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| Code  | **ME437 & ME537** |
| **Title** | BiomechatronicsTop of FormBottom of Form |
| **Faculty** | Faculty of Engineering and Natural Sciences |
| **Subject** | Mechatronics (ME) |
| **SU Credit** | 3 |
| **ECTS Credit** | 6 |
| **Instructor(s)** | Meltem Elitashttp://myweb.sabanciuniv.edu/melitas/ |
| **Language of Instruction** | English |
| **Level of Course** | BS and MS |
| **Type of Course** | Applied mechatronics in biology and medicine |
| **Work Placement(s)** | No |
| **Prerequisites(only for SU students** | Engineering fundamentals, analytical skills. |
| **Mode of Delivery** | Formal lecture |
| **Content** | * Introduction to biomechatronics (Motivation and highlights of biomechatronic technologies),
* Human as a physiological system,
* Biological actuators,
* Biological sensors,
* Biological feedback mechanisms,
* Brain and brain machine interfaces,
* Active and passive prosthetic limbs,
* Orthotics, Exoskeletons, Exomusculatures,
* Biocompatibility and biocompatible materials in biomechatronics,
* Implants,
* Medical robotics,

Diagnostic devices. |
| **Objectives** | This course aims to present students the knowledge in the cross area of biomechatronics, medical robotics, and surgical robotics while providing fundamentals of human body as a physiological system. This course will widen their eyesight and increase their creativity to better produce engineering-inspired products, and to engineer tools that will better serve the human beings. |
| **Description** | Biomechatronics is an interdisciplinary higher level undergraduate course (and graduate level course) that introduces human body, presents analogies between biological systems and engineering systems, explains application of mechatronics systems in biology and medical fields, integration of mechanical elements, electronics, and parts of biological organisms. This course will introduce the motivation of biomechatronic systems, medical robotics, robotic surgery and surgery tools, the background, ethics, fundamentals, current state-of-art technology, and future trends in the field.  |
| **Learning Outcome** | * Current state of art, ethical issues and future challenges in biomechatronics.
* Analyze human as a physiological system.
* Make analogies between biological and engineering systems: actuators, sensors, feedback mechanisms, etc.
* Analyze, evaluate, and compare the design and construction of biomechatronic technologies and surgical robotics.
* Design and model simple biomechatronic systems, medical robotics, surgical tools and perform simulations using computational tools.
* Produce a technical report incorporating details of designs, models, simulations and outcomes.
* Present a technical report on an interdisciplinary subject.
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| **Programme Outcomes** | Interdisciplinary course, as a topic it covers one of the state-of-art research topics for mechatronics engineering. |
| **Assessment Methods and Criteria** |  |
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| **Percentage (%)** |

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|  | **Undergraduate** | **Graduate** |
| Assignments (x6) | 30 | No assignments: 0 |
| Attendance/discussion/presentations | 10 | 20 |
| Project Progress Report + Presentation: 1 Midterm | 30 | 40 |
| Project Final Report + Presentation: Final | 30 | 40 |
| **Recommended or Required Reading** | **Introduction to Biomechatronics,** Graham Brooker, 2010. Biomechatronics in Medicine and Healthcare, Raymond Tong Kaiyu, 2011 by Pan Stanford.Biomechatronic Design in Biotechnology: A Methodology for Development of Biotechnological Products, Carl-Fredrik Mandenius, Mats Björkman, 2011 by Wiley. Myer Kutz, Editor, Biomedical Engineering and Design Handbook, Second Edition, Volume 1: Fundamentals, McGraw-Hill Companies, 2009. |
| Project Topics: Student’s project proposals are highly welcome. Students can provide the papers those they plan to realize for the course projects. Some project topics might be the implementation of the following papers:  |
| * **Design and fabrication of microstructures for microbes:** <https://www.mdpi.com/2079-6374/13/3/312/htm>
* **Design and development of microneedles for drug/cell delivery:** <https://www.nature.com/articles/s41551-021-00720-1>
* **Design and production of electrosurgical grasper for minimal invasive surgery:** <https://asmedigitalcollection.asme.org/medicaldevices/article/12/1/011007/366914/Design-of-a-Novel-Three-Dimensional-Printed-Two>
* <https://www.isasunflower.org/fileadmin/documents/Proceedings/10thISC1982/Processing/283-285.pdf>
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 ***"We may have to revise the course plan according to the countrywide reassessment to be made regarding higher education. This is expected to happen at the beginning of April. The content to be delivered is certain but the method of course delivery, the number and dates of exams, and some other details are subject to change."***