DEPARTMENT OF BIOMEDICAL ENGINEERING

COURSE INFORMATION

1ˢᵗ SEMESTER

ATI101 Atatürk's Principles and History Turkish Revolution-I

Basic Conceptual Knowledge about the Course; The Ottoman Empire and its dissolution; Tanzimat and First Constituitonal Era. Ideological Movements in the Late Period of the Ottoman State; The Battle of Tripoli; The Balkan Wars; World War I. Armistice of Mudros and Occupations; The Rise of the National Movement and National Organizations; Mustafa Kemal Pasha's Departure to Samsun and the statue que in Anatolia; Amasya Protocol; National Congresses; Announcement of National Pact; Promulgation of the Great National Assembly; Turkish War of Independence; Armistice of Mudanya; Treaty of Lausanne; Establishment of the Republic.

MBYM101 Introduction to Biomedical Engineering

Definition and history of biomedical engineering; Basic concepts in biomedical engineering; Fields of study in Biomedical Engineering; Biomaterials; Biomechanics; Biomedical instrumentation, Biomedical measurement and analysis; Biomedical imaging, Cell and genetics; Pharmaceutical; Energy and energy cycle in living things; Ethical principles in biomedical engineering.

MBYM103 Computer Programming and Algorithm-I

The History of computers; Brief description of programming languages; Algorithms; Flowcharts; Introduction to computer programming; The general form and concepts of C programming language; Fundamentals of code development using C programming language; Statements and operators in C; Problem solving; Assignment and input/output statements; Selection structures and loops.

OFIZ101 Physics I

Measurement and unit systems; Vectors, Motion in one dimension; Motion in two and three dimensions; Newton's laws and applications; Work and energy; Potential energy and conservation of energy; Center of mass and linear momentum; Protection of collision and linear momentum; Rotation of solid objects.

OKIM101 Chemistry

Investigation of the matter; The structure of atoms and the behavior of molecules; Concept of mole and chemical bonds; States of matter, compounds; Molecules and types of chemical reactions; Solids, liquids, gases; Solutions and acid-bases; Electrochemistry.

OMAT101 Mathematics I

Basic properties and functions of numbers; Concepts of limit and continuity; Solutions of derivative and differential equations; Rolle and mean values theorems, Study of trigonometric and reverse trigonometry functions; Examination and drawing of logarithmic and hyperbolic functions; Uncertain shapes; Drawings of parametrical and polar curves; Curvature and curvature diameters; Unspecified integral, specific integral and applications (area, volume, and area of rotational surfaces).

TDI101 Turkish Language-I

Characteristics of Turkish Language in terms of structure and meaning; basic works; Expressing himself/herself in society; Ways of using the language more effective and accurate.

YDI101 Foreign Language I

Nouns; Articles; Personal pronouns; Possessive adjectives; Verb "To Be"; Possessive "s"; Asking for names; Prices & Jobs; Some, Any, No, Every; Countable & uncountable nouns; Cardinal and ordinal numbers; "What Time Is It?" Dates, Prepositions of Time, and Place; Present progressive; Forms of Questions; Question Words; Imperatives; Present simple; Comparison of present simple and present continuous.

2nd SEMESTER

MBYM102 Medical Biology

Introduction to medical biology; Cellular organization; Structure and function of DNA; Chromosome; DNA replication; RNA structure and functions; Genetic code and protein synthesis; Mutation; General principles of heredity; Cell cycle and cell division; Immune system; Cancer biology, Stem cells and tissue engineering.

MBYM104 Organic Chemistry

Carbon compounds and chemical bonds; Basic organic reactions and mechanisms; Alkanes and cycloalkanes; Stereochemistry; Alkyl Halides; Nucleophilic displacement and separation reactions; Alkenes, alcohols and ethers; Synthesis of alcohols; Displacement, separation and esterification reactions; Thiols and their properties; Synthesis and reactions of thiols, Crown ethers, Organometallic compounds and their reactions, Conjugated unsaturated systems, Resonance rules, Aromatic compounds and nomenclature, Reactions of aromatic compounds, Electrophilic displacement reactions, Friedel-Crafts reactions.

MBYM106 Computer Programming and Algorithm-II

Algorithm development and flow diagrams; MATLAB and programming environment; Arrays in MATLAB; Using disp and fprintf commands; Loops; Operations in matrices; Function M files; File

management in MATLAB; Polynomial manipulations in MATLAB; 2D Graphic Operations in MATLAB; Symbolic variables and operations in MATLAB; Applications.

OFIZ102 Physics II

Charge and matter; Electric fields; Gauss's law; Electric potential; Capacitance and dielectrics; Current and resistance; Direct current circuits; Magnetic fields; Sources of the magnetic field; Ampere's law; Faraday's law; Alternating-current circuits.

OMAT102 Mathematics II

Generalized integrals; Infinite arrays and series; Vectors, Vector-Valued functions; Multivariate functions and partial derivatives; Multiple integral calculations.

TDI 102 Turkish Language-II

Characteristics of Turkish Language in terms of structure and meaning; basic works; Expressing himself/herself in society; Ways of using the language more effective and accurate.

YDI102 Foreign Language II

Vocabulary gain; Grammar; Reading skills; Writing skills; Speaking skills; Listening skills.

ATI102 Atatürk's Principles of and History Of Turkish Revolution-II

Reforms in the political field (Abolition of the sultanate, the capital of Ankara, establishment of the Republic and the abolition of the Caliphate); Establishment of the Progressive Republican Party; The Sheikh Sait Rebellion; Declaration the Law for the Maintenance of Public Order and the assassination attempt to Atatürk; The Liberal Republican Party: Establishment and dissolution; Menemen and Bursa Incidences; The Turkish Constitution of 1924; Other constitutional developments in the field of law; The reforms carried out in the secularization period of Turkey; The revolutionary movements in education and culture relating to the regulation of social life (The Law of Unification of Instruction, the adoption of the Latin alphabet, National schools, Turkey Establishment and activities of History and Language institutions, Turkish history thesis, The sun-language theory, 1933 University reform, Community houses); Developments in the healthcare field; Izmir Economic Congress; Economic policy in the early years of the Republic; Reflection of the World Economic Depression (1929); The emergence of statist economic policies in Turkey and the First Five-Year Development Program; Turkish foreign policy in the period of Atatürk's presidency (Turkish-British, Turkish-Soviet, Turkish-French, Turkish-Italian relations in 1923-1938 period, relations with neighbors, Balkan and Sadabat Pact); Definition of Ataturkist thought system, its scope; Foundational principles of Ataturk (republicanism, secularism, nationalism, populism, statism, reformism) and threatens to these foundational principles; The post-Ataturk period in Turkey (Inonu's presidency, World War II and Turkey, the establishment of the Democratic Party and the transition to multi-party life).

GIR102 Entrepreneurship

This course includes the features and types of entrepreneurship, advantages, and disadvantages; Entrepreneurship; Idea generation; Entrepreneurship process; Business plan; Marketing plan; Resource management; Growth management and social entrepreneurship.

3ʳᵈ SEMESTER

MBYM201 Circuit Theory

Ohm's and Kirchhoff's laws; Resistance circuits; Circuit analysis methods; Thevenin- equivalent and Norton-equivalent circuits; Operational amplifiers; Analysis of first order dynamic circuits; Analysis of RLC circuits with matrices; Sinusoidal steady state analysis; Circuit analysis with Laplace transform.

MBYM203 Electromagnetic Fields and Waves

Static magnetic fields; Magnetic circuits; Time-varying fields; Maxwell's equation; Wave propagation in vacuum; Polarization, reflection and transmission of plane waves; Waveguides.

MBYM205 Biochemistry

Introduction to biochemistry; History of biochemistry; Development of biochemistry, Definition of biochemistry; Cell and cell structure; Importance of water and water in biological systems; Properties of aqueous solutions; Amino acids; Chemical properties of amino acids; Chemical reactions of amino acids; Synthesis methods of amino acids; Proteins; Structure and properties of proteins; Classification of proteins and some important proteins; Purification methods of proteins; Amino acid and protein metabolism; Carbohydrates; Structure and classification of carbohydrates; Carbohydrate metabolism; Glycolysis; Regulation of glycolysis; Krebs cycle and pentose phosphate interface; Gluconeogenesis; Lipids; Structure and classification of lipids; Nucleotides and properties; Enzymes; Classification and naming of enzymes; Enzyme kinetics; Enzyme inhibition; Control and regulation of enzymatic reactions; Vitamins and coenzymes; Classification of vitamins; Structure and function of vitamins; Hormones; Classification of hormones according to their structures; Secretion and mechanisms of action of hormones.

MBYM207 Human Anatomy & Physiology

Basic concepts of anatomy and physiology; Tissue and tissue types; Skeletal system; Anatomical structure of bone; Joints & types of joints; Circulatory system; Respiratory system; Nervous system; Sense organs; Endocrine system; Digestive system; Reproductive system; Excretory system.

MBYM209 Electrical Measurement and Analysis Laboratory

Ohm's and Kirchhoff's laws; Resistance circuits; Circuit analysis methods; Thevenin- equivalent and Norton-equivalent circuits; Operational amplifiers; Analysis of first order dynamic circuits; Analysis of RLC circuits with matrices; Sinusoidal steady state analysis; Circuit analysis with Laplace transform.

OMAT203 Linear Algebra

Matrices; Matrix operations; Inverse matrix; Elementary processes; Linear equation systems; Gauss and Lu decomposition; Vector spaces and sub spaces; Additional matrix; Determinant; Inner product spaces; Eigenvectors; Diagonalization.

OBDE201 Nature of Science and Critical Thinking

Critical thinking has played a crucial role in the advancement of scientific processes from the Antiquity to the present day. In this course, the position of critical thinking in scientific processes will be illustrated by giving various examples from the history of science. In addition, it will be examined where critical thinking stands in today's science and what importance it has. In addition, various texts will be analyzed in accordance with critical thinking methods.

OYDI201 Academic English I

The aim of the Academic 1 English Course is to make students gain academic reading and writing skills. In order to understand academic reading texts, the main components required for academic reading such as grammar, vocabulary, and world knowledge will be mentioned, and the reading techniques will be presented to the students. Also, students will be able to learn paragraph writing steps and types of paragraphs.

4th SEMESTER

MBYM202 Electronic

Semiconductor diodes; Diode applications; BJTs; DC and AC effects of BJTs; FETs and FET amplifiers; Frequency responses of BJT and JFETs; Operational amplifiers; Applications of operational amplifiers; Power amplifiers; Feedback and oscillator circuits; Voltage regulators; Biomedical applications.

MBYM204 Medical Physics

Solid mechanics; Fluid mechanics; Thermodynamics; Sound waves; Electricity; Optics; Atomic and nuclear physics; Nanotechnology.

MBYM206 Cell Biology

General characteristics of cell; Organelles; Cell analysis methods; Cell skeleton; Structure of the cell membrane and transport; Cell surface; Extracellular matrix; Cell adhesion; Ion channels; Membrane

potential; Nerve action potential; Intercellular stimulation; Intracellular stimulation; Cellular respiration; Cell death; Cell culture.

MBYM208 Biomechanics and Applications

Historical development of biomechanics; Structure and properties; Application areas; Information and ideas about the solution of problems.

MBYM210 Logic Circuits

Analog and digital concepts; Analysis of number systems; Numerical codes and coding types; Boolean rules and simplification of logic expressions; Logic gates and logic circuits; Logic functions, Description, simplification with accurate table; Karnaugh maps; Simplification with Karnaugh Maps; Table method; Multiplexer; Demultiplexer; Encoder and decoder; Comparison circuits; Arithmetic operation circuits.

MBYM212 Electronic Laboratory

Semiconductor diodes; Diode applications; BJTs; DC and AC effects of BJTs; FETs and FET amplifiers; Frequency responses of BJT and JFETs; Operational amplifiers; Applications of operational amplifiers; Power amplifiers; Feedback and oscillator circuits; Voltage regulators; Biomedical applications.

OMAT204 Differential Equations

First order differential equation and its applications; Higher order linear differential equation and second order differential equation applications; Linear differential equation systems and solutions; Laplace transform.

OYDI202 Academic English II

Analyzing the reading passage, reviewing the text and gaining reading skills, Examining the reading passage/Discussion, using a dictionary, Understanding the integrity of meaning in the paragraph, Giving comparative and superlative meanings using adjectives, brainstorming and writing a paragraph, Analyzing the reading passage, Methods of understanding the author's purpose in the text. Comprehension, Identifying the Cause-Effect Relationship in the Reading Passage, Using a Dictionary, Writing a Process Paragraph, Using Purpose Infinitives, Writing and Sharing a Paragraph Explaining a Process Using Imperative Sentences, Distinguishing State and Opinion Statements in the Reading Passage, Discussion, Discussion/Video Activity, Using phrasal verbs in the passage, Creating a paragraph outline, Writing supporting sentences and conclusion sentence, brainstorming and writing an opinion paragraph, Examining the reading passage and obtaining relevant vocabulary, synthesizing the information, Analyzing and filling in the graph, Analyzing the reading passage and discussion, watching/interpreting videos, understanding and using collocations, examining explanatory paragraph examples and using case and rating adverbs, writing explanatory paragraphs, general review/mutual evaluation of the period.

5th SEMESTER

MBYM301 Signals and Systems

Signal and system concepts; Signal and system types and properties; Definitions of linear time invariant systems; The convolution; Fourier series and transform; Laplace and Inverse Laplace transformations; Z and Inverse Z-Transforms; Sampling and modulation; Time and frequency characteristics of systems and signals; Applications.

MBYM303 Microprocessors and Microcontrollers

Microcontrollers; C programming language; Command set; Data input and output programming; LED; Pushbutton; Display keyboard usage; Serial parallel; Analog, digital, output operation; Cutting operation; Program structure and design; Tools and techniques for program development; Design and interface examples.

MBYM305 Biomedical Instrumentation

Introduction to biomedical instrumentation; Definition and history of biomedical instrumentation; Introduction to instrumentation. Measurement concept in biomedical engineering; Measurement errors; Noise in signal measurement; Sensors and basic sensor information; Signal amplifiers; Amplifiers and converters; Effect of transducer properties on measurement; Signals in the physiological system. Principles of body temperature and temperature measurement. Pressure measurements and catheters; Biopotentials; Fundamentals of signal processing; Basic components of continuous and discrete signals and systems; Analog signal processing; Spectrophotometric methods in medicine; Detectors used in nuclear medicine and radioactivity measurement; Image processing; Introduction of biomedical devices and basic working principles; Medical imaging devices; Physiological signal monitoring diagnostic and recording devices; Life support and treatment devices; Medical laboratory and non-patient application devices.

MBYM307 Biomedical Instrumentation Laboratory

Source and properties of bioelectrical signals; Recording and analysis of electromyography (EMG) signals; Recording and analysis of electroencephalography (EEG) signals; Recording and analysis of echocardiography (ECG) signals; Recording and analysis of the respiratory cycle (respiratory rates, relative breathing depths, regulation of ventilation); Galvanic skin response and analysis; Recording and analysis of electrooculography (EOG) signals; Reaction time (learning at fixed intervals and pseudo-random presentation experiments); Respiratory function (determination of lung volumes and capacities); Respiratory function (determination of pulmonary flow rates); Biofeedback (relaxation and alertness); Blood Pressure (Indirect blood pressure measurement, Ventricular Systole & Diastole, Korotkoff sounds, mean arterial pressure) recording and analysis; Heart Sounds (heart valve functions; Recording and analysis of electrical & mechanical events.

OMAT301 Numerical Methods

Promotion; Algorithm Development and Flow Diagrams; Numerical methods: Approaches and errors, Roots of algebraic equations; Open methods; Systems of linear equations; Iterative solution methods; Solutions of nonlinear equation systems; Curve fitting methods; Interpolation method with Newton divided difference table; Lagrange interpolation; Numerical integration; Numerical derivative; Ordinary solution numerical solutions of differential equations; Solution of initial value problems with MATLAB; Stiff problems; Engineering applications; Definition of boundary value problems; Boundary conditions; Finite difference method; Finite difference method and engineering applications.

OYDI301 Academic English III

Academic English 3 course aims to improve students' language skills necessary for academic settings. An integrated approach will be used for improving four language skills.

ELECTIVE COURSES

MBYM351 Medical Device Design

Fundamentals of mechanical design; Reliability-based design; Failure types and analysis; Medical product design and development process; Material selection in design; Design optimization.

MBYM353 Bioinformatics

Concept of Bioinformatics; History of Bioinformatics, and its relationship with other branches of science; Areas of use of Bioinformatics; Information theory; Information collection and processing; Creating and using databases; Using data banks; Genome; Maps and sequences; Human genome project; Genome and expression data banks; Protein modeling; Genomics and Proteomics.

MBYM355 Cell Culture Systems

Primary cell cultures and continuous cell lines, cell culture morphology, cell lines, cryopreservation and storage of cell lines, protocols.

MBYM357 Cardiovascular Instrumentations

Introduction to the cardiovascular system; Cardiac conduction system; Formation and cellular transmission of electrical potentials in the heart; Control of the cardiovascular system by sympathetic and parasympathetic nervous systems; Regulation of hemodynamics; Blood circulation; Pressure gradient and resistance to flow; Regional regulation of blood flow and acting forces; Cardiac anatomy; Passive myocardial constitutive properties; Electrical activation; Ventricular pump function; Ventricular-vascular coupling; Regional and global function; Invasive and noninvasive measures; Ventricular valve stress prediction models; Muscle properties and myocardial infarction; Heart failure and ventricular function resulting from left ventricular assist changes; Introduction to modeling and measurement methods for the analysis of the cardiovascular system; Blood flow dynamics; Heart

function and noninvasive approaches; Cardiovascular instrumentation; Basic cardiovascular system research; Assistance devices and their applications to disease processes.

MBYM359 Radiation and Nuclear Medicine

The role of radiation physics in nuclear medicine; Basic processes of radiation physics; Radiation sources and radiopharmaceuticals in nuclear medicine; Radiation detectors for medical applications; New horizons in nuclear medicine.

MBYM361 Genetics

Introduction and history of genetics; Basic genetic concepts; Molecular structure of genetic material; Cell division; Crossing-over; Allele concept; Karyotype; Mendelian genetics; Monohybrid cross; Dihybrid and trihybrid crosses; Incomplete dominance, co-dominance, multiple alleles; Extranuclear inheritance; Autosomal Chromosomes; Sex chromosomes and sex determination; Population genetics.

MBYM363 Biopharmaceutics

Definition of biopharmaceuticals; Importance of biopharmaceuticals; Advantages and disadvantages of biopharmaceuticals; Difference between biopharmaceuticals and conventional drugs; Production methods of biopharmaceuticals; Relationship between recombinant DNA technology and Biopharmaceuticals; Structural and biological properties of biopharmaceuticals; Quality, safety and effectiveness of biopharmaceuticals; Biomarkers; Properties and structure of biomarkers; Clinical and post-clinical use of biomarkers.

MBYM365 Bioanalytic Methods in Biomedical Engineering

Definition of spectroscopy; Basic concepts of Spectroscopy; Types of spectroscopy; Atomic spectroscopic methods; Mass spectroscopic methods and biomedical applications; Definition of chromatography; Basic concepts of chromatography; Liquid chromatography (High Pressure Liquid Chromatography-HPLC); Gas chromatography; Ion chromatography and biomedical applications; Electroanalytical methods definition; Voltametric methods; Potentiometric methods; Amperometry methods and biomedical applications.

MBYM367 Manufacturing Processes

Casting; Casting methods; Plastic shaping methods; Welding methods.

MBYM369 Scientific Research Methods

Scientific research methods; Scientific research planning: Research problems, hypotheses and aims; Access to scientific information: Library, digital library, databases; Scientific data collection and measurement methods; Data analysis methods and presentation; Writing a research proposal, Preparing a 'Summary' proposal; Research report preparation/reporting methods; Basic rules and examples in

article writing; Ethical problems/unethical behaviors in research and their prevention; Validity and reliability concepts, Higher education council scientific research and publication ethics directive.

6th SEMESTER

MBYM302 Biosensors

Introduction to biosensors, definition, and history of biosensors; Working principles of biosensors; Important performance characteristics of biosensors; Types of biosensors; Amperometric biosensors; Potentiometric biosensors; Voltametric biosensors; Advantages and disadvantages of biosensors; Uses of biosensors (Food-Environment-Defense-Health).

MBYM304 Medical Imaging Systems

Basic imaging principles; Image formation; Image quality; Radiographic imaging devices; Nuclear medicine imaging devices; Ultrasound imaging; Magnetic resonance imaging.

MBYM306 Materials Science and Biomaterials

Materials; Definition of biomaterials; Biocompatibility; Natural biomaterials; Synthetic and biological materials; Classification of synthetic biomaterials; Polymers; Factors affecting the implant and host system; Application areas of biomaterials; history of implants; Current studies and trends in biomaterials; Mechanical properties of biomaterials; Surface analysis methods; Metallic, polymeric, ceramic, and composite biomaterials.

MBYM308 Fluid Mechanics

Introduction to fluid mechanics; Basic concepts and dimensions; Velocity; Rotation viscosity; Surface tension and evaporation pressure and investigation of flow technical; Hydrostatic pressure forces; Translation and rotation; Frictionless flows analysis; Friction flows analysis; Laminar flow; Turbulent flow; Local losses in pipes and multiple pipe systems; Open-channel flows.

OYDİ302 Academic English IV

Academic grammar; Listening to texts with academic content; Understanding and commenting on the texts; Making deductions; Making short speeches; Group and classroom discussions.

MBYM310 Summer Internship

It is carried out in accordance with the departmental internship directive in order to increase the professional manners and knowledge gained during the education period until this semester, to see the differences in application methods and methods in various institutions and organizations, and to improve the knowledge gained during education by practicing.

ELECTIVE COURSES

MBYM350 Biomedical Robot Design

Relationship between robotics and biomedicine; Robots according to coordinate systems; Robots according to control systems; Dynamic properties of robots; Forward-inverse kinematic analysis; Concept of forward and inverse kinematic analysis in robots; Their meanings in real applications; Denavit-Hartenberg (D-H) notation; Control elements in robots and robot hand mechanisms and robot control; Programming and simulation of robots; Creation of a robot software development environment; Determination of robot workspace and trajectory planning; Workspace simulation with robotic hand application; Medical robots and sensors; High-precision biomedical robots and analysis; Nanorobot technology and biomedical technologies; Nanorobotics.

MBYM352 Clinical Engineering

Job descriptions of clinical engineers and relevant legal regulations; Building equipment to provide healthcare services; Devices, materials and software commonly used in the healthcare industry; Planning and legal processes for the purchase of these products; Operational process; Maintenance, repair, calibration services etc., Consultancy, support and training services related to medical technologies; Productivity; R&D activities, Academic roles.

MBYM354 Cell Cultures and Cancer Biology

Definition of stem cell; Basic properties and isolation of stem cells; Stem cell niche; Life cycle of stem cells and aging; Stem cell types; Differentiation of stem cells; Characteristics of cancer cells; Role of environmental agents and genetic factors in cancer formation; Protooncogenes; Oncogenes, Cancer stem cell formation; Metastasis, Current issues in stem cells and cancer biology.

MBYM356 Biopolymers

Definition and history of polymers; Biopolymer concept and basic definitions; Biodegradable and bioinert synthetic polymers; Smart biopolymers and gels; Thermodynamic and mechanical properties of biopolymers; Water-soluble biopolymers; Modification, and structures of biomolecules with biopolymers; The relationship between biological activity and physicochemical properties of biopolymers; Use of biopolymers; Applications of biopolymers in medicine and pharmaceutical fields.

MBYM358 Current Issues in Biomedical Engineering

Genetic science and human genome project; Biotechnology; Nanotechnology; Nanomedicine and biomedical applications; Biomechanics; Biomaterials; Controlled drug release and transport; Biomedical devices and machines; Biosensors.

MBYM360 Modeling and Control of Biomedical Systems

Introducing the concept of medical instrumentation for physiological measurements; Sensing elements such as piezoelectric transducers; Photocoupler sensors, Thermal sensors and various surface electrodes; Measurement module control modes; Gain and bandwidth; Understanding the relationships between biomedical signals and circuits.

MBYM362 Biomedical Signal Processing

Introduction to biomedical signals; ECG, PCG, CP, EEG, ENG, EMG, EGG, speech signals; Introduction to digital programming (MATLAB); Representation of biomedical signals in MATLAB program; Discrete-time signals and systems; Representation of discrete time signals in MATLAB Program; Demonstration of discrete time system properties and their applications in MATLAB; Linear Time Invariant (LTI) Systems; Application of LTI systems; Convolution in biomedical signals and systems; Representation of convolution and its applications in MATLA, Difference equations and transient behavior in biomedical systems; Representation of Difference Equations in MATLAB and transient behavior applications, Frequency domain analysis of biomedical signals and systems; Systems of linear time-invariant systems and frequency domain representation and applications in MATLAB, Frequency domain analysis of biomedical signals and systems; Discrete time Fourier transform and its applications in the MATLAB, Frequency domain analysis of biomedical signals and systems; Fast Fourier Transform and its Applications in the MATLAB, Frequency function analysis of Linear Time-Invariant Systems; Z transform applications; Transfer function and its applications in MATLAB; Digital filter structures; Realization of digital filter structures in MATLAB, Filtering in biomedical signals; FIR filter design and its applications in MATLAB; Filtering in biomedical signals; IIR filter design and its applications in MATLAB; Waveform analysis and waveform complexity in biomedical signals; Correlation coefficient, energy of signals and its applications in MATLAB, Frequency domain characterization of signals and systems; Derivation of Fourier spectrum and power spectral densities and applications.

MBYM364 Biotechnology

Introduction to biotechnology; Definition and history of biotechnology; The place and importance of biotechnology in industry; Environmental biotechnology; Animal biotechnology; Microbial biotechnology; The place and importance of biotechnology in medicine; Forensic medicine biotechnology; The place and importance of biotechnology in the food field; The place and importance of biotechnology in the defense industry; Biotechnology in agriculture its place and importance in the field of plant biotechnology; current developments in the field of biotechnology and biosafety systems.

MBYM 366 Bioseperation and Purification

Properties of biological products; Pre-treatments; Cell disruption methods; Solid-liquid separation; Concentration processes; Purification processes; Final processes.

MBYM 368 Modern Optics and Lasers

Historical introduction to lasers; Basic concepts about lasers; Electromagnetic theory and Maxwell's equations; Reflection, refraction and absorption of light; Quantum theory of light-matter interaction; Diffraction and laser beam progression; Laser types: gas, excimer, solid-state and semiconductor lasers; Introduction to photonics; Fiber optics, optical sensors and modulators; Scientific and industrial applications of lasers and photonics; Ultrafast lasers and nonlinear optics.

7th SEMESTER

MBYM451 Biomedical Image Processing

What is digital image processing? Application areas of digital image processing; Digital image fundamentals; How are digital images produced? Sampling, quantization, aliasing, image zoom and reduction; Spatial image enhancement; Histogram equalization; stretching; Image transformations; Filtering; Frequency domain image enhancement; Edge detection algorithms; Color image processing; Color transformations; Color image smoothing and sharpening; Image restoration; Image compression; Compression methods and standards; Regional operations; .linear and non-linear image filters; Image enhancement techniques (histogram, histogram equalization); Mask processing techniques; Morphological operations; Image segmentation; 2D Fourier transformation of the image; Image statistical calculations; Feature extraction; Biomedical image processing; Classification of medical imaging modalities; Quality control and improvement of image quality in medical imaging; Mathematical foundations of image creation and image processing; 2D image reconstruction; Image reconstruction from 3D projections and other related techniques; Medical use of virtual reality technology applications; MATLAB applications.

MBYM453 Nanotechnology and Bionanotechnology

Nano concept and introduction to nanotechnology; Basic concepts in nanotechnology; Synthesis of nanomolecules; Characterization of nanomaterials; Usage areas of nanotechnology; Nanoparticles; Nanowires; Nanofilms; Nanotechnology and its applications in biology and health; Bionanomaterials; Advantages and disadvantages of bionanomaterials; Current bionanotechnological products.

MBYM455 Biostatistics and Probability

Introduction to statistics; Data type, sampling and data collection; Frequency tables; Data visualization; Measures of central tendency and dispersion; Introduction to probability; Conditional probability and independence; Probability density function; Random variables; Prediction; Moment generation functions; Distributions; Hypothesis testing; Confidence interval and conditions; Regression analysis, ANOVA test; Multiple comparison of means; Chi-Square test; Artificial neural networks method.

MBYM457 Bioelectromagnetism

Definition of Bioelectromagnetics; Electromagnetic fields produced by living cells, tissues or organisms; Cell membrane potential; Electric current in nerves and muscles; Action potential; Potential effects of electromagnetic fields created by human-made sources; Geomagnetic; The effectiveness of mobile phones and devices used to treat various conditions and the development of new treatment tools in the field; Providing analysis of its place in life.

MBYM459 Controlled Release Systems and Drug Targeting

Polymers used in these systems; Polymer structures, physical and chemical properties; Drug release mechanisms and kinetics in controlled drug release systems.

MBYM461 Prosthesis and Artificial Organs Implant Design

Learning the structure/materials, working principles and technologies of prosthetics, artificial organs and implants used in clinics today; Gaining the ability to comment on problems waiting to be solved or improvements; Having an idea about the technologies under development in this field; Systems and related prostheses, orthoses & implants; Biomedical design; Biocompatibility; Dialysis; Dental prosthesis, orthosis & implants; Tissue engineering.

MBYM463 Fuzzy Logic and Artificial Neural Network

Fuzzy Sets; Membership functions; Fuzzy Operations; T-norm and S-norm operations; Fuzzy rules; Fuzzification; Clarification; Fuzzy inference; Mamdani fuzzy inference; Mamdani fuzzy inference applications; Sugeno fuzzy inference and application example; Fuzzy logic applications in MATLAB environment; What is a neural network? Human brain; Models of a neuron; Perceptron; Computer experiment: pattern classification; Model building by regression; Least mean square algorithm; Multilayer perceptrons; Ensemble learning and online learning; Back-propagation algorithm; Kernel methods and radial basis function networks; K-clustering means; Supporting vector machines; Learning algorithms; ANN application examples in MATLAB environment.

MBYM465 Computer Aided Visualization

Image processing; Segmentation, grouping and boundary detection; Recognition and perception; Motion estimation and structure from motion, Introduction to computer vision, Linear algebra and probability analysis, Digital images, Logic operations and algebraic operators in digital images, Linear filters, Clustering and segmentation, Applications of pseudo color, Morphological filters, Connected component labeling, Object recognition, Object classification, Human gesture recognition.

MBYM467 Nuclear Magnetic Resonance Imaging Systems

Introduce the fundamentals of magnetic resonance imaging (MRI) and its applications in disease diagnosis; Physics of magnetic resonance imaging; MR hardware; MR signal; 2D and 3D MR imaging;

MR image quality; Clinical applications of MR for the diagnosis of various diseases; Explains the basic physics of MRI; Nuclear introduction to spin and nuclear magnetic moment; Explains the basic physics of MRI; Describes MR image formation based on Fourier transform; Examines the hyperfine structure of spectra; Depicts MR image formation based on Fourier transform; Describes clinical applications of MR for the diagnosis of various diseases; Stern-Gerlach Properties of the method and NMR methods (Rabi; Bloch and Purcell) and measurements of nuclear magnetic moments; Describing the clinical applications of MRI for the diagnosis of various diseases; Fundamental phenomena of NMR spectroscopy; Revising the magnetization of biological tissues; Several NMR medical imaging device components; NMR image acquisition and obtaining reconstruction; Some of the Spatial properties of the NMR image; Example of functional NMR imaging; Methods to remove NMR image artifacts; Review Preservation methods during NMR image acquisition; Advantage and disadvantage of NMR imaging over other imaging methods; Normal appearance of anatomy in pathological whole body sections to relate and compare with findings; Understand MRI Section Anatomy.

MBYM469 Biomedical Sensor Technologies

Sensor and transducer concept; Temperature sensors; Magnetic sensors and transducers; Optical sensors and transducers; Sound sensors and transducers; Humidity sensors; Speed sensors; Vibration sensors; Acceleration sensors; Position sensors; Pressure sensors; Flow sensors; Proximity sensors; circuits applications circuits with sensors.

MBYM471 Microprocessors and Biomedical Applications

Microcontroller controlled systems; PIC Microcontroller Family; PIC Microcontroller Development Tools; Program Development; PIC microcontroller applications; Creating various waveforms in real time; Microcontroller controlled biomedical device designs; Microcontroller sensor applications.

MBYM473 Visual Programming Language

Ability to set up and use a visual programming language; Using palettes in a visual language; Using basic components and organize components visually; Introduction to the development environment; Data types and expressions specific to the programming language; Basic components and their properties; Program control commands; Loops (while, do -while); Loops (for, foreach); Arrays (One-Dimensional); Arrays (2D); Class-Object concepts, Object access permissions; Program debugging issues; Dynamic object creation; Dynamic object arrays; Objects of certain types finding it in the application and changing its properties; Introduction to the database; Simple database query applications; Filtering and displaying data dynamically from the database according to multiple criteria; Simple database information entry applications; Simple database information editing and deleting applications; Database; Dynamic object creation; Hybrid applications.

MBYM475 Computer Aided Drawing

Teaching the basic commands of AutoCAD-2D; AutoCAD application examples with geometric drawings; Standard paper sizes; concept headings; Technical writing; Introduction of standard lines; Preparing AutoCAD formatted A3, A4, A5 papers and filling in concept headings; Basic principles of engineering drawings such as scale and measurement teaching the concepts; Teaching standard view drawings and making application examples; Making application examples in standard views; Teaching drawings of isometric views; teaching drawings of isometric views from standard views and making application examples; Model practice with standard and isometric views; Teaching special view drawings and model practice.

MBYM477 Computer Aided Circuit Design

Introduction of the simulation program; Simulation of basic circuits; Simulation of analog circuits; Simulation of analog circuits; Simulation of digital circuits; Simulation of digital circuits; Introduction of the printed circuit program; Circuit drawing in the program environment; Repetition of the applications of creating the printed circuit diagram.

MBYM479 Instrumental Analysis Methods

Introduction to instrumental analysis methods; Concept of measurement and fundamentals of measurement; Introduction to atomic spectroscopy; Optical atomic spectroscopy; Atomic absorption and Atomic Fluorescence Spectrometry; Atomic emission and atomic mass spectrometry; Molecular spectroscopy and its applications; Electroanalytical methods; Voltammetry; Potentiometry; Separation Methods; Chromatographic separations; Capillary electrophoresis.

MBYM481 Optimization Methods

Fundamentals of set constrained and unconstrained optimization; 1D search methods; Newton's method; Line search in multidimensional optimization; Gradient methods; Newton's method for non-linear least squares; Solution of linear equations; Least squares analysis; Recursive least squares algorithm; Global search algorithms; Simulated annealing; Particle swarm optimization; Genetic algorithms; Ant colony optimization algorithms.

MBYM401 Vocational Education in Business

Workflow analysis; Building models for solving problems and developing solutions.

8th SEMESTER

MBYM402 Medical Device Maintenance, Repair and Calibration

Hospital quality standards; Control of environmental conditions; Calibration instructions; Accreditation; Instruction preparation; Archiving, function testing; Calibration instruments used in calibration;

calibrators used in biomedical devices, test devices used in biomedical devices, calibration environments, Issues to be considered in biomedical device measurements; Calibrator and test devices; The effect of measuring limits on the results, Operations to be carried out in the limit values.

MBYM404 Biomedical System Design

Designing a biomedical system; Searching literature; Modeling and/or simulating a design; Developing skills as a team and reporting on a project; Application of knowledge of design experience and skills acquired in previous courses and laboratory studies; Economic, environmental, ethical, reproducibility, sustainability; Health and safety; Preparation and presentation of written reports.

MBYM406 Graduation Project

Determination of the research project and the preparation of a detailed work plan; Approaches methods for research project; The submission of the thesis writing and presenting it.

ELECTIVE COURSES

MBYM450 Tissue Engineering

Introduction to tissue engineering; Cell and tissue homeostasis; Definition of Extracellular Matrix elements and biocompatible materials; Use of Extracellular Matrix elements and biocompatible materials in tissue engineering; Cell types and sources used in tissue engineering; Cell culture techniques and cell differentiation; Tissue skeletal properties; Tissue engineering architecture; organ systems; Skin tissue engineering; Cartilage tissue engineering; Bone tissue engineering; Nerve tissue engineering; Tissue engineering and ethical approaches.

MBYM452 Modern Techniques in Molecular Biology

Nucleic Acid extraction and analysis methods; Genetic markers; DNA sequence analysis; PCR optimization; PCR application and PCR types; DNA fingerprinting; Gene expression analyses; Structural analyzes of proteins; DNA protein interaction analyses; Molecular diagnostic methods; Electrophoresis and methods; Cell culture techniques.

MBYM454 Forensic Chemistry and Toxicology

Definition and history of forensic chemistry; Analysis methods used in forensic chemistry; Forensic toxicology; Forensic DNA analyses; Fingerprint analyses; Fire and explosive analyses; Ink and paint analyses; Crime scene investigations and blood trace analyzes (Blinded crime scene blood analyses); Forensic serology.

MBYM456 Gas Sensors and Medical Applications

Introduction to gas sensors; Definition of gas sensors; Types and working principles of gas sensors; Performance characteristics of gas sensors; Advantages and disadvantages of gas sensors; Application

areas of gas sensors; Place and importance of gas sensors in the field of medicine; Applications of gas sensors in the field of medicine; Gas sensors used in blood analysis its importance and advantages.

MBYM458 Wearable Technology and Sensors

Definition and history of wearable technology; Usage areas of wearable technology; Advantages and disadvantages of wearable technology; Types of sensors used in wearable technology; Performance characteristics of sensors used in wearable technology; Advantages and disadvantages of sensors used in wearable technology; Latest developments in wearable technology; Applications of wearable technology in the field of medicine.

MBYM460 Nervous Systems, Neurophysiology and Physiological Control

Introduction to blood physiology; Blood cells and their properties; Blood clotting; inflammation response; prevention of coagulation; Blood and biomaterial interaction; Effect of physical and chemical properties of materials on blood compatibility; Effect of extracorporeal circulation circuit design on blood compatibility; Methods used to increase blood compatibility; Introduction to muscle physiology; Muscle types and properties; Muscle-nerve junction; muscle contraction; Introduction to nerve physiology; Examination of nerve cell properties and neural electrical events; Respiration; Ventilation; partial pressure effect; Examination of gas exchange between the body and tissues with gas laws; Filtration in the excretory system and reabsorption mechanisms; The effect of blood pressure on nephron function; Factors affecting filtration; Examination of the control mechanisms of filtration and reabsorption.

MBYM462 Biomedical Optics

Biomedical optics course introduces the basic concepts of optics; General principles of light, ray, geometric and fiber optic systems; Lasers; Interference and diffraction; Tissue optics; Biophotonic imaging; Introducing the fundamentals of light-tissue interaction; therapeutic and diagnostic applications of light; Summary of optical principles; Electromagnetic theory; Light sources; Classical optics; Optical interaction; Light-tissue interaction theory; Light-tissue interaction mechanisms and applications: Photophysical; photochemical; photobiological; Therapeutic and diagnostic applications of light; Introduction to the use of light in diagnostic and therapeutic approaches; Summary of optical principles: Classical optics; optical interaction.

MBYM464 Ultrasonography: Techniques and Applications

Introduction to ultrasonography; Basic physical principles of ultrasonography; Properties of sound Waves; Generation of ultrasound; Piezoelectric effect; Transducers; Sound-Tissue interaction; Factors affecting image quality; Imaging methods in ultrasonography.

MBYM466 Artificial Intelligence Systems

Artificial Intelligence is aimed at computational study of intelligent behavior; The common basis in all fields of artificial intelligence is to create agents/machines that can "think"; This course focuses on methods that allow agents/computers to behave intelligently (problem solving, representing information, reasoning, learning, perception and interpretation) includes a broad technical introduction; Basic concepts and methods of artificial intelligence, Problem solving using artificial intelligence; Search methods that use and do not use problem information; Local search methods and simulated annealing algorithm; Meta-heuristic algorithms; Introduction to artificial neural networks; Game Problems; Prolog programming language; knowledge representation and logical inference.

MBYM468 Modelling Nervous Systems

What is computational neuroscience? Nervous system; Experimental studies on nerve cells; Modeling of systems; Structure of the nerve cell; Electrical activities in the neuron; Types of synapses; Ion channels; Modeling of nerve cells; Hodgkin-Huxley model; Compartmental models; Synaptic connection models; Models of ion channels; Simplified neuron models (Single-compartment model); Cable theorem multi-compartment model; MATLAB applied homework.

MBYM470 Engineering Analysis with MATLAB

Numerical analysis methods; Errors and error analysis; Matrices; Numerical solutions of systems of linear equations (Analytical solution methods, Elimination and substitution method, Solution method by taking the inverse of the coefficient matrix, Cramer method, Gauss Elimination method, Gauss-Jordan method, Cholesky method, Iterative solution methods, Gauss-Siedel method, Jakobi method) Taylor series; Numerical solution of nonlinear equations (Bisection method); Linear interpolation (False Position) method; Simple iteration method; Newton-Rapson method; Secant method; Müller method; Non-linear Numerical solution methods of systems of equations; Generalized Newton-Rapson method; Interpolation method and finite differences (Forward, backward and central direction finite differences) Interpolation methods, Gregory-Newton interpolation method; G, N, Forward and backward direction Interpolation using the finite difference method; Interpolation with central differences (Stirling and Bessel interpolation formula); LaGrange interpolation method, Curve fitting methods (least squares method, least squares method for linearly distributed data, Polynomial, rational, exponential and trigonometric distributed data least squares method for data); Numerical derivative; Backward direction, Forward direction and central direction numerical derivative with finite differences; Numerical derivative with Taylor series; Numerical derivative with Gregory-Newton interpolation formulas; Numerical derivative with Bessel interpolation formula; Numerical derivative with polynomials derivative; Numerical solution of differential equations; Classification of differential equations; Solution of differential equations with Taylor and Maclaurin series; Solution of differential equations with Euler method; Solution of differential equations with Adams-Moulton and Adams-Bashforth

methods; Solution of differential equations with shortcut-correction method; Solution of differential equations with two- and four-step runge-kutta methods; MATLAB solutions of these abovementioned Methods.

MBYM472 Database Management Systems

Basic database concepts; Database design: Entity/Relationship model, functional dependency, mapping, normalization; Creating a table and determining its properties; SQL; Writing view, trigger and cursor queries; Writing program queries; Establishing a database-application connection and performing operations with Ado, Net, Reasons for using the database, Database design, Creating tables, adding, updating, deleting data, Using SQL language, Accessing and using the data in the database on the application side.

MBYM474 Biomedical Image Processing with FBGA

Programmable Logic Circuits; PLA, PAL, CPLD, FPGA concepts; FPGA Software development; Trial simulation environments; Hardware description languages and features; VHDL Programming language and engineering problem solving; Analysis and modal practice of application; Simulation and implementation steps using VHDL language; Microprogramming; Sequential logic circuit design with FPGA; Verilog programming language and its application to engineering problems; Analysis of simulation and implementation steps using Verilog language; Use of computer and industrial interfaces with FPGA; Image processing applications with FPGA; Embedded systems.

MBYM476 Communication Skills and Management Systems

Theories and methods in social psychology; Understanding the social environment; Perception of people; Self-Concept; Attitudes and attitude change; Definition of management; Historical development of management concept; Organization definition; Organization types; Organizational charts; Division; Management ethics; Management functions (planning, organizing, execution, coordination, supervision); New management techniques; Quality control circles; Benchmarking.

MBYM478 Ethics in Biomedical Engineering

Ethics and moral concepts; Ethical theories; Rights and justice concepts; Ethical decision making; Ethics in business life; Social responsibility; Ethical and unethical behaviors.