivery of radioactive materials, gold nanoparticles, and photonic crystals. |

| **Course Learning Outcomes** | **Program Learning Outcomes** | **Teaching Methods** | **Assessment Methods** |
|---|---|---|---|
| 1) Basics of material science, electrical, optical, and magnetic properties of biomaterials. | 2,4,5,6,7,11 | 1,2,3 | A,C,D |
| 2) Types of biomaterials used in radiology and imaging | 2,4,5,6,7,11 | 1,2,3 | A,C,D |
| 3) Polymeric biomaterials used in delivery of radioactive materials | 2,4,5,6,7,11 | 1,2,3 | A,C,D |
| 4) Gold nanoparticles, photonic crystals. | 2,4,5,6,7,11 | 1,2,3 | A,C,D |

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| **Teaching Methods:** | 1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study |
| **Assessment** | A: Testing, B: Experiment, C: Homework, D: Project presentation |

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| **Methods:** | |

| COURSE CONTENT | | |
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| **Week** | **Topics** | **Study Materials** |
| 1 | Basics of material science and biocompatibility | Lecture notes, articles |
| 2 | Electrical and magnetic propeties of biomaterials | Lecture notes, articles |
| 3 | Optical propeties of biomaterials | Lecture notes, articles |
| 4 | Radioactivity | Lecture notes, articles |
| 5 | Basics of hierarchical biological nanomaterials | Lecture notes, articles |
| 6 | Biomaterials used in radiology and imaging | Lecture notes, articles |
| 7 | MID-TERM | Lecture notes, articles |
| 8 | Polymeric biomaterials used in delivery of radioactive materials | Lecture notes, articles |
| 9 | Proteins and tags | Lecture notes, articles |
| 10 | Gold nanoparticles and photonic crystals | Lecture notes, articles |
| 11 | Hybrid materials | Lecture notes, articles |
| 12 | Production of hybrid materials | Lecture notes, articles |
| 13 | Characterization of electrical and magnetic properties of materials | Lecture notes, articles |
| 14 | Characterization of optical properties of materials | Lecture notes, articles |

| RECOMMENDED SOURCES | |
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| **Textbook** | |
| **Additional Resources** | |

| MATERIAL SHARING | |
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| **Documents** | |
| **Assignments** | |
| **Exams** | |

| ASSESSMENT | | |
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| **IN-TERM STUDIES** | **NUMBER** | **PERCENTAGE** |
| Mid-terms | 1 | 50 |
| Homework | 10 | 20 |
| Presentation | 1 | 30 |
| **Total** | | **100** |
| **CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE** | | 40 |
| **CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE** | | 60 |
| **Total** | | **100** |

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

| COURSE'S CONTRIBUTION TO PROGRAM | | | | | | | |
|---|---|---|---|---|---|---|---|
| **No** | **Program Learning Outcomes** | **Contribution** | | | | | |
| | | **0** | **1** | **2** | **3** | **4** | **5** |
| 1 | Ability to reach wide and deep knowledge through scientific research in the field of Biomedical Engineering, evaluate, interpret and apply. | | | | | **X** | |
| 2 | Ability to use scientific methods to cover and apply limited or missing knowledge, and to integrate the knowledge of different disciplines to identify, define, formulate solutions to complex engineering problems. | | | | **X** | | |
| 3 | Ability to construct Biomedical Engineering problems, develop methods to solve the problems and use innovative methods in the solution. | | | | **X** | | |
| 4 | Ability to develop new and/or original ideas, tools and algorithms; develop innovative solutions in the design of system, component or process. | | | | | **X** | |
| 5 | Ability to have extensive knowledge about current techniques and methods applied in Biomedical Engineering and their constraints. | | | | **X** | | |
| 6 | Ability to design and implement analytical modeling and experimental research, solve and interpret complex situations encountered in the process. | | | | | **X** | |
| 7 | Ability to use a foreign language (English) at least at the level of European Language Portfolio B2 in verbal and written communication. | | | | | **X** | |
| 8 | Ability to lead in multidisciplinary teams, develop solutions to complex situations and take responsibility. | | | | **X** | | |
| 9 | Ability to pass process and the results in Biomedical Engineering field, in national and international area in or outside of the field, systematically and clearly in written or oral form. | | | | **X** | | |

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| 10 | Awareness of the social, legal, ethical and moral values and environmental dimensions. The ability to conduct research and implementation work within the framework of these values. | | | | X | | | |
| 11 | Awareness of the new and emerging applications in Biomedical Engineering field, and the ability to examine them and learn if necessary. | | | | | X | | |
| 12 | Ability to read, understand, present, critise research work and conduct original theoretical or applied research. | | | | X | | | |

| ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION | | | |
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| **Activities** | **Quantity** | **Duration (Hour)** | **Total Workload (Hour)** |
| Course Duration (Excluding the exam weeks: 12x Total course hours) | 12 | 3 | 36 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 5 | 70 |
| Midterm examination | 2 | 3 | 6 |
| Homework | 5 | 6 | 30 |
| Presentation | 1 | 20 | 20 |
| Final examination | 1 | 3 | 3 |
| **Total Work Load** | | | 240 |
| **Total Work Load / 25 (h)** | | | 9.6 |
| **ECTS Credit of the Course** | | | **10** |