

OKAN UNIVERSITY
ENGINEERING FACULTY
GENETICS AND BIOENGINEERING ENGLISH PROGRAM
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Semester 1

MATH113 Mathematics I (3-2)4

Functions and Their Graphs, Combining Functions; Shifting and Scaling Graphs, Trigonometric Functions. Rates of Change and Tangents to Curves, Limit of a Function and Limit Laws, The Precise Definition of a Limit, One-Sided Limits, Continuity, Limits Involving Infinity; Asymptotes of Graphs. Tangents and the Derivative at a Point, The Derivative as a Function, Differentiation Rules, The Derivative as a Rate of Change, Derivatives of Trigonometric Functions, The Chain Rule, Implicit Differentiation, Related Rates, Linearization and Differentials. Extreme Values of Functions, The Mean Value Theorem, Monotonic Functions and the First Derivative Test, Concavity and Curve Sketching, Applied Optimization, Antiderivatives. Area and Estimating with Finite Sums, Sigma Notation and Limits of Finite Sums, The Definite Integral, The Fundamental Theorem of Calculus, Indefinite Integrals and the Substitution Method, Substitution and Area Between Curves, Volumes Using Cross-Sections, Volumes Using Cylindrical Shells, Arc Length, Areas of Surfaces of Revolution. Inverse Functions and Their Derivatives, Natural Logarithms, Exponential Functions, Indeterminate Forms and L'Hopital's Rule, Inverse Trigonometric Functions, Hyperbolic Functions.

PHYS113 Physics I (2-2)3

Vectors. Kinematics. Newton's Law of Motion. Work and energy. Conservation of energy. Linear momentum and its conservation. Rotation of rigid bodies about a fixed axis. Rotational kinetic energy.

ATA111 History Of Turkish Revolution I (2-0)2

This course covers the analysis of the causes and the consequences of the First World War; the searches for independence of the Turkish nation in Anatolia and salvation of the Turkish lands that were occupied after the Armistice of Montrose; the development and activities of Nationalist militias and the societies against them; the evaluation of the congress administrations that were formed after 19 May,1919 in terms of their form and content; the structure of the Grand National Assembly and the process through which it gained legitimacy; the leadership of Turkish War of Independence; Treaty of Lausanne, and the Establishment of the Republic.

TRD111 Turkish Language I (2-0)2

What is language? Importance of language and its place in a nation's life, language-culture relationship. Definition of grammar, function of grammar and departments of grammar. Phonetics: sounds and audio features of Turkish. Morphology; formal properties of Turkish (roots-adds). Words and word phrases. General information about composition, subject,

perspective, ideas, main and ancillary ideas, paragraphs, intellectual order. Written expression, paragraph, the content and types (entrance, development and conclusion paragraphs). Expression forms, explanatory, descriptive, argumentative, narrative expression. Written expression; petition writing, quoting, footnotes and bibliography writing. Oral expression; speech and speech types (prepared speeches, panel, and discussion policies). Literary types; artistic (poetry, short stories, novels, theater and intellectual (articles, paragraphs, essays, criticism, interviews...)). Reading and studying the works that about literature and idea world. Analyzing an editing text (story, novel, theater).

GBE101 Introduction to Bioengineering (2-0)2

Discuss the terms molecular biology, genetics and bioengineering, describe the molecular structure of the DNA, RNA and proteins, explain the importance of DNA, to discuss the relation between DNA, RNA and proteins, explain the how DNA damage occurs and how cells repair the DNA damage, describe transcription and discuss the differences of transcription between eukaryotic and prokaryotic cells, describe the translation and gene expression studies, explain what the stem cells are and main properties of stem cells

CHM101 Chemistry (3-0)3

Properties of Matter, Fundamental Laws Of Chemistry, The Atomic Theory, Electron configuration, The concept of the mole, The Periodic Table, Chemical Compounds, Thermochemistry-enthalpy-entropy,internal energy , Solutions and their physical properties, Chemical Kinetics-Determination of the rate of reaction, Chemical equilibrium, Acids and Bases, Electrochemistry, Batteries and Electrolysis, Redox reactions

Semester 2

MATH114 Mathematics II (3-2)4

Integration by Parts, Trigonometric Integrals, Trigonometric Substitutions, Integration of Rational Functions by Partial Fractions, Improper Integrals. Sequences, Infinite Series, The Integral Test, Comparison Tests, The Ratio and Root Tests, Alternating Series, Absolute and Conditional Convergence, Power Series, Taylor and Maclaurin Series, Convergence of Taylor Series. Three-Dimensional Coordinate Systems, Vectors, The Dot Product, The Cross Product, Lines and Planes in Space, Cylinders and Quadric Surfaces. Functions of Several Variables, Limits and Continuity in Higher Dimensions, Partial Derivatives, The Chain Rule, Directional Derivatives and Gradient Vectors, Tangent Planes and Differentials, Extreme Values and Saddle Points, Lagrange Multipliers. Double and Iterated Integrals over Rectangles, Double Integrals over General Regions, Area by Double Integration, Double Integrals in Polar Form, Triple Integrals in Rectangular Coordinates, Triple Integrals in Cylindrical and Spherical Coordinates, Substitutions, Integration, fundamental theorem integral calculus. Application of definite integrals; area between curves, volumes calculation,

lengths of plane curves, area of surfaces of revolution. Transcendental functions; exponential functions, logarithms, hyperbolic functions. Techniques of integration.

PHYS114 Physics II (2-2)3

Charge and matter. The electric field. Gauss' Law. Electrostatic potential. Capacitance. Current and resistance. Electromotive force and circuits. RC circuits. The magnetic field. Ampère's law. Faraday's Law of Inductance.

ATA112 History Of Turkish Revolution II (2-0)2

Lausanne Peace Treaty resulting success that is being converted to a modern state via announcement of Republic, and being gained to this state a modern, convenient to development identity, and placing Atatürk's Thought System to the memories precisely by the following revolutions of this process, so that our young people are made conscious and durable against to the threats to their personalities and to their countries.

TRD112 Turkish Language II (2-0)2

The place of Turkish language among the world languages, alphabets that Turks are used. The historical development of Turkish language, dialects of Turkish language. Turkish's syntax features, sentence analysis studies. Etymology, Semantics I (basic meanings, connotations) and Sense Events (meaning contraction, meaning expansion, meaning shift), Words' meaning relationship. Semantics II, metaphors, transfers (name transfer, phrase transfer) words, idioms, proverbs, slogans and terms. Expression (language) mistakes and applications. Oral expression, speech and speech types (panel, discussion principles). Written expression; business letters, minutes, report and news writing techniques. Ways to improve thinking in the paragraph, identification, sampling, comparison, utilization of numerical data, producing a witness. Literary types; artistic(poetry, short stories, novels, theater) and intellectual (articles, paragraphs, anecdotes, essays, criticism, travel, biography, memoirs, letter...) Reading and studying the selected sample texts from the literature and idea world. Reviewing a scientific text.

GBE102 Molecular Cell Biology I (2-0)2

Describe the basics of molecular biology, explain the basic processes of molecular cell biology, describe the terminology of life sciences, describe the cellular matrices and discuss how important they are for living cells, explain basic structures and of functions of cellular membranes, describe role of cytoskeleton and how it interacts with cellular components , review the roles of organelles, describe energy production and types of energy productions in cells, describe the communication and transport in/between cells.

CLP001 Career and Life Planning (0-2)1

Professional and personal development, seminars, workshops, specialized certification programs, industry and business-field demonstrations, meetings with professionals, on-site training sessions, social-sporting events.

Semester 3

GBE201 Molecular Cell Biology II (2-2)3

Define the detailed structure and function of DNA, explain the mechanisms of chromosomal DNA packaging, discuss genome organization, define DNA replication, repair and recombination, explain how cells read the genome: from DNA to protein, indicate the similarities and differences of transcription and translation mechanisms in prokaryotes and eukaryotes, identify gene expression control mechanisms, underline epigenetics, explain the cell cycle and justify the importance of cell-cycle control system, differentiate cell death mechanisms, describe and differentiate most commonly used molecular biology techniques.

GBE203 Biochemistry (2-2)3

Describe general cell structure and subcellular organelles, describe the structure and metabolic function of carbohydrates, lipids, proteins and nucleic acids, describe the functions, properties and mechanisms of enzymes, describe the biochemical function of vitamins, describe the biochemical function of membrane, describe the metabolism in cytoplasm, mitochondria and nucleus, summarize the metabolism of amino acid and proteins, carbohydrates and lipids in different compartments of the cell, describe metabolic disorders of amino acid and proteins, carbohydrates and lipids, understand the principles of laboratory tests.

GBE205 Microbiology (2-2)3

Describe the content of the microbiology and classification of microorganisms, discussion of structure, physiology, and culture conditions of the bacteria, describe the general features of fungus, viruses and parasites, genetic structures of bacteria and other microorganisms, understand the microorganism-host interaction, basic immunology and immune response mechanism, describe antimicrobial agents and resistance mechanism, understand the concept and application of sterilization and disinfection.

MATH265 Probability and Statistics I (3-0)3

Set Theory, Random Variable, Sample Space, Important Theorems on Probability, Conditional Probability, Bayes' Theorem, Tree Diagrams, Permutations, Combinations, Binomial Coefficients, Stirlings Approximation, Discrete and Continuous Probability Distributions, Mathematical Expectation, Variance and Standard Deviation, Joint Distributions, Normal, Binomial, Poisson, Multinomial, industrial applications.

MATH215 Mathematics III (2-2)3

Systems of linear equations; Solution sets of linear equations; Linear dependence and independence; Matrix Algebra; Inverse of a matrix and its characterization; Partitioned matrices; Determinants and their properties: Calculation of determinants; Column and row expansions; Minor and cofactors and inverse matrix; Cramer's rule; Vector spaces: Subspaces, null spaces and column spaces (Image); Basis and coordinate transformations; Linear transformations and their representations; Representation of coordinate transformation; Eigenvalues and eigenvectors :Characteristic polynomial and Cayley-Hamilton Theorem; Diagonalization of linear transformations and matrices; Matrix polynomials; Diagonalization of symmetric matrices and projections; Generalized eigenvectors and eigenspaces; Inner product spaces: Orthonormal sets, Gram-Schmidt process; Singular value decomposition; Pseudo inverse; Least squares

Semester 4

CMPE152 Computer Programming (2-2)3

Computer architecture, RAM structure and structural programming concept. C Programming Language :Fundamentals, data types, control statements, loops, string functions, array manipulations, procedures, functions, units and recursion. Sort and search algorithms. Basic file applications. Dynamic variables and elementary data structures (Pointer, Stack, Queue, Linked list).

GBE206 Biomaterials (2-2)3

Describe the molecular structure of the major classes of biomaterials, explain the importance of biomaterials in human health and synergy of interdisciplinary fields to improve comfort in human life, explain the developing profession of biomaterials in modern era, describe how the biosynthesis and assembly of biomaterials (including but not restricted to bone, cartilage, basement membrane, wool, silk, cellulose) leads to desirable functional properties (mechanical strength, adhesion, lubrication, etc.), describe the characterization methods used to investigate proper biomaterials for specific uses, explain what the biocompatibility and biodegradation is and their importance in biomaterials science, describe effectiveness of defining proper parameters in the laboratory experiments in order to obtain suitable biomaterial, discuss safety in a laboratory, perform a lab manual and analyze experimental data, describe the economical perspective and market of biomaterials, explain ethics principles and describe the complex legal issues related to biomaterials such as tests on animals.

GBE202 Bioengineering Laboratory (0-4)2

Learn the safety and general rules of a laboratory, how to use basic laboratory instruments, learn how to use basic measurement device, and make calculations with them, prepare basic buffers, mediums and mixes about biological samples, learn bacterial growth, staining, imaging, describe molecular tools such as PCR, isolation, ligation etc. and learn how to use them.

MATH266 Probability and Statistics II (3-0)3

The relationship among Normal, Binomial, Poisson, Multinomial, Hypergeometric etc Distributions, Population and Sample, Statistical Inference, Population Parameters, Sample Statistics, Sampling Distribution of Means, Sampling Distribution of Proportions, Sampling Distribution of Variances, Frequency Distributions, Statistical Decisions, Statistical Hypotheses, Test of Hypotheses and Significance, Type I and Type II Errors, One Tailed and Two Tailed Tests, Special Test of Significance for Large Samples

MATH216 Mathematics IV (2-2)3

Introduction and Classification of Differential Equations; First Order Differential Equations: Solution of Separable and Linear Differential Equations; Substitution Methods and Exact Differential Equations; Order reduction; Higher Order Differential. Equations: Linear, homogeneous Equations with Constant Coefficients; Nonhomogeneous Equations and Method of Undetermined Coefficients; Method of Variation of Parameters; Laplace Transform: Solution of initial value problems; Linear Systems of Differential Equations; Homogeneous Differential equations in R^2 ; Solution via eigenvalues and eigenvectors; Homogeneous Differential equations in R^3 ; Matrix exponential and Fundamental matrix solution; Solution of Nonhomogeneous Equations; Laplace transform methods; Power Series Method: Series Solution Near Ordinary Points; Regular Singular Points; Method of Frobenius

Semester 5

GBE301 Cell and Tissue Engineering (2-4)4

Discuss the terms of cell and tissue engineering, recognize its applications, describe the subjects, tools and protocols used in cell and tissue engineering, explain the characteristics of cells, tissues and microenvironments used for tissue engineering, describe the technological requirements for in vitro cell, tissue and biomaterial development, explain molecular and cellular engineering, describe the applications of cell and tissue engineering in medicine and recognize the complications, understand the ethical, legal and quality aspects of cell and tissue engineering applications.

GBE303 Physiology (3-2)4

Introduction to Physiology, Cell membrane potentials and transport, Muscle Physiology, Cardiovascular and Circulatory Physiology, Respiratory System Physiology, Neurophysiology, Gastrointestinal System Physiology, Hematology and Endocrine System Physiology, Genitourinary System Physiology

GBE305 Bioinformatics (2-2)3

Use various publically available databases, use various bioinformatics tools, describe different Next generation sequencing methods, select necessary tools to analyze next generation sequencing data, run bioinformatics analysis for various biological questions

GBE310 Interdisciplinary Bioengineering (3-0)3 (Departmental Elective Course)

It is aimed to combine bioengineering discipline with other disciplines such as molecular biology, genetics, biochemistry, neurobiology, evolutionary biology, structural biology, cell biology, immunology, developmental biology, cancer biology, stem cell biology and biophysics via reading, examining, analyzing and discussing popular novel papers in order to be a bioengineer with an interdisciplinary point of view.

GBE311 Biochemical Reaction Engineering (3-0)3 (Departmental Elective Course)

The aim of this course is to provide the student with understanding and skills to enable them to analyse a biotechnical processes. These will provide the basis for the design and scale-up of processes in biotechnology. Therefore, the students will learn about biocatalysis (enzymes), microorganisms and their growth kinetics, reactor types and designs, the principles of aerobic and aerobic digestion for the design of the relative bioreactor or fermenter.

Semester 6

GBE302 Genetic Engineering (2-4)4

Underline how genetic engineering can be used to edit the genome to set up experimental models, recognize the methods of genetic engineering, perform DNA cloning, differentiate the vectors for protein expression, design a recombinant DNA via using bioinformatics tools, express a recombinant protein, explain how genetic editing is done in cell lines, discuss the applications of genetic engineering in different fields of industry.

GBE304 Tissue Biochemistry (3-0)3

Describe the structure and metabolic function of epithelial tissue, connective tissue, muscle tissue, nervous tissue, bone tissue and adipose tissue, describe the biochemical function of endocrine glands, describe the structure of and types of muscle cells, describe the structure of the nerve cells-axons, cell body and dendrite, describe the synapses and the various types, define neurotransmitters and the various types, describe the neurotransmitters as component

of impulse transmission, define and discuss the various classes of hormones with examples, discuss the mechanism of action of a named steroid hormone, discuss the mechanism of action of a named water soluble hormone, discuss the various importance of hormones

GBE306 Quality and Safety Management (1-0)1

Quality-Quality Control-Quality Management-Quality Engineering, Total Quality Management, Quality management system standards, Processes-Processes Management-Statistical Processes Control, Processes capability analysis and control schemes, Quantitative control charts, Qualitative control charts, Other special control schemes (CUSUM, EWMA, Regression), Acceptance Sampling, One and two-stage sampling, Multi-stage and serial sampling, Quality improvement – Kaizen and Six Sigma, Quality economics.

GBE312 Biotransport (3-0)3

Understand conservation of mass, momentum and energy as applied to the flow of heat and fluids, derive appropriate conservation equations, select boundary conditions, and apply analytical techniques to solve flow and heat problems in biological systems, specify characteristics of fluid and thermal components in bio/medical systems, identify the importance of transport processes to the function of living systems.

GBE320 Protein Engineering (3-0)3 (Departmental Elective Courses)

Underline the importance of protein biotechnology, discuss the therapeutical usage of hormones and growth factors such as insulin, LH, FSH, EPO, IGF etc., explain interferons, interleukins and additional regulatory factors, comprehend protein purification methods, define enzyme biosynthesis, activity, catalysis, specificity and inhibition, discuss the tools of gene expression analysis.

GBE321 Molecular Signalling Pathways and Cancer (3-0)3 (Departmental Elective Course)

Imagine the basics of signal transduction, discuss the signaling pathways in which signaling proteins interact with each other in vast interconnected networks, describe the cellular effects of signaling molecules, describe the nature of cancer, comprehend the maintenance of genomic integrity and development of cancer, recognize the underlying molecular biology and genetics in anti-cancer therapies

Semester 7

GBE421 Industrial Genetics and Bioengineering I (2-6)5

The goal is to teach the interrelation of plant design and research in bioengineering. Students will learn how to approach in solving problems in the manufacture of industrially important products by using genetically modified materials or microorganisms and significantly using bioengineering tools. They will be coached in skills needed to thrive in a research in industry, and to accomplish their projects efficiently. By making tema work in the class, they will also learn the importance of understanding the context of their work with respect to their colleagues, their society, and their world. During the course, they will learn the enzyme kinetics, bioreactor and fermenter design, separation techniques in upstream and downstream processing. This course is the application of whole learnings in the previous years.

GBE411 Biomedical Engineering (3-0)3

To explain and discuss what biomedical engineers do in their professional activities, understand the fundamental principles used by bioengineers in cellular and molecular biotechnology, biomaterials, tissue engineering, biomechanics and biomedical imaging, explain the developing profession of biomedical engineering in modern era, describe the economical perspective and market of biomedical instruments, explain ethics principles and describe the complex legal issues

GBE497 Genetic and Bioengineering Design (0-2)1

In this course which consists of the design of a complex system, process, device or product, within the framework of preferably a multi-disciplinary engineering problem, under realistic constraints, and taking into consideration social, economic and environmental conditions as well as relevant national and international standards and characteristics of sustainability and manufacturability, without compromising ethical principles, the student is required to document the requirements specification and the design in conformance with international standards.

BBA222 Entrepreneurship Applications (2-0)2

Principals of entrepreneurship, Strategic management for entrepreneurship, creativity, human resources management and communication for entrepreneurs, Business Planning, Entrepreneurship in Turkey / Success stories.

GBE404 Immunology (3-0)3 (Departmental Elective Course)

Discuss the terms of immunology, understand the basics of adaptive and innate immune system, explain the differences between adaptive and innate immune system, discuss the members of innate and adaptive immune system, describe the molecular structure of MHC and antibodies, explain the antigen processing and presentation pathways, discuss the

maturation, activation and regulation of lymphocytes, explain the effector mechanisms of immune responses, describe the immune system in defense and disease: hypersensitivity, tumor immunity, transplantation immunity.

Semester 8

GBE422 Industrial Genetics and Bioengineering II (4-4)6

In the context of this course, the students will practically learn how to prepare a preliminary plant design by using the bioengineering methods, the criteria in selecting the appropriate genetically modified materials or microorganism, possible bioreactor or fermenter design, the selection or design of each unit in plant, final financial analysis, and feasibility report, according to the whole knowledge they recovered in the previous years.

GBE498 Genetics and Bioengineering Graduation Project (0-4)2

This course consists of the implementation based on accessible resources, then testing and validation of the level of satisfaction of the requirements followed by the documentation of all this process in conformance with international standards, and its defense in front of a jury, of a complex system, process, device or product, designed within the framework of preferably a multi-disciplinary engineering problem, under realistic constraints, and taking social, economic and environmental conditions as well as relevant national and international standards and characteristics of sustainability and manufacturability into consideration, without compromising ethical principles.

INT010 Internship I (0-0)0

Our students have to work for 20 work-days in research laboratories of universities, hospitals or research laboratories related to hospitals, R&D companies, drug producing research centers or private companies or research laboratories of universities abroad in order to gain practice