

ENGINEERING AND ARCHITECTURE FACULTY
BIOMEDICAL ENGINEERING DEPARTMENT

I. FALL SEMESTER

BMM105 Introduction to Biomedical Engineering 2+2 (ECTS 4)

A full description of biomedical engineering and its related subjects. The relationship between the biomedical engineering with the other scientific disciplines, such as engineering, basic science and medical science; biomechanic, biomaterials, tissue engineering, biomedical instrumentation, biomedical sensors, biosignals and bioelectrical subjects. The working areas of the biomedical engineering, ethical concepts and topical advancements.

MAT151 Calculus I 3+2 (ECTS 6)

Single variable functions. Limit and continuity. Derivatives and derivation techniques. Extremum points and optimization problems. High order derivatives. Taylor Series. Inverse functions and derivatives. Indefinite integrals, the derivation of trigonometric functions. Integration techniques. Volumes and Surface areas. The integration of rational and irrational functions. Uncertainties and L'Hôpital rule. Inverse trigonometric functions. Hyperbolic functions.

FIZ151 Physics I 2+2 (ECTS 6)

Physical quantities and measurements. Vectors. 1-D motion. 2-D motion. Newton laws. Circular motion and applications of Newton laws. Work, power and energy. Conservation of energy. Linear momentum and collisions. Rotational motion, angular momentum and torque.

BMH111 Algorithm and Programming 2+2 (ECTS 5)

Algorithm. Flow diagrams. Input-Output commands. If-else if- else, switch case. For loop, While loop. String arrays and matrix operations. Application and Modelling. Numerical and symbolic computation.

TRD151 Turkish Language I 2+0 (ECTS 2)

ENG151 English I 3+0 (ECTS 3)

KIM151 General Chemistry 3+0 (ECTS 4)

Chemical structures. Basic chemistry concepts and laws: atomic and molecular weight, mole, Avogadro number. Thermodynamical approaches and applications. Reaction rate and equilibrium. Solutions. Electrochemistry and corrosion. Periodic table and atomic structure, Chemical bonds, redox reactions. semiconductors: amorphous and crystal structures.

II. SPRING SEMESTER

MAT166 Linear Algebra 2+2 (ECTS 5)

Vectorel analysis. Linear homogeneous and inhomogeneous equations. Matrix operations and special matrices. Inverse matrix. Orthogonal basis, Least squares and Gram-Schmidt process. Determinants, cofactors and Kramer rule. Eigenvalues, eigenvectors and diagonals of matrices. Pozitive-definite metrics.Singular value decomposition.

MAT152 Calculus II 3+2 (ECTS 6)

Generalized integrals, Series and arrays. The definite integrals and its applications, Calculations of surface areas and volumes. Vector valued functions. Coordinat systems.Arc length. Multivariable functions. Limit and contionuity. Partial and directional derivatives. Ekstramum point problems. Lagrange's theorem. Taylor series. Repeated integrals and its applications. Curvilinear integrals and surface integrals. Green and Stokes theorem.

FIZ152 Physics II 2+2 (ECTS 6)

Electrical charge and electrical field. Coulomb and Gauss laws. Electrical potential. Dielectric and capacitors. Resistance and Current. Electromotor force and electric circuits. Magnetic fields, Ampere and Faraday laws. Resistance-resistivity, inductance and condensator circuits. Magnetic properties of solids. Electromagnetic waves and geometrical optic. Interference and diffraction.

EEM102 Computer-Aided Design 2+2 (ECTS 4)

Strengthening the skills in CAD of mechanical components assemblies and systems. Theoretical basics and practical applications of CAD. The latest softwares and application of design process which are relevant to biomedical engineering.

TRD152 Turkish Language II 2+0 (ECTS 2)

ENG152 English II 3+0 (ECTS 3)

BMM104 Medical Biology 3+0 (ECTS 4)

Introduction: the definition and branches of biology, the origin of living things. Definition and properties of cell. Cell organelles. Cell chemistry. Enzymes and vitamins. Cell metabolism. Cell division. Structure and function of the genetic material. Nucleic acids. Regulation of gene expression. Genes and chromosomes. Mendelian genetics. Genetic diseases: chromosomal diseases, specific genetic disorders, multifactoral disorders, birth defect diagnosis. Immunity. The development and Causes of cancer.

III. FALL SEMESTER

BMM205 Human Anatomy and Physiology 2+2 (ECTS 6)

Human anatomy and its working facts and organizations, and the functions of organelles. Anatomical and physiological terminology, anatomical position and image sections, the structure and functions of body, the organization of human nervous system, the circulatory and respiratory system, endocrine system, respiratory physiology, sleep physiology and the cell structure of human body.

BMM213 Tissue Engineering and Biomaterials 3+0 (ECTS 5)

Tissue types in human body. Natural and artificial biological materials used in medical science and their applications. Materials used in orthodontics. Polymer, ceramic, synthetic and the other implanted materials. Interaction of biomaterials with live tissues.

EEM209 Electrical Circuits I and Laboratory 3+2 (ECTS 6)

Circuit elements and electrical magnitudes. Power and energy. Basic ohmic circuits. Inductance. Capacitor. Self inductance. Circuit analysis: node voltage rules and Kirchhoff rules, Complex Inductance and Phasor diagrams. Continuous Sinusoidal Signal analysis and power calculations. Three phase systems. Laboratory applications.

EEM205 Probability and Random Variables 2+2 (ECTS 5)

Random experiments and probability axioms. Random variable concept, discrete random variables and functions. Two dimensional probability functions. The covariance of two dimensional independent random variables. The probability functions and covariance matrices of N dimensional random variables. Law of large numbers. Central limit theorem.

MAT251 Differential Equations 2+2 (ECTS 6)

First ordered differential equations: Separable, homogeneous, linear and nonlinear equations. Complete solution of differential equations. First and second ordered linear differential equations and their solutions. Differential equations with boundary-value problems. Higher order linear differential equations. Linear differential equation system and its solutions. Laplace transformation and transfer function. Convolution theorem. Laplace transformation applications.

ATA151 Atatürk Principles and Revolutions History-I 2+0 (ECTS 2)

IV. SPRING SEMESTER

BMM206 Physiology for Enginners 3+0 (ECTS 6)

Inducable cells in human body and electrochemical activities, The formation and propagation of the excitation potential. Hodgkin-Huxley model, voltage-clamp experiment. The physiological origin of EEG, EKG and EMG signals and the measurement principles of electrical potentials by using engineering methods.

EEM216 Electrical Circuits II ve Laboratory 3+2 (ECTS 6)

Resistance-Inductance (RL) and resistance-condansator (RC) circuits. Natural and step responses of RLC circuits. Laplace transformation and transfer functions. Bode diagrams. Frequency selective circuits: low-pass, high-pass, and band-pass filters. Operational amplifier circuits: summation, integration-derivation and active filter circuits.

BMM204 Biochemistry 3+0 (ECTS 5)

The structure and functions of biological molecules in human body. The chemical techniques used in the analysis of biological molecules.

EEM210 Signals and Systems 2+2 (ECTS 5)

Classification of signals. System properties. Properties of linear, time-invariant systems. Convolution. Systems represented by differential and difference equations, block diagram. The Fourier representation of linear, time-invariant systems. Sampling and reconstruction of signals. Laplace and Z transformation.

EEM220 Electromagnatic Theory I 3+2 (ECTS 6)

A brief history of electromagnetic theory: From Oersted to Einstein – an electomagnetic model. Vector analysis, electrostatic, Coulomb and Gauss laws, Poisson's equations, electrostatic energy, conductors and dielectrics, boundary-value problems. Magnetostatic fields, Biot -Savart law, Ampere law, magnetic dipole, magnetic forces and energy, magnetic materials. Electromagnetic induction, Faraday law. Maxwell equations, scalar and vectorel potentials, Umov-Poynting theorem.

ATA152 Atatürk Principles and Revolutions History-II 2-0 (ECTS 2)

V-VI-VII. FALL-SPRING-FALL SEMESTER

BMM303 Biomechanic 3-0 (ECTS 6)

The application of mechanical principles in investigation of the structure of human musculoskeletal system. The mechanical properties and analysis of tissue, bones, muscles and joints. Orthopedic materials. The fluid dynamics of human physiology. Cardiovascular dynamics.

BMM302 Medical Imaging Systems (3+2) (ECTS 6)

The imaging methods used in medical diagnosis and treatment. Conventional X-ray imaging, fluoroscopy, computed tomography, PET/SPECT, magnetic resonance imaging and ultrasonographic imaging techniques.

BMM315 Biomedical Instrumentation I 3-2 (ECTS 6)

The classification and measurement techniques, measurements standards and units of electrical and nonelectrical biological signals. The measurement equipments with components. Biopotential amplifiers, measurement noises. The definition of the leakage current and grounding, the elimination methods of measurement noises, the fundamental measurement principles of physiological variables.

BMM316 Biomedical Instrumentation II (3+2) (ECTS 6)

The measurement systems used in brain functions, the measurement methods and equipments related to respiratory system. The main principles and properties of the devices used in operating room, intensive care unit, coroner care unit. Hemodialysis systems, medical ultrasonic systems.

BMM403 Medical Equipment Maintenance and Calibration (3+0) (ECTS 5)

The importance and definition of medical device calibration. The typical encountered problems in the calibration of medical devices, the situation and conditions needed for the calibration of instruments, the functional faults related to the type of devices, the calibration frequencies related to type of devices and the parameters which are needed to be tested. The service areas related to medical equipment calibration, the organizations related to calibration service.

DEPARTMENTAL ELECTIVES:

BMM304 Medical Equipment Design (3+0) (ECTS 5)

The general principles and system components in medical equipments. Environmental conditions, security, and the performance parameters of measurement and diagnosis devices. Groups of electrical and mechanical devices are used in medicine. The origin of signals in living tissues and the types of energies which can be applied to tissues.

BMM307 Biomedical Simulation and Modelling (2+2) (ECTS 5)

The principles of system modelling, system classifications. The definition of simulations and animations. Modelling of Software packages with a universal standards which aims to provide a coordination between the the working mechanism of human body and the nervous system components.

BMM308 Biotechnology (3+0) (ECTS 5)

Basics of biotechnology and its application areas. History of biotechnology. The biological properties and aspects of human body. The biological methods and concepts to solve the problems related to human health.

BMM309 Radiobiology (3+0) (ECTS 5)

Radiation types and their biological effects. Cell and tumor kinetics, cell survival curve, the chronic effects of radiation, the particular treatment of radiotherapy, linear quadratic models, dose calculations.

BMM310 Artificial organs (3+0) (ECTS 5)

The definition of artificial organs. The phases of the production of artificial organs and design parameters. Stem cells, the interactions between living tissues and cell scaffold. Artificial kidney, artificial heart and artificial blood productions. Topical developments and the latest applications of the artificial organs which are successfully implanted or integrated into human or living bodies.

BMM311 Radiation Physics (3+0) (ECTS 5)

Electromagnetic radiation, the electromagnetic spectrums used in medical radiobiology. The usage of electromagnetic radiation in medical diagnosis and treatment. X-ray physics, wave and particulate radiation, the absorption of X-ray in tissues. Radioactivity measurements.

BMM312 Clinical Biochemistry (3+0) ECTS 5)

The metabolism changes in the situations of postprandial and fasting. The conditions of the metabolism disorders. The disorders in carbohydrate metabolism, lipid metabolism, protein

and amino acid metabolism and hormonal metabolism. The analytical techniques and devices used in the measurement of metabolism disorders.

BME313 Biomedical Signal Processing (3+2) (ECTS 5)

Classification and denomination of signal and systems wrt their properties. Electrical signals can be detectable from human body. Dimension, time, frequency, stability, causality in systems. Power and energy definitions. Inverse systems and its properties. Z-transform, discrete time Fourier transform. Analysis methods of Electrical brain, heart and muscle activities.

BMM314 Prosthesis Equipments (3+0) (ECTS 5)

Kinematic properties of human body. The design and production of prosthesis arm and legs. Functional necessities and standards in Prosthesis production. Prosthesis types (body inside or body outside), artificial joint pathologies. Implanted-tissue interactions, artificial heart valves, artificial blood veins, bone and joint prosthesis, Heart assist devices.

BMM404 Internet Programming and Networking (3+0) (ECTS 5)

Web definition, Fundamental principles and instruments are to improve the Web applications. Internet technology and Web protocols. Internet programming languages. The importance of Internet programming in medical and health sector.

BMM405 Robotic Surgery (3+0) (ECTS 5)

Robotic devices and their components which are used mainly in surgery. Installation of communication interface between the surgery robots and surgeons. Electronical and mechanical design properties of Da Vinci robotics. The latest topical applications.

BMM406 Occupational Health and Safety (3+0) (ECTS 5)

The national and international laws applied in occupational health and safety, a brief history of the regulations, instructions, and special legislations. Quality standards in the usage of medical devices, risks, working hours, protection methods, occupational health and safety .

BMM407 Medical Nanotechnology (3+0) (ECTS 5)

The physical, chemical and biological topics in nanometer scales. The products and its properties which are used in biological events happened in nanometer scales and in human body. The measurement devices with a nanometer scale sensitivity, and with a higher resolution.

BMM408 Medical Informatics (3+0) (ECTS 5)

Electronical medical records in health sector, Secure networking properties. Clinical and hospital information systems. Safe internet communication and standards between the health institutions.

BMM409 Neurophysics and Neurophysiology (3+0) (ECTS 5)

Neuron types in human body and neuronal behaviors. Role and structure of neural networks in physiological events. Origin of electrical activities hold in brain, brain biophysics. Neuronal communication mechanism of human's reflex movements. Measurement methods of neuronal activities.

BMM410 Medical Technology Management (3+0) (ECTS 5)

Tasks and responsibilities of clinical engineers. Information system of radiology. Organization and planning of service about the maintenance-reparation of medical devices. Total quality management. Operating and supervising of Nuclear medicine devices, operating of medical equipments located in surgery and intensive care room, operating of medical gaseous systems, operating of sterilization centers.

BME411 Biostatic (3+2) (ECTS 5)

Basic statistical concepts. Calculation methods in biostatistical problems Applications of SPSS programming.

BMM413 Microelectromechanical Systems (3+2) (ECTS 5)

Advanced semiconductor technology, mass production, Silicon microchips. Bulk and surface micromachining techniques. Honeywell uncooled infrared detectors, electroplating, acceleration sensor and Gyroscop. Applications of microelectromechanical systems in medical field.

BMM414 Medical Data Banking (3+2) (ECTS 5)

Data banking methods and systems used in collection and preservation of medical datas. History of data mining. Software determination mechanisms used in classification of medical records wrt their properties. Artificial nervous networks, statistical methods, algorithms, variance analysis. Legal methods of data mining.

BMM415 Health Information Standards (3+0) (ECTS 5)

Basis of health information and networking of national health information. National health index and electronic health records. Security, privacy and privacy of information. Information strategy of quality process in health. Smart health cards and lifelong electronic health records. HL7 standards and related committees.

BMM416 Biomedical Optics (3+0) (ECTS 5)

Fundamental concepts of optic. The wave and particle nature of light. Fiber optic systems. Lasers and its applications in health. Interactions and effects of laser in living tissues. Optical applications in diagnosis and treatment. Biophotonic imaging.

BMM417 Genetic Technology (3+0) (ECTS 5)

Genome sequencing technology used for improving the human health. Technological methods used in isolation, alteration, crossing over, and reunion of genes. Artificial gene transfer.

BMM418 Physiologic Control Systems (3+2) (ECTS 5)

Homeostasis, communication mechanism in human nervous system. Modelling of respiratory system, hormonal system and sensor system. Implementation of physiological models by using Matlab-Simulink. Mathematical models of reflex movements. Control mechanisms developed in human body.

BMM419 Telemedicine (3+2) (ECTS 5)

Telecommunication in medical field and utilization of computer networking technologies. Transportation of physiological parameter and medical imaging via secure communication systems; telecommunication components. Information systems standards in medicine. Legal and ethical restrictions in telemedicine applications.

BMM471 Professional English I (3+0) (ECTS 5)

Professional English for Biomedical Engineers, Vocabulary needed for biomedical engineers, Techniques of the translation from Turkish to English and vice versa.

BMM472 Professional English II (3+0) (ECTS 5)

Seminar about the biomedical engineering areas and subjects, interpretation and translation techniques of academical publications, and techniques of the preparation of an effective CV and statement of purpose.