Graduate Scholl of Engineering & Science
PhD Program of Bioengineering

Program Records

About the Program	Bioengineering is an interdisciplinary field that basically aims to understand, modify or control medical systems by integrating material sciences and engineering. It fabricates the devices that helps the diagnosis and treatment of diseases and designs the products that provide the traceability of physiological functions. In other words, bioengineering applies basic science and engineering principles into life and living system through laboratory and aims to perform research that helps to elongate human lifetime and improves life quality. Bioengineering incorporates different fields. One of those fields is biomedical computing and screening which identifies biomaterials that are inspired by nature. Another subject that falls under biomedical engineering is the technology of biomedical devices that is involved in synthesizing artificial tissues in addition to "smart" drug carriers, sensory-chip systems for disease diagnosis and treatment and all assistant biomedical equipment that are involved in disease screening. Bioengineering also comprises the biosynthesis of animal and plant products. In addition to that, it is involved in cellular and molecular engineering and regenerative medicine, which deals with recombinant DNA technology, welfare and control of foods, development and control of new biotechnological products with high added value such as GMO.
Program Outcomes	Bioengineering graduates: 1. To provide original and innovative solutions for local and global problems through interdisciplinary education and research experience gained from basic sciences and engineering fields. 2. Take part in research and development projects in national and international organizations 3. Will be able to undertake the design, production and control of the products, as a researcher and entrepreneur.
Qualification Awarded	Master/Bioengineer
Length of Program & Credits	4 years & 240 ECTS
Level of Qualification	Master; QF-EHEA: Level 3; EQF-LLL: Level 8
Mode of Study	Full Time
Field of Study	Natural Science-Engineering-Life Science
Admission Requirements	A Master's diploma; an acceptable score from YDS (Foreign Language Exam), YÖKDİL (Foreign Language Exam for Higher Education Institutions), or TOEFL; an acceptable score from the Academic Personnel and Postgraduate Education Entrance Exam (ALES - Mathematical Score Type); a passing score at the oral interview for the concerned doctoral program. International students are admitted based on the criteria posted by the university. Required minimum scores are as follows: 3.00 undergraduate GPA for applicants with an undergraduate diploma; 80 mathematical score from ALES; an acceptable score from YDS, YÖKDİL or TOEFL. Passing the oral interview for the concerned doctoral program.

Recognition of Credit Mobility	**Course Substitution:** For course substitutions, medium of instruction of a previous course must be English, its final grade must be at least 3.00 out of 4.00 and approval of a relevant University Board is required. **Lateral Transfer:** Spending at least one semester at the master's program currently enrolled in, taking at least 2 credit courses and passing them with at least 3.00 out of 4.00.
Graduation Requirements & Regulations	Successful completion of 7 Courses, Seminar and Ethics; a minimum grade point average (GPA) of 3.00; earning 240 ECTS credits; passing the PhD qualifying exam and successful submission of a thesis proposal and thesis.
Occupational Profiles of Graduates	Bioengineers can be employed in the industrial fields such as health care, medical devices, and drug research in different departments such as research and development, quality control and marketing besides academic career in universities.
Access to Further Studies	---

Assessment & Grading Policy

Based on Abdullah Gul University Undergraduate Education and Examination Regulation rules;

Letter Grade	Coefficient	Score	Status	Letter Grade	Status
A	4.00	90-100	Pass	NA	Not Attended
A-	3,67	87-89	Pass	W	Withdrawn
B+	3,33	83-86	Pass	I	Incomplete
B	3,00	80-82	Pass	T	Transferred
B-	2,67	77-79	Pass	S	Satisfactory
C+	2,33	73-76	Pass	U	Unsatisfactory
C	2,00	70-72	Pass	P	In Progress
C-	1,67	64-69	Conditional Pass	EX	Exempt
D+	1,33	56-63	Conditional Pass		
D	1,00	50-55	Conditional Pass		
F	0,00	0-49	Failed		

Program Outcomes

PO1-Ability to apply knowledge of mathematics, science and engineering.
PO2- The ability to have scientific and ethical values.
PO3- To solve unexpected and encountered problems in related applications.
PO4- To plan and manage activities required for professional development.
critically evaluate the accuracy and relevancy of knowledge and skills acquired;
PO5-To define and assess learning needs; and to direct learning processes.
PO6- Ability to identify, formulate, and solve complex engineering problems.
PO7- Share their opinions or solution offers to the problems to specialists or non-specialists, supporting these with qualitative and quantitative data.
PO8- Have enough competency in a foreign language to follow the literature in bioengineering and communicate with their peers
PO9- Use computer software and communication and information technologies required in the field of bioengineering competently and use these to access scientific resources
PO10- Comply with social, scientific and ethical values in the process of collecting, interpreting and using data and reporting the results in the field of bioengineering
PO11- Awareness of the environmental protection and work/laboratory safety.
PO12- Have the skills to work in interdisciplinary subjects

PO13- To have skills to use modern devices required for the practices.
PO14- Have competency in keeping up with global innovations and developments in bioengineering and in related fields.

TQF-HE & Program Outcomes Coverage

	Knowledge	**Skills**	**Competences**			
	Theoretical Conceptual	Cognitive Practical	Work Independently and Take Responsibility	Learning	Communication And Social	Field Specific
PO1	X		X	X		
PO2					X	
PO3	X		X			
PO4					X	X
PO5	X		X	X	X	
PO6				X		
PO7				X	X	
PO8		X	X			X
PO9	X	X		X		X
PO10					X	
PO11			X		X	
PO12	X	X	X			
PO13	X	X	X	X		
PO14		X		X		X

Institutional & Program Outcomes Coverage

	IO1	IO2	IO3	IO4	IO5	IO6	IO7
P01	X						
PO2	X	X					
PO3	X				X		
PO4	X				X		X
PO5					X		
PO6						X	
PO7					X		
PO8					X	X	X
PO9			X	X			
PO10			X				X
PO11	X				X		
PO12	X				X		
PO13	X				X		
PO14		X					

Code	**BENG 601**
Name	**Emerging topics in biotechnology**
Hour per week	3(3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall, Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Asst.Prof. Dr. Aysun CEBECI AYDIN
Content	Course aims to teach recent developments in biotechnology to graduate students. Throughout the course students will learn about broad understanding of the biotechnological fields, interaction of biotechnology with other technologies and its industrial applications. The subjects of the course include history of biotechnology, molecular biology techniques, plant and animal biotechnology, antimicrobials and drug discovery, industrial biotechnology, stem cell research, nanobiotechnology and ethics in biotechnology.

Code	**BENG602**
Name	**Introduction to Nanobiotechnology: Concepts and Applications-**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	---
Coordinator(s)	Asst. Prof. Dr. Yoshiaki Z. Ohkubo
Content	Bionanotechnology is an emerging field, in which the fundamental nanotechnologies are applied to biological and chemical problems as well as to new devices and tools for medicine and energy. This course is designed to introduce biological background and modern applications of nanoscience in biotechnology, with the emphasis on how to monitor and control biological phenomena via the structure and functionality of nanomaterials. Topics include biomimetic molecules, nanoparticles, carbon nanotubes, scanning probe microscopy, and nanosensors.

Code	**BENG 603**
Name	**Ethics in Biotechnology**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall, Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Asst. Prof. Dr. Aysun CEBECI AYDıN
Content	The course aims to teach the ethical problems and arguments in the biotechnology field. Throughout the course students will learn about main fields in biotechnology, ethical concerns of the biotechnology community, and suggest basic arguments in the ethical problems of biotechnology. They will gain experience in defending their ideas in an arguable field. The subjects of the course include biotechnology and biosafety, ethical problems, ethics regulations, stem cells and cancer research and biological terror.

Code	**BENG604**
Name	**Tissue Engineering and Regenerative Medicine**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Asst.Prof. Dr. İsmail Alper İŞOĞLU
Content	Tissue engineering and regenerative medicine aims to give basic information about tissue engineering applications and regenerative medicine, and to describe how regeneration and repair take place in different tissue types. Based on the recent achievements in biotechnology field, cloning and novel drug design technologies will be discussed. The stages towards clinical applications will be thoroughly explained as well as design and preparation of the scaffolds with multifunctional characteristics for an efficient tissue regeneration. This course covers the following topics: Tissue engineering, general definition, repair and regeneration process, treatment approaches, cell differentiaon, biosignal molecules, cloning.

Code	**BENG605**
Name	**Artificial Organs**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Dr. Sevil DİNÇER İŞOĞLU
Content	This course includes the topics related to general components of the body at the organ level, engineering events at the body and artificial organ design with biomimetics approach. Students taking this course gain knowledge about the general principles of artificial organ formation; gain ability to think about how to design an artificial and functional organ. The definition of artificial organs, principles of mass transfer and fluid mechanics in the body, basic components and chemical reactions in the body, effects of artificial organs on community health, applications such as artificial heart, kidney and lung are discussed within the scope of the course.

Code	**BENG606**
Name	**Biomechanics**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Dr. Sevil DİNÇER İŞOĞLU
Content	This course aims at learning of the systems which provide living organisms with locomotion. learning of how to apply bioengineered devices to movement and locomotion systems. Biomechanics course covers introduction to biomechanics and musculoskeletal system, introduction to processes of biomechanics and transport in biological systems, dynamics of mechanical systems, dynamics of muscle and joint, responses of living tissues to prolonged loads, application methods of mechanical engineering to human musculoskeletal system, mechanical properties of tissues, analysis of orthopedic materials in terms of their mechanical properties, stress- strain and unit deformations in materials, analysis of break and fracture, fixation of break- fracture, friction of implants, cases of polishing and wearing, selected topics about dynamics of heart and the tempo of the heartbeat, circulatory systems, microcirculation and mechanistic of muscles, current developments in advanced mathematical biomechanics, introducing of urgent problems that can be solved with certain research fields of biomechanics.

Code	**BENG607**
Name	**Multifunctional Polymeric Nanocarriers**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Dr. Sevil DİNÇER İŞOĞLU
Content	Multifunctional Polymeric Nanocarriers focuses on the importance of nanocarriers on drug delivery, design criteria and methods used in the preparation of a multifunctional nanocarrier. Students will have knowledge about cross-linked micelles, stimuli-responsive carrier systems and drug-conjugated systems. Multifunctional Polymeric Nanocarriers covers the following topics: design of multifunctional nanocarriers, required characteristics of nanocarriers, carrier types, polymeric carriers, nanoparticles and micelles, types of controlled polymerizations, surface modification, using PEG and targeting.

Code	**BENG608**
Name	**Biosensors**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Dr. Sevil DİNÇER İŞOĞLU
Content	Biosensors course aims to give basic information about how to develop biosensors consisting biological compounds and a transducer part. Students will able to learn different types of biosensors including enzymatic biosensors, immunosensors, nucleic acid sensors, optical biosensors, cell based biosensors, electrochemical biosensors. Different types of measurement methods and immobilization techniques will be discussed. This course covers the following topics: Introduction, enzymatic biosensors, immune-biosensors, Nucleic acid biosensors, cell based biosensors, electrochemical biosensors, optic biosensors; fluorescence, “Surface Plasmon Resonances”, other measurement methods, immobilization of biologic compounds, properties and types of material that carry biologic compounds.

Code	**BENG609**
Name	**Advanced Polymer Technology**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Dr. Sevil DİNÇER İŞOĞLU
Content	Advanced Polymer Technology aims to give information about polymer science and technology, polymerization types, polymer classification and polymer characterization methods. This course covers general polymer properties and classification; concepts of conformation, configuration, isomerism; morphology; thermal properties, molecular weight concept, mechanical properties and measurement techniques; polymerization types; polymerization processes and fabrication techniques.

Code	**BENG610**
Name	**Nanofabrication for Biological Applications**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Asst.Prof. Dr. Kutay İÇÖZ
Content	This course focus on Learning the fundamentals of materials and fabrication methods of nano/micro devices and particle sand reviewing recent literature and application of the devices to biology and medicine. This course covers the following topics: Nanotechnology and its applications, Materials and specification, Fabrication Process:, Etching, Deposition and patterning, Surface properties, Nanotechnology based transduction, Microfluidics, Micro/nano biosensors, Standard laboratory methods, Micro/nano cantilevers , Biochips.

Code	**BENG 612**
Name	**Cell Death**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	-
Type	Elective
Prerequisites	None
Coordinator(s)	Assistant Prof. Mona El Khatib
Content	Cell death results in the termination of normal cellular processes. This course provides an overview about the different cell death mechanisms and the guidelines that are followed based on morphological, biochemical and functional characteristics that are used to identify the different types of cell death. It will also introduce the different that are used to detect and dissect cell death pathways This course covers; - Introduction to the guidelines and definition of cell death. - Describe the difference between programmed and non-programmed cell death - Present the different morphological, biochemical and functional characteristics of the different cell death mechanisms - Review the latest insights into different cell death pathways - Discuss cell death in the context of experimental and internal medicine including cancer, immunity and neuroscience.

Code	**BENG613**
Name	**Implant-Cell Interactions**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Asst.Prof. Benay UZER
Content	Cell response on implant strongly governs the success of the treatment. This course aims to shed light on to the molecular and cellular interactions with the implant surfaces. The changes in cell structure will be analyzed both in normal and cancer cells. Based on topics covered student will be able to design implants which would enhance the cell response and minimize the post-surgical complications.

Code	**BENG614**
Name	**Mechanical Properties of Biomaterials**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Asst. Prof. Dr. Benay UZER
Content	This course aims to bring an understanding of the fundamental relationships between the mechanical properties of a range of biomaterials and the biomedical applications. Critical properties influencing the success of the application will be discussed by analyzing the current clinical applications. Students will learn how to characterize some of the main properties and implement this knowledge into the selection of an appropriate material specific to the application.

Code	**BENG615**
Name	**Biomechanics of Human Lower Limb**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	
Content	This course includes definitions, conventions and terms for human gait, temporal and stride measures, kinematics of activities, kinetics of activities will be examined and the reflections of these studies for prosthetic device design, rehabilitation device and therapy design or assistive device design will be conducted as well.This course covers the following topics: Biomechanical analysis of human lower limb during activities of daily life, e.g. walking, sit to stand, stair climbing, running, etc…

Code	**BEG616**
Name	**Human-centered design and applications**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	
Content	In this course, students will apply their engineering knowledge to design devices that are focused on human needs. In this regard, prosthetics and exoskeleton designs are the field of interest. Students would have chances to apply their knowledge from previous their undergraduate courses. In a summary throughout the course students will be able to conduct: kinematics analysis of mechanisms, dynamics analysis of mechanisms, analysis of conceptual design and system modeling, analyses of multi-degree of freedom multi-body mechanisms for their design purposes. Students would eventually apply their knowledge into several mechanisms both in the simulation environment and with prototypes. For this purpose, students will also gain experience and knowledge on using machinery, building CAM models, assembly design and realization and also designing test environment and evaluating prototypes.

Code	**BENG617**
Name	**Glyco-Protein Engineering**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Asst. Prof. Dr.Altan ERCAN
Content	Glyco-protein is a protein modified with a glycan via enzymatic reaction. Majority of the proteins in human body are glycosylated. This protein glycosylations have a profound structural and functional consequences. Therefore, glycol-proteins need to be properly glycosylated. Especially, this is very important for therapeutic glyco-proteins which requires carefully control. In this course, the importance of protein glycosylation will be discussed in terms of the requirements for protein glycosylation, glycosylation machinery, techniques for characterization of glycoprotein, impact of glycosylation in human biology, and finally implication of these aspects of glycosylation in engineering of glyco-proteins for therapeutic applications.

Code	**BENG618**
Name	**Recombinant DNA Technology**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	
Content	This course will introduce the theory and application of recombinant DNA technology. It will cover the steps involved in basic cloning strategy including different types of restriction enzymes, DNA ligase, types of vectors, and how they are used to create a recombinant DNA molecule. Making DNA and cDNA libraries to find a specific gene will be discussed. Finally, students will have a detailed knowledge about the applications of recombinant DNA technology in different fields. Specific techniques to analyze recombinant DNA molecules suchs as DNA sequencing will be covered.

Code	**BENG619**
Name	**Proteomics and Metabolomics**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Asst. Prof. Dr. Şerife AYAZ GÜNER
Content	This course aims at - Learning principles of the most common proteomics techniques - Understanding the mass spectrometry based proteomics workflow - Learning experimental design, sample preparation and enrichment of techniques. - Designing their own research project by proteomics and metabolomics techniques. This course covers the following topics: Introduction to proteome and proteomics technology. General workflow for bottom-up and top-down proteomic approaches. Exploration of differential protein expression, post-translational modifications and protein-protein interactions (PPI). Introduction to metabolome and metabolomics. Metabolite identification, pathway identification and pathway integration.

Code	**BENG620**
Name	**Mass Spectrometry**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate / Anytime
Semester	Fall and Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Asst. Prof. Dr. Şerife AYAZ GÜNER
Content	This course aims at -Learning basic principles of mass spectrometry -Evaluating pros and cons of variety of MS instruments -Overview applications of mass spectrometry in biological sciences -Learning analysis mass spectrometry data This course covers the following topics: Basic concepts and principles of mass spectrometry. Ion sources and ionization (ESI, APCI, FAB, MALDI and others), analyzers (Magnetic-Sector, Quadrupole, Time-of-Flight, Ion-trap, FT-ICR), and detectors. Interpretation of mass spectral data. Examples of mass spectrometry methodologies in different biological applications

Code	**BENG621**
Name	**Cell Signaling**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall/ Spring
Type	Elective
Prerequisites	None. However, students are expected to be familiar with cell/molecular biology and biochemistry.
Special Conditions	---
Coordinator(s)	Asst. Prof. Dr. Aysun ADAN
Content	This course covers the following topics: Basic principles of cell signaling. Characterization of signaling components including receptors (membrane and intracellular/nuclear receptors), ligands, second messengers and effectors. Integration and amplification of signals. How to transfer information: posttranslation modification of proteins and cross talk between signaling pathways. Major signaling pathways, Cell signaling and apoptosis. Cell cycle control. Signaling defects.

Code	**BENG622**
Name	**Machine Learning**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall/Spring
Type	Elective
Prerequisites	----
Coordinator(s)	Assist. Prof. Dr. Müşerref Duygu Saçar Demirci
Content	The course presents an introduction to popular machine learning approaches. Through a course project, the students will apply a few machine learning software on a real problem.The key processes in machine learning will be covered: common classification methods like SVM and Decision Tree and approaches like hierarchical clustering will be analyzed in detail.

Code	**BENG 623**
Name	**Transgenic mice**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall, Spring
Type	Elective
Prerequisites	None
Coordinator(s)	Asst. Prof. Dr. Mona El Khatib
Content	Transgenic mice are a valuable model in order to study various human pathologies. This course provides a theoretical overview about the generation of transgenic mice. Moreover, different gene alteration techniques and transgenic mouse models will be discussed throughout the course. By the end of the course, students will be able to design and choose the best transgenic mouse model that best serve their experimental design.

Code	**BENG624**
Name	**Metastasis and Tumor Environment**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall, Spring
Type	Elective
Prerequisites	None
Coordinator(s)	Assistant Prof. Mona El Khatib
Content	Tumor is more than a mass of cancerous proliferating cells. It is a complex architecture that is composed of cancerous and normal cells that constitute the tumor microenvironment. This tumor can grow and spread throughout the body by a process called metastasis. This course will provide a detailed overview about the molecular events that regulate and drive tumor metastasis and its effect on the tumor microenvironment.