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	Bachelor's Degree
Length of Program & Credits	4 years (excluding one year of English Preparatory Program) 240 ECTS
Level of Qualification	First Cycle (Bachelor's) Degree; EQF-LLL Level 6, QF-EHEA Level 1
Mode of Study	Full Time
Field of Study	Bioengineering
Admission Requirements	High school diploma; Placed by National Higher Education Exam (YKS) scores; Proof of English proficiency (TOEFL or Abdullah Gül University English Proficiency Exam) For foreign students, proof the admission requirements that are announced by the university.
Recognition of Credit Mobility	Courses taken outside of the program could be transferred in accordance with the associated principals of the Abdullah Gul University Undergraduate Education and Examination Regulation rules by the respective management board.
Graduation Requirements & Regulations	a) All courses in the curriculum must be completed with a minimum grade of D or S. b) Student has to complete all courses in the program curriculum with a minimum GPA of 2.00. c) At least half of the total credit of the curriculum must be taken in AGÜ except for the international joint degree programs conducted with the contracted higher education institutions abroad. d) Except for international exchange programs conducted with contracted higher education institutions abroad and partnering international undergraduate degree

programs, the last two semesters must be completed at AGÜ

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	Graduates may apply to second cycle (Level 7 or Level 8) degree programs.

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.
PO5. critically evaluate the accuracy and relevancy of knowledge and skills acquired; 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 Theoretical Conceptual	**Skills** Cognitive Practical	**Competences** Work Independently and Take Responsibility	Learning	Communication And Social	Work Independently and Take Responsibility
P01	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					

Curriculum Summary

	Courses	**Credit**	**ECTS**
AGU Signature Courses GLB101, GLBXXX	5	15	20
YÖK/HEC Courses ENG101, ENG102, TURK101, TURK102, HIST201, HIST202, OHS401, OHS402	8	19	18
Compulsory XXX	26	89	146
Non-Technical Electives XXX	3	9	10
Technical Electives XXX	8	24	40
Summer Practice XXX	0	0	6
TOTAL	**50**	**156**	**240**

ABDULLAH GÜL UNIVERSITY
Bioengineering Undergraduate Program

1st Year/FALL Semester

Course Code	Course Name	PreReq	Lec.	Lab	Credits	ECTS
MATH 151	Calculus I		5	0	5	6
BENG 103	Biology for Life Sciences		3	0	3	4
BENG 102	General Chemistry		3	2	4	5
ENG 101	English I		4	0	4	4
GLB 101	AGU Ways		3	0	3	4
BENG 101	Introduction to Bioengineering		2	0	2	2
PHYS 101	Physics I		3	2	4	5
	Total Credits					30

1st Year/SPRING Semester

Course Code	Course Name	PreReq	Lec.	Lab	Credits	ECTS
MATH 152	Calculus II	MATH 151	5	0	5	6
GLB XXX	Global Issues Elective I		3	0	3	4
ENG 102	English II		4	0	4	4
MBG 207	Organic Chemistry	BENG 102	3	2	4	5
PHYS 102	Physics II		3	2	4	5
COMP 101	Art of Computing		3	2	4	6
	Total Credits					30

2nd Year/ FALL Semester

Code	Course Name	PreReq	Lec.	Lab	Credits	ECTS
BENG 201	Biochemistry	BENG 103	3	0	3	6
BENG 202	Fluid Dynamics in Bioengineering	MATH 152	3	0	3	6
GLB XXX	Global Issues Elective II		3	0	3	4
TURK 101	Turkish I		2	0	2	2
BENG 203	Thermodynamics for Bioengineers	MATH 152	3	0	3	6
MATH 205	Differential Equations	MATH152	3	0	4	5
	Total Credits					29

2nd Year/ SPRING Semester

Code	Course Name	PreReq	Lec.	Lab	Credits	ECTS
BENG 204	Cell and Molecular Biology	BENG103	3	0	4	5
BENG 205	Heat and Mass Transfer	MATH 152	3	0	3	5
MBG 210	Sciences and Ethics		2	0	2	4
BENG 207	Microbiology		3	0	4	5
BENG 216	Bioengineering Laboratory I		3	2	4	6
GLB XXX	Global Issues Elective III		3	0	3	4
TURK 102	Turkish II		2	0	2	2
	Total Credits					31

TRACK –I- BIOMATERIALS AND TISSUE ENGINEERING

3rd Year/FALL Semester

Course Code	Course Name	PreReq	Lec.	Lab	Credits	ECTS
BENG 316	Bioengineering Laboratory II		3	2	4	7
GLB XXX	Global Issues Elective IV		3	0	3	4
HIST 201	History of Modern Turkey I		2	2	2	2
BENG 302	Biomaterials Science		3	0	3	6
BENG 303	Bioprocess Engineering		3	0	3	6
	Concentration Area Electives					5
						30

3rd Year/SPRING Semester

Course Code	Course Name	PreReq	Lec.	Lab	Credits	ECTS
BENG 318	Bioengineering Laboratory III		3	2	4	7
HIST 202	History of Modern Turkey II		2	0	2	2
BENG 304	Tissue Engineering		3	0	3	6
BENG 305	Artificial Organs		3	0	3	6
XXX	Nontechnical Elective					4
	Concentration Area Electives					5
	Total Credits					30

4th Year/ FALL Semester

Course Code	Course Name	PreReq.	Lec.	Lab	Credits	ECTS
BENG 491	Capstone Project I*		2	0	2	8
	Concentration Area Elective					5
	Concentration Area Elective					5
	Concentration Area Elective					5
XXX	Nontechnical Elective Course					3
OHS 401	Occupational Health and Safety I		2	0	2	1
BENG 493	Summer Internship		0	0	0	6
	Total Credits					33

* 1st and 2nd year core courses must be completed (passed).

4th Year/ SPRING Semester

Course Code	Course Name	PreReq.	Lec.	Lab	Credits	ECTS
BENG 492	Capstone Project II**	BENG491	2	0	2	8
OHS 402	Occupational Health and Safety II		1	0	1	1
	Concentration Area Elective					5
	Concentration Area Elective					5
	Concentration Area Elective					5
XXX	Nontechnical Elective Course					3
	Total Credits					27

** Capstone Project I should be passed.

TRACK –II- GENETICS

3rd Year/FALL Semester

Course Code	Course Name	PreReq	Lec.	Lab	Credits	ECTS
BENG 316	Bioengineering Laboratory II		3	2	4	7
GLB XXX	Global Issues Elective IV		3	0	3	4
HIST 201	History of Modern Turkey I		2	2	2	2
BENG 309	Genetics		3	0	3	6
BENG 303	Bioprocess Engineering		3	0	3	6
	Concentration Area Electives					5
						30

3rd Year/SPRING Semester

Course Code	Course Name	PreReq	Lec.	Lab	Credits	ECTS
BENG 318	Bioengineering Laboratory III		3	2	4	7
HIST 202	History of Modern Turkey II		2	0	2	2
MBG 204	Biostatistics		3	2	4	6
BENG 310	Recombinant DNA Technology		3	0	3	6
XXX	Nontechnical Elective					4
	Concentration Area Elective					5
	Total Credits					30

4th Year/FALL Semester

Course Code	Course Name	PreReq.	Lec.	Lab	Credits	ECTS
BENG 491	Capstone Projects I*		2	0	2	8
	Concentration Area Elective					5
	Concentration Area Elective					5
	Concentration Area Elective					5
XXX	Nontechnical Elective Course					3
OHS 401	Occupational Health and Safety I		2	0	2	1
BENG 493	Summer Internship		0	0	0	6
	Total Credits					33

* 1st and 2nd year core courses must be completed (passed).

4th Year/SPRING Semester

Course Code	Course Name	PreReq.	Lec.	Lab	Credits	ECTS
BENG 492	Capstone Project II**	BENG 491	2	0	2	8
OHS 402	Occupational Health and Safety II		2	0	2	1
	Concentration Area Elective					5
	Concentration Area Elective					5
	Concentration Area Elective					5
XXX	Nontechnical Elective Course					3
	Total Credits					27

** Capstone Project I should be passed.

TRACK –III- BIOMEDICAL ENGINEERING

3rd Year/ FALL Semester

Course Code	Course Name	PreReq	Lec.	Lab	Credits	ECTS
BENG 316	Bioengineering Laboratory II		3	2	4	7
GLB XXX	Global Issues Elective IV		3	0	3	4
HIST 201	History of Modern Turkey I		2	0	2	2
BENG 306	Bioinstrumentation		3	2	4	6
BENG 303	Bioprocess Engineering		3	0	3	6
	Concentration Area Elective					5
						30

3rd Year/SPRING Semester

Course Code	Course Name	PreReq	Lec.	Lab	Credits	ECTS
BENG 318	Bioengineering Laboratory III		3	2	4	7
HIST 202	History of Modern Turkey II		2	0	2	2
BENG 307	Biomedical Sensors and Transducers		3	0	4	6
BENG 308	Microprocessors and Microcontrollers in Biomedical Engineering		3	0	4	6
XXX	Nontechnical Elective					4
	Concentration Area Elective					5
	Total Credits					30

4th Year/FALL Semester

Course Code	Course Name	PreReq.	Lec.	Lab	Credits	ECTS
BENG 491	Capstone Project I*		2	0	2	8
	Concentration Area Elective					5
	Concentration Area Elective					5
	Concentration Area Elective					5
XXX	Nontechnical Elective Course					3
OHS 401	Occupational Health and Safety I		2	0	2	1
BENG 493	Summer Internship		0	0	0	6
	Total Credits					33

* 1st and 2nd year core courses must be completed (passed).

4th Year/SPRING Semester

Course Code	Course Name	PreReq.	Lec.	Lab	Credits	ECTS
BENG 492	Capstone Projects II**	BENG 491	2	0	2	8
OHS 402	Occupational Health and Safety II		2	0	2	1
	Concentration Area Elective					5
	Concentration Area Elective					5
	Concentration Area Elective					5
XXX	Nontechnical Elective Course					3
	Total Credits					27

** Capstone Project I should be passed.

Concentration Area Electives*

TRACK –III- BIOMEDICAL ENGINEERING					
Code	Course Name	Lec.	Lab	Credits	ECTS
BENG 410	Biomedical Signals and Systems	3	0	3	5
BENG 411	Cardiovascular Engineering	3	0	3	5
BENG 412	Numerical Methods for Biomedical Engineering	3	0	3	5
BENG 413	Neural Engineering	3	0	3	5
BENG 414	Biomechatronics	3	0	3	5
BENG 415	Clinical Engineering	3	0	3	5
BENG 416	Biophotonics	3	0	3	5
BENG 418	Machine Learning	3	0	3	5
BENG 419	Fundamental of BioMEMS	3	0	3	5
BENG 420	Data Mining	3	0	3	5
BENG 421	Biomedical Image Processing	3	0	3	5
BENG 422	Biomedical Signal Processing	3	0	3	5
BENG 423	Medical Imaging Systems	3	0	3	5
BENG 424	Computational Biology	3	0	3	5
TRACK –I- BIOMATERIALS AND TISSUE ENGINEERING					
BENG 425	Immunology	3	0	3	5
BENG 426	Polymer Science	3	0	3	5
BENG 427	Artificial Organs	3	0	3	5
BENG 429	Controlled Drug Delivery	3	0	3	5
BENG 430	Biomedical Polymers	3	0	3	5
BENG 431	Nanofabrication	3	0	3	5
BENG 432	Tissue Engineering and Regenerative Medicine	3	0	3	5
BENG 433	Nanoparticles for Biomedical Applications	3	0	3	5
BENG 434	Stem Cells	3	0	3	5
BENG 430	Tissue Biomaterial Interaction	3	0	3	5
BENG 435	Separation Techniques	3	0	3	5
BENG 436	Drug Design and Discovery	3	0	3	5
BENG 437	Bioorganic and Medicinal Chemistry	3	0	3	5
BENG 438	Introduction to Bionanotechnology	3	0	3	5
BENG 439	Metabolic Engineering	3	0	3	5
TRACK –II- GENETICS					
MBG 409	Cancer Biology	3	0	3	5
MBG 410	Micro Array Data Analysis	3	0	3	5
MBG 411	Model Organisms	3	0	3	5
MBG 413	Biotechnology	3	0	3	5
MBG 416	Developmental Biology	3	0	3	5
MBG 417	Basics of Neuroscience	3	0	3	5
MBG 419	Functional Genomics	3	0	3	5
MBG 421	RNA biology	3	0	3	5
MBG 426	Histology of Tumors	3	0	3	5
MBG 430	Virology	3	0	3	5
MBG 431	Human Physiology	3	0	3	5
MBG 435	Disease and Genetics	3	0	3	5
MBG 436	Bioinformatics				
OTHER AREA ELECTIVES					
BENG 440	Regulations and IP Rights in Bioengineering	3	0	3	5
BENG 441	Scientific Writing and Understanding	3	0	3	5
BENG 442	Entrepreneurship in Bioengineering	3	0	3	5

*It is not obligated to take an elective course from a different track than student choose.

GLB Electives
(4 out of all GLB courses must be taken / GLB kodlu derslerin dördü alınmak zorundadır)

GLB 102	Innovation and Entrepreneurship	3	0	3	4
GLB 201	Food and Health	3	0	3	4
GLB 202	Immigration and Population	3	0	3	4
GLB 301	Sustainability	3	0	3	4

1st Year/FALL Semester

Courses Descriptions

Code	**BENG 101**
Name	**Introduction to Bioengineering**
Hour per week	2+0
Credit	2
ECTS	2
Level/Year	Undergraduate/1
Semester	Spring
Type	Compulsory
Prerequisites	-
Special Conditions	-
Coordinator(s)	Prof. Dr. Sevil Dinçer İşoğlu
Content	This course covers the critical principles and basic concepts in bioengineering which integrates the biological, physical, and chemical laws and principles enlightening bioengineering as an emerging, novel, complex approach with deep roots in the fundamental science. Topics covered in this course include definition and history of bioengineering and explaining the area of bioengineering such as biomaterials, tissue engineering, regenerative medicine, biomedical engineering, bioprocess engineering, genetics, drug delivery, nanotechnology, 3D bioprinting and artificial organs.

Code	**BENG 102**
Name	**General Chemistry**
Hour per week	3+2
Credit	4
ECTS	5
Level/Year	Undergraduate/1
Semester	Fall
Type	Compulsory
Prerequisites	-
Coordinator(s)	Assistant Prof. İsmail Akçok
Content	course covers the understanding of interaction and relationship between chemistry and other fields such as biology, physic and engineering. This course also provides an introduction to the chemistry of biological, inorganic and organic molecules. The main emphasis is on basic principles of atomic and molecular electronic structure, thermodynamics, acid-base and redox equilibria, chemical kinetics and catalysis.

Code	**BENG 103**
Name	**Biology for Life Sciences**
Hour per week	3(3+0)
Credit	3
ECTS	4
Level/Year	Undergraduate / 1
Semester	Fall
Type	Compulsory
Prerequisites	-
Coordinator(s)	Assistant Prof. Dr. Oktay İ. Kaplan
Content	The biology for Life Sciences covers basic biology including microscope, macromolecules, cellular organelle and their function, DNA, RNA, protein, cell division. In this course we will also focus on immunology, different systems of animals, reproduction, development, and control systems of animals. This course is ideal to cover basic biological concepts of animals.

2nd Year/FALL Semester

Code	**BENG 201**
Name	**Biochemistry**
Hour per week	3 (3+0)
Credit	3
ECTS	6
Level/Year	Undergraduate
Semester	Fall
Type	Compulsory
Prerequisites	-
Coordinator(s)	Assistant Prof. Dr. İsmail AKÇOK
Content	This course examines the chemical and physical properties of the cell and its building blocks, with special emphasis on the structures of proteins and principles of catalysis, as well as the chemistry of organic / inorganic cofactors required for chemical transformations within the cell. Topics encompass the basic principles of metabolism and regulation in pathways, including glycolysis, gluconeogenesis, fatty acid synthesis / degradation, pentose phosphate pathway, Krebs cycle and oxidative phosphorylation

Code	**BENG 202**
Name	**Fluid Mechanics in Bioengineering**
Hour per week	3 +0 (Theory+ Practice)
Credit	3
ECTS	6
Level/Year	Undergraduate
Semester	Spring
Type	Compulsory
Location	Classroom
Prerequisites	
Special Conditions	-
Coordinator(s)	Assistant Prof. Dr. İ. Alper İşoğlu
Webpage	-
Content	This course will give the fluid characteristics and its applications in biological systems. This course covers the classification of fluid, the basic equations in fluid mechanics, compressible and non-compressible fluids in pipeline and conduit, the measurement techniques of fluids and related devices

Code	**BENG 203**

Name	**Thermodynamics for Bioengineers**
Hour per week	3+0 (Theory Practice)
Credit	3
ECTS	6
Level/Year	Undergraduate
Semester	Fall
Type	Compulsory
Location	Classroom
Prerequisites	MATH 152
Special Conditions	-
Coordinator(s)	Dr. Ozkan Fidan
Webpage	-
Content	This course presents the laws of thermodynamics and their applications to biological systems. Topics cover first, second, and third laws of thermodynamics, open and closed systems, enthalpy and specific heat, Gibb's free energy and its applications in biological systems, and reaction kinetics.

3rd Year / SPRING Semester

Code	**BENG 204**
Name	**Cell and Molecular Biology**
Hour per week	3(3+0)
Credit	4
ECTS	5
Level/Year	Undergraduate / 2
Semester	Spring
Type	Compulsory
Prerequisites	BENG 103
Coordinator(s)	Assistant Prof. Dr. Oktay İ. Kaplan
Content	This course tackles the cellular biology of higher organisms. Knowledge of the structure, function, and formation of cellular membranes and organelles, in addition to cellular growth and oncogenic transformation will be covered throughout the course. Also, the course will cover transport, receptors, and cell signaling, the cytoskeleton, the extracellular matrix and cell movement, chromatin structure and RNA synthesis. This course focuses on the interaction of the cell's social context that includes its neighboring cells, the extracellular matrix (ECM) and the soluble mediators.

Code	**BENG 205**
Name	**Heat and Mass Transfer**
Hour per week	3 +0 (Theory+ Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Spring
Type	Compulsory
Location	Classroom
Prerequisites	MATH152
Special Conditions	-
Coordinator(s)	Assistant Prof. Fatih Ortakci
Webpage	-
Content	The course will give an introductory treatment of the governing laws for heat and mass transfer. The following topics are covered: Steady state and transient conduction, fundamentals and engineering treatment of convection heat transfer, heat transfer with phase change (boiling/condensation), radiation heat transfer and heat exchangers. Both analytical and numerical solution methods are presented.

Code	**BENG 216**
Name	**Bioengineering Laboratory I**
Hour per week	5 (3+2)
Credit	4
ECTS	6
Level/Year	Undergraduate / 2
Semester	Spring
Type	Compulsory
Prerequisites	-
Coordinator(s)	
Content	This applied laboratory course covers following practices: 1) Sterilization and aseptic techniques, media preparation and transfer of microorganisms, 2) Gram staining and microscopic observation of microorganisms, 3) Microbial growth and growth curve and microbial cell count, 4) Isolation and preservation of microorganisms from environment

Code	**BENG 207**
Name	**Microbiology**
Hour per week	3(3+0)
Credit	4
ECTS	5
Level/Year	Undergraduate / 2
Semester	Spring
Type	Compulsory
Prerequisites	-
Coordinator(s)	Assistant Prof. Dr. Fatih Ortakçı
Content	This course covers survey of microorganisms and their activities; emphasis on structure, function, ecology, nutrition, physiology, genetics. Survey of applied microbiology—medical, agricultural, food and industrial microbiology. Intended to satisfy any curriculum which requires introductory level microbiology.

3rd Year/FALL Semester

Code	**BENG 302**
Name	**Biomaterial Science**
Hour per week	3 (3+0)
Credit	3
ECTS	6
Level/Year	Undergraduate / 3
Semester	Fall
Type	Compulsory
Prerequisites	-
Coordinator(s)	Prof. Dr. Sevil Dinçer İşoğlu
Content	This course covers biomaterial science beginning from introduction to the different application areas, classification, biocompatibility, implant-tissue interaction, material types with production and characterization will be in the scope of this course.

Code	**BENG 303**
Name	**Bioprocess Engineering**
Hour per week	3+0 (Theory Practice)
Credit	3
ECTS	6

Level/Year	Undergraduate
Semester	Fall
Type	Compulsory
Location	Classroom
Prerequisites	-
Special Conditions	-
Coordinator(s)	Dr. Özkan Fidan
Webpage	-
Content	This course focuses on the applications of chemical engineering principles in the analysis and design of bio-based processes. The emphasis is placed on biochemical kinetics, enzyme engineering, cell growth and metabolism, bioreactor analysis and design, and recovery and purification of products.

Code	**BENG 316**
Name	**Bioengineering Laboratory II**
Hour per week	5 (3+2)
Credit	4
ECTS	7
Level/Year	Undergraduate / 3
Semester	Fall
Type	Compulsory
Prerequisites	-
Coordinator(s)	Dr. Ozkan Fidan and Dr. Fatih Ortakci
Content	This course focuses on the recombiant production of a bioproduct, in which students will gain hands-on experience in the molecular biology and bioprocess engineering. Students will clone a gene of interest using PCR and insert it into an expression system to construct a plasmid. Then, the plasmid will transformed into a host bacteria for the expression and production of the bioproduct. The expression and production will be checked by SDS-PAGE and HPLC, respectively. Finally, students will scale up the production of the bioproduct in bioreactor.

3rd Year/SPRING Semester

Code	**BENG 304**
Name	**Tissue Engineering**
Hour per week	3 +0 (Theory+ Practice)
Credit	3
ECTS	6
Level/Year	Undergraduate
Semester	Spring
Type	Compulsory
Location	Classroom
Prerequisites	
Special Conditions	-
Coordinator(s)	Assistant Prof. Dr. İ. Alper İşoğlu
Webpage	-
Content	This course covers the introduction to tissue engineering, types of cells and tissues, extracellular matrix and its components, natural and synthetic polymers for tissue engineering, the regulation of cell functions, cell- matrix interactions, tissue modelling, recent advances in tissue engineering

Code	**BENG 305**

Name	**Artificial Organs**
Hour per week	3 (3+0)
Credit	3
ECTS	6
Level/Year	Undergraduate / 3
Semester	Spring
Type	Compulsory
Prerequisites	-
Coordinator(s)	
Content	This course covers introduction to artificial organs , cells and biomaterials used to develop artificial organs, hemodialysis and artificial kidney, artificial blood production, structure of artificial liver and bio-artificial liver, heart support devices, oxygenators and artificial lung production.

Code	**BENG 306**
Name	**Bioinstrumentation**
Hour per week	3+2
Credit	4
ECTS	6
Level/Year	Undergraduate / 3
Semester	Fall
Type	Selective
Prerequisites	N/A
Coordinator(s)	Assistant Prof. Dr. Kutay İçöz
Content	Biomedical engineers design all sorts of medical equipment and systems, including EGCs, pacemakers, defibrillators, prosthetics, implants, vascular graphs, x-rays, MRIs, medicine delivery systems, replacement valves and laparoscopic surgery. Biomedical products require the expertise of electrical, mechanical computer science and chemical engineers, working with physicians. This lesson and associated activity look at the special design challenges engineers face when designing surgical instruments and other biomedical devices used with living human bodies.

Code	**BENG 307**
Name	**Biomedical sensors and transducers**
Hour per week	3
Credit	4
ECTS	6
Level/Year	Undergraduate/3
Semester	Spring
Type	Compulsory
Prerequisites	-
Coordinator(s)	Assistant Prof. Kutay İçöz
Content	This course include following subjects: ● Nano/Micro technology applications for Biosensing ● Materials and specifications ● Surface properties ● Transduction mechanisms ● Microfluidics ● Micro/nano biosensors ● Standard laboratory methods for biosensing ● Cantilever/Carbon Nanotube Biosensors ● Target based Biosensing

Code	**BENG318**
Name	**Bioengineering Laboratory III**
Hour per week	5 (3+2)
Credit	4
ECTS	7
Level/Year	Undergraduate / 3
Semester	Spring
Type	Compulsory
Prerequisites	-
Coordinator(s)	
Content	

Code	**BENG 305**
Name	**Recombinant DNA Technology**
Hour per week	3 (3+0)
Credit	3
ECTS	6
Level/Year	Undergraduate/3
Semester	Spring
Type	Compulsory
Prerequisites	None
Coordinator(s)	
Content	The aim of this course is to explain the applications and principles of techniques used in molecular biology. The course includes cloning, PCR, microarray, RNAseq, cell culture and techniques used to diagnose hereditary diseases. Moreover, the course will also cover the Crispr / cas-9, one of the most recent gene editing techniques of our time. In addition, the application of the learned techniques and the evaluation of the results will be carried out in this course. Learning both theoretical and practical knowledge of the methodology of molecular biology and genetics will enable students to acquire the ability to understand and design their projects.

Code	**BENG 308**
Name	**Microprocessors and microcontrollers in biomedical engineering**
Hour per week	3
Credit	4
ECTS	6
Level/Year	Undergraduate / 3
Semester	Spring
Type	Compulsory
Prerequisites	N/A
Coordinator(s)	Prof. Bülent Yılmaz
Content	The course focuses on the principle of microprocessors and microcontrollers and their applications in biomedical Engineering. Introduction to hardware system: CPU, Memory, Input/Output Interfacing, and System Bus. Instruction sets; assembly and machine languages. Fetch Cycle, Execution cycle, Instruction cycle. Detailed study of a particular Microprocessor or Microcontroller architecture: Instruction set; assembly language programming, Programming techniques, Loops, Delays, parallel and serial interfaces, interrupt control systems; Timers.

4th Year/FALL Semester

Code	**BENG 491**
Name	**Capstone Project I**
Hour per week	4 (0 + 4)
Credit	4
ECTS	8
Level/Year	Undergraduate / 4
Semester	Fall
Type	Compulsory
Prerequisites	1st and 2nd year core courses must be completed (passed).
Content	This course aims to apply the theoretical knowledge and skills gained during undergraduate education to the practice. The capstone project can be an independent or a team-based project. It introduces students to the design of new biological technologies with the aim of addressing societal needs. Students design the concept followed by implementation and testing. The project, mentored by an advisor from faculty, have to be reported with methods, results, data evaluation, discussion and conclusion.

Code	**BENG 493**
Name	**Summer Internship**
Hour per week	0
Credit	0
ECTS	6
Level/Year	Undergraduate / Starting from 2nd year
Semester	Fall
Type	Compulsory
Prerequisites	None
Content	Summer Internship aims to gain students experience in industrial or research environments. This internship program cannot be less than 20 working days. During the internship; the students will be able to apply the theoretical knowledge they have learned in the lessons practically and discover their own interests. This internship program helps the student to find their personal aim.

4th Year/SPRING Semester

Code	**BENG 492**
Name	**Capstone Project II**
Hour per week	6 (0 + 6)
Credit	6
ECTS	8
Level/Year	Undergraduate / 4
Semester	Spring
Type	Compulsory
Prerequisites	1st and 2nd year core courses must be completed (passed). BENG491 Capstone Project I should be passed.
Content	This course aims to apply the theoretical knowledge and skills gained during undergraduate education to the practice. The capstone project can be an independent or a team based project. It introduces students to the design of new biological technologies with the aim of addressing societal needs. Students design the concept followed by implementation and testing. The project, mentored by an advisor from faculty, have to be reported with methods, results, data evaluation, discussion and conclusion.

Concentration Area Electives*

Track-III-BIOMEDICAL ENGINEERING

Code	**BENG 410**
Name	**Biomedical signals and systems**
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall-spring
Type	Elective
Prerequisites	N/A
Coordinator(s)	Assistant Prof. Kutay İçöz
Content	This course includes following contents: ● Origin of bio-signals. ● Circulation, neural and muscle systems ● Transducers, and instrumentation circuitry ● Classification of bio-signals and fundamental features ● Bio-signal processing ● Frequency Domain characterization.

Code	**BENG 411**
Name	**Cardiovascular engineering**
Hour per week	3+0
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall-spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Bülent Yılmaz
Content	This course includes following contents: ● Cardiovascular diseases ● Fundamentals of cardiovascular anatomy ● Basic cardiac electrophysiology ● Modeling of electrical activity on cardiac cell membranes (action potential) ● Action potential propagation on cardiac cells and between cells ● Mechanism of the heart muscle contraction ● Physiology and modeling of blood flow in the vessels ● Anatomical and functional imaging of cardiovascular system ● Technologies used in the diagnosis and treatment of cardiovascular system

Code	**BENG 412**
Name	**Numerical methods for biomedical engineering**
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate

Semester	Fall-spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Bülent Yılmaz
Content	This course will cover both the theoretical and practical studies in the computational bio(nano)technology and theoretical materials science areas. Within the frame of this course, students will learn the numerical methods and algorithms in general. This course will provide information about diffusion, bioinformatics, molecular dynamics, and homology modelling. It will also give practical information about state of the art computer software, which will adapt the students into this rapidly developing field.

Code	**BENG 413**
Name	**Neural engineering**
Hour per week	3+0
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall-spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Bülent Yılmaz
Content	This course includes following contents: ● Fundamentals of neuroanatomy ● Basic neuroelectrophysiology ● Modeling of electrical activity on neural membranes (action potential) ● Actial potential propagation on a neuron and between neurons ● Eye, vision and related diseases, technologies used in diagnosis and treatment of neural diseases of this organ ● Ear, audition and related diseases, technologies used in diagnosis and treatment of neural diseases on this organ ● Anatomical and functional imaging of brain and neural system ● Technologies used in the diagnosis and treatment of brain and neural system

Code	**BENG 414**
Name	**Biomechatronics**
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall-spring
Type	Elective
Prerequisites	N/A
Coordinator(s)	Prof. Bülent Yılmaz
Content	Biomechatronics is a contraction of biomechanics and mechatronics. In this course the function and coordination of the human motion apparatus is the central focus, and the design of assistive devices for the support of the function of the motion apparatus. Examples are assistive devices like an orthosis, prosthesis or Functional Electrical Stimulation of muscles. The goal is to provide some function to patients with functional deficiencies.

Code	**BENG 415**
Name	**Clinical Engineering**
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall-spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Bülent Yılmaz
Content	Clinical engineering is a sub-discipline of biomedical engineering, and it concerns the design and management of biomedical technology systems and equipment. This program prepares individuals who are interested in technology and health sciences to enter a challenging career in biomedical engineering. It provides ability to participate in the development and application of technology in medicine and biology for student, educates students on how to apply and implement medical technologies to optimize modern health-care delivery.

Code	**BENG 416**
Name	**Biophotonics**
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall-spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Bülent Yılmaz
Content	This course covers the interaction of light with biological material. A particular focus is the use of photonics in medical diagnostics. The course includes introductory biological concepts such as DNA, proteins, cells, and tissues. In addition, the course teaches the principles and applications of bioimaging, spectroscopy, and biosensors, as well as summarizes recently published progress in the field.

Code	**BENG 418**
Name	**Machine Learning**
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	-
Type	Elective
Prerequisites	-
Coordinator(s)	Assistant Prof. Müşerref Duygu Saçar Demirci
Content	The course presents an introduction to basic machine learning approaches. The main topics include: Supervised learning (support vector machines, decision tree, random forest), Unsupervised learning (hierarchical clustering, k-means clustering, dimensionality reduction). Also, the course will include numerous case studies and applications from various areas.

Code	**BENG 419**
Name	**Fundamentals of BIOMEMS**
Hour per week	3
Credit	3

ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall-spring
Type	Selective
Prerequisites	-
Coordinator(s)	Assistant Prof. Kutay İçöz
Content	This course includes following contents: ● Nanotechnology and its applications ● Materials and specifications ● Fabrication Process: Etching, Deposition and patterning ● Surface properties ● Nanotechnology based transduction ● Microfluidics ● Micro/nano biosensors ● Standard laboratory methods ● Micro/nano cantilevers ● Biochips.

Code	**BENG420**
Name	**Data Mining**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	-
Type	Elective
Prerequisites	-
Coordinator(s)	Assistant Prof. Müşerref Duygu Saçar Demirci
Content	The course presents an introduction to popular data mining approaches. The main processes in data mining will be covered: types of attributes, common data set structures, data preprocessing, feature selection, sampling, using different statistical and machine learning techniques and visualization.

Code	**BENG 421**
Name	**Biomedical Image Processing**
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall-spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Bülent Yılmaz
Content	This course gives an overview of medical image formation, enhancement, analysis, visualization, and communication as well as their applications in medical imaging. It starts with a brief introduction to medical imaging modalities and acquisition systems. Basic approaches to display one-, two-, and three-dimensional (3D) biomedical data are introduced. As a focus, image enhancement techniques, segmentation, texture analysis and their application in diagnostic imaging will be discussed. To complete this overview, storage, retrieval, and communication of medical images are also introduced. In addition to this theoretical background, an overview of useful software tools is given. In particular, ImageJ as Java-based platform for medical image enhancement and visualization (including plugins for DICOM import and 3D rendering) will be carefully demonstrated.

Code	**BENG 422**
Name	**Biomedical Signal Processing**
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall-spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Bülent Yılmaz
Content	This course covers following subjects: Signal analysis: time- and frequency, sampling, digital signals, Fourier transform (FFT), estimation of the power spectrum, input windows, leakage, aliasing, convolution and correlation properties, digital filters, physiological and mathematical models of bioelectricity: cell membrane, resting- and action potentials, Nernst equation, volume conducting, forward- och inverse problems measurement of bioelectrical signals: electrode properties, measurement systems, electrocardiography: origin of the ECG, ECG-leads, ECG analysis neurophysiology: nervous system, muscles, EEG, EP, EMG, ERG, EOG, signal analysis, electrostimulation: defibrillation, pacemakers, electrostimulation Laboratory experiment: biosignal processing.

Code	**BENG 423**
Name	**Medical Imaging Systems**
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall-spring
Type	Elective
Prerequisites	-
Coordinator(s)	Prof. Bülent Yılmaz
Content	This course covers following subjects: ● General characteristics of imaging systems; • X-ray and CT: general principles, interaction of X-rays with tissues, contrast agents, imaging techniques, image reconstruction, radiation dose; • Nuclear Medicine: general principles, radionuclide, radioactive decay, gamma camera, imaging techniques, SPECT, PET; • Ultrasound imaging: general principles, interaction of acoustic waves with tissue, acoustic impedance, instrumentation, scanning modes, artifacts, blood velocity measurements, contrast agents; • MR imaging: general principles, nuclear magnetism, magnetic resonance, instrumentation, imaging sequences, contrast agents, imaging techniques, functional MRI.

Code	**BENG 424**
Name	**Computational Biology**
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	-

Type	Elective
Prerequisites	-
Coordinator(s)	Assistant Prof. Müşerref Duygu Saçar Demirci
Content	This course covers the foundations of computational biology combining theory with practice. The topics include: Biological sequence analysis, sequence alignment, comparative genomics, phylogenetic trees, RNA structure, regulatory genomics and recent advances in the field.

TRACK –I- BIOMATERIALS AND TISSUE ENGINEERING

Code	**BENG425**
Name	**Immunology**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Spring
Type	Elective
Prerequisites	-
Coordinator(s)	-
Content	This course covers basic knowledge of immunology. Topics, which will be covered in this course, are development of different hematopoietic cells, innate immunity, adaptive immunity, structure and function of lymphoid organs, synthesis, function of antibody and immunologically important proteins such as Fc-receptors, cytokines, cytokine receptors, major histocompatibility complex molecules. In addition, special attention will be given on the basic immunological mechanisms of allergy and autoimmunity.

Code	**BENG 426**
Name	**Polymer Science**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Spring
Type	Electives
Prerequisites	-
Coordinator(s)	
Content	This course covers definition of polymers, classification of raw material resources, structural, mechanical, thermal, electrical, optical and chemical properties of polymers, molecular weight and determination methods, synthesis methods of polymers, industrial production methods, processing techniques.

Code	**BENG 429**
Name	**Controlled Drug Delivery**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Spring
Type	Electives
Prerequisites	-

Coordinator(s)	
Content	This course covers the definition of controlled drug delivery, the aim of using this system for drug administration, controlled drug delivery routes, polymer types, release kinetics and applications.

Code	**BENG 430**
Name	**Biomedical Polymers**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Spring
Type	Electives
Prerequisites	-
Coordinator(s)	
Content	This course covers the concept of biomedical polymers, definition, and classification of medical polymers, characterization, structural analysis and purification methods of medical polymers, the concept of biocompatibility, types of biomedical polymers including synthetic and natural ones are going to be discussed with many different applications in the scope of this course.

Code	**BENG 430**
Name	**Tissue Biomaterial Interaction**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Spring
Type	Electives
Prerequisites	-
Coordinator(s)	
Content	This course covers methods for biomaterials surface characterization and analysis of protein adsorption on biomaterials, molecular and cellular interactions with biomaterials are analyzed in terms of unit cell processes, such as matrix synthesis, degradation, and contraction, mechanisms underlying wound healing and tissue remodeling following implantation, design of implants and prostheses based on control of biomaterials-tissue interactions, comparative analysis of intact, biodegradable, and bioreplaceable implants by reference to case studies, criteria for restoration of physiological function for tissues and organs.

Code	**BENG 431**
Name	**Nanofabrication**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Spring
Type	Electives
Prerequisites	-
Coordinator(s)	
Content	This course covers introduction to conventional methods in macro and nanofabrication, basics of film deposition techniques, optical and electron beam

	lithography, wet and dry etching methods, implantation and diffusion, applications of microfabrication to CMOS fabrication and micro and nanoelectromechanical systems, some non-conventional methods of micro and nanostructure fabrication.

Code	**BENG 432**
Name	**Tissue Engineering and Regenerative Medicine**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Spring
Type	Electives
Prerequisites	-
Coordinator(s)	
Content	This course covers extracellular matrix, extracellular matrix analogs, synthetic polymers and natural polymers, cell, cell culture, stem cells, regulation of cell functions, cell structure, cell and biomaterial interaction, cellular movements and metabolism, tissue development and tissue modeling, tissue regeneration release, immunology, inflammation, tissue engineering approaches, tissue induction, cell transplantation, biohybrid organs; blood formation, tissue engineering products: patents, rules, recent developments.

Code	**BENG 433**
Name	**Nanoparticles for Biomedical Applications**
Hour per week	3(3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	-
Type	Elective
Prerequisites	-
Coordinator(s)	Assistant Prof. Zeliha Soran Erdem
Content	This course focuses on the design and biomedical applications of varying classes of nanoparticles. Topics covered in this course are nanoparticle behavior in biological environments, design parameters such as targeting, shape effect, administration route, and nanoparticle characterization techniques. Moreover, different types of nanoparticles such as polymeric nanoparticles, carbon nanoparticles, fluorescent nanoparticles, and self-assembled nanoparticles along with their potential applications in biomedicine will be covered at the end of this course.

Code	**BENG434**
Name	**Stem Cell**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Spring
Type	Elective
Prerequisites	-
Coordinator(s)	-
Content	This course will introduce a broad range of topics related to stem cell biology. It will present stem cells in relation to many aspects of basic and applied biology and medicine including development, regeneration/repair, and cancer. The course will

	cover the following concepts and themes: pluripotency and reprogramming, pluripotent cell types, organ systems, stem cells and cancer, therapeutics and ethics.

Code	**BENG 435**
Name	**Separation Techniques**
Hour per week	3 +0 (Theory+ Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	
Type	Elective
Location	Classroom
Prerequisites	-
Special Conditions	-
Coordinator(s)	Prof. Sevil Dinçer İşoğlu
Webpage	-
Content	The course presents engineering fundamentals of separations and purification of biological molecules. This course covers the following topics: Introduction to bioseparation processes, principles and practice of centrifugation, extraction, adsorption, precipitation, crystallization, filtration, membrane based separations, chromatography and electrophoresis.

Code	**BENG 438**
Name	**Introduction to Bionanotechnology**
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Spring
Type	Elective
Prerequisites	-
Coordinator(s)	Assistant Prof. İsmail AKÇOK
Content	This course covers the understanding of cellular components and how they may be used as a constituent of, or may interact with, bionanotechnologies. These technologies include bioanalytical techniques; applied genomics and proteomics; nanoparticles, nanostructures and biomimetics; and the interaction of nanomaterials with biological systems. In this course nanomedicine applications and nanodevices will be covered.

Code	**BENG 439**
Name	**Metabolic Engineering**
Hour per week	3(3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	-
Type	Elective
Prerequisites	-
Coordinator(s)	Assistant Prof. Özkan Fidan
Content	This course includes the engineering concepts for analysis, design, and modification of metabolic pathways to convert raw materials to food, pharmaceuticals, fuels and chemicals. It provides the fundamental knowledge of cellular metabolic pathways, the basic principles and applications of metabolic engineering, metabolic flux analysis, the

	regulation of metabolic pathways, and the biosynthesis of primary/secondary metabolites.

Code	**BENG 440**
Name	**Regulations and IP Rights in Bioengineering**
Hour per week	3+0
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	-
Type	Elective
Prerequisites	-
Coordinator(s)	Assistant Prof. Alper İşoğlu
Content	This course primarily aims to teach the basics of intellectual property rights. It includes trademarks, industrial design, copyrights and related rights, patent research, claim regulation and the economic value of intellectual property. Researching patent databases, reading and understanding patent applications, preparing claim arrangements and understanding the types of intellectual property rights are among the outcomes of the courses.

Code	**BENG 441**
Name	**Scientific Writing and Understanding**
Hour per week	3(3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	-
Type	Elective
Prerequisites	-
Coordinator(s)	Assistant Prof. Fatih Ortakçı
Content	This course aims to demystify the writing process and teach the fundamentals of effective scientific writing. Instruction will focus primarily on the process of writing and publishing scientific manuscripts. The course will be presented in two segments: Part (1) teaches students how to write effectively, concisely, and clearly and part (2) takes them through the preparation of an actual scientific manuscript. Students taking the class for 2 units will be asked to attend a weekly lecture and to complete some short writing and editing exercises. Students will receive regular, relevant feedback on their writing and presentation skills and will be expected to provide constructive feedback to their colleagues in the course.

Code	**BENG 442**
Name	**Entrepreneurship in Bioengineering**
Hour per week	3+0
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	-
Type	Elective
Prerequisites	-
Coordinator(s)	Assistant Prof. İ. Alper İşoğlu
Content	The main purpose of this course is to transform bioengineering studies and innovations into coherent and applicable solutions of todays technology. Comprehensive and collective knowledge of technologies utilized in life science, biomedical and medical biology sectors; clinical, economical and sociological

	perspective will be given to students. In addition, innovation and entrepreneurial understanding in health sector will be developed to promote the idea of business initiatives and start-up companies.

TRACK-II-GENETICS

Code	**MBG 304**
Name	**Bioinformatics**
Hour per week	5 (3 + 2)
Credit	4
ECTS	6
Level/Year	Undergraduate / 3
Semester	Spring
Type	Compulsory
Prerequisites	none
Coordinator(s)	
Content	This course is designed to introduce students to bioinformatics tools and analysis methods and therefore is a hands-on type. Most weeks will include both classroom lecture and computer lab time. Upon completion of the course, the students should be comfortable with handling biological data and online tools that are relevant to their research. The topics include databases, sequence alignment, homology search, phylogenetic trees, and structure prediction.

Code	**MBG 409**
Name	**Cancer Biology**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3,4
Semester	Fall, Spring
Type	Elective
Prerequisites	none
Coordinator(s)	
Content	This course will provide a general background of the cancer development process at the cellular and molecular level. Various genetic and molecular changes during carcinogenesis process will be introduced to students. These changes include dysregulated cell proliferation, escape from cell death, angiogenesis, metastasis and invasion. Moreover, this course will discuss the factors involved in cancer development, interactions between tumor and its environment, cancer prevention and treatment approaches.

Code	**MBG 410**
Name	**Microarray Data Analysis**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3,4
Semester	Fall, Spring
Type	Elective
Prerequisites	none
Coordinator(s)	
Content	This course will provide the theories and applications in data analyses. Topics include general concepts including data preprocessing, feature selection, sampling, using different statistical and machine learning techniques and visualization.

Code	**MBG 411**
Name	**Model Organisms**
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level	Undergraduate / 3,4
Semester	Fall, Spring
Type	Elective
Prerequisites	none
Coordinator(s)	
Content	In this course, model organisms will be discussed extensively in molecular and biological studies. Mice, frogs, zebrafish, *drosophila* and *Caenorhabditis elegans* are the main model organisms that are focused on throughout the course. Model organisms have advantages and disadvantages according to different studies, which will be also covered in the course. The course will discuss the appropriate usage of right type of model organisms to the right studies and techniques.

Code	**MBG 413**
Name	**Biotechnology**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level	Undergraduate / 3,4
Semester	Fall, Spring
Type	Elective
Prerequisites	none
Coordinator(s)	
Content	The course deals with the major elements of biotechnology and its global significance, the categories of biotechnological processes and products, and a comparison between "traditional" vs "modern" biotechnology processes. Also, the key developments in the history of biotechnology specifically fermentation, downstream processing; recombinant methods, monoclonal antibody, analysis and automation, genomics, proteomics and metabolomics.

Code	**MBG 416**
Name	**Developmental Biology**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3,4
Semester	Fall, Spring
Type	Elective
Prerequisites	MBG101, MBG102
Coordinator(s)	
Content	The developmental biology explores how living things are shaped, how their lives are formed, how this complex structure develops and differentiates. The course covers topics such as the stages of development in different organisms in the early period, how fertilization, meiosis, organogenesis and environmental factors affect the organism's development. It also links the content of the course to the context of modern and old experiments used in the study of developmental biology.

Code	**MBG 417**
Name	**Basics of Neuroscience**
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3,4
Semester	Spring
Type	Elective
Prerequisites	none
Coordinator(s)	
Content	This undergraduate-level course will teach how the nervous system functions at the molecular and cellular level. The main purpose of this course is to introduce types of nervous cells, strctures of nervous cell, nerve impulse, connection between nervous cells, nerve cell formation in the brain and spinal cord; sensory systems such as vision, hearing, smell, transformation and processing of physical energy into neural signals, neurochemical basis of brain diseases, emotional, mobility, learning and memory control systems.

Code	**MBG 419**
Name	**Functional Genomics**
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3,4
Semester	Fall, Spring
Type	Elective
Prerequisites	none
Coordinator(s)	
Content	In this course, genomic transition from genetics, genomic sequence acquisition and analysis, evolution of genomes, genome description, genomic variations, gene and homology, basic and applied genomic methods; the principles of DNA microarrays and other intermediate technologies, cloning and expression strategies, in vivo gene expression techniques, proteomics principles and techniques will be covered. Current examples of the application and development of functional genomic technology and its use in biotechnological industry are also included in the course.

Code	**MBG 421**
Name	**RNA Biology**
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate /3,4
Semester	Fall, Spring
Type	Elective
Prerequisites	none
Coordinator(s)	
Content	The course covers types and roles of RNAs, RNA structure and non-coding RNAs in post-transcriptional gene regulation. The main topics of the course include RNA splicing, editing, localization, regulation and translation.

Code	**MBG 426**
Name	**Histology of Tumors**
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3,4
Semester	Fall, Spring
Type	Elective
Prerequisites	none
Coordinator(s)	
Content	The course will cover the histopathology of tumors, classification of tumors, introduction to histological methods, cytohistological features of malignant tumors, markers used in immunohistochemistry of tumors.

Code	**MBG 430**
Name	**Virology**
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate /3,4
Semester	Fall, Spring
Type	Elective
Prerequisites	none
Coordinator(s)	
Content	The course covers the topics of virus taxonomy, virus structure, epidemiology, molecular basis of the viral replication and infection in the host cells, immune response of the host cell against the viruses and host cell growth control, virus vaccines, antiviral drugs, prions, and virus vectors for gene therapy.

Code	**MBG 431**
Name	**Human Physiology**
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3,4
Semester	Fall, Spring
Type	Elective
Prerequisites	none
Coordinator(s)	
Content	This course provides knowledge on functional systems of the human body along with the physiological mechanisms taking role in the regulation/maintenance of the body. It covers the topics of the skeletal system, endocrine system, circulatory system, respiratory system, nervous system, immune system, reproductive organs, kidney and urinary system, and the muscle function from the level of the cell to the level of the organism.

Code	**MBG 435**
Name	**Disease and Genetics**
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3,4
Semester	Fall, Spring
Type	Elective
Prerequisites	none
Coordinator(s)	
Content	This course will introduce number of diseases to students. Students will learn diseases and their molecular mechanism in details. Diseases that we will touch are cancer, diabetes, obesity, neurodegenerative diseases including Prion and Creutzfeldt–Jakob disease, autoimmune diseases, Muscle Diseases, Lysosomal diseases, Mitochondrial Diseases. Student will also learn gene editing technics and gene therapy that are important and very new technics for untreatable disorders. Most importantly, this course will focus on relationships between diseases and its genetic background which will help to understand molecular mechanism of those diseases. In this course, students will present an article about a disease which are explained in the lecture or a presentation about a disease. In this way, the students will strengthen what they have learned in lecture. In addition, students will be able to improve their ability to present papers.