

ISTINYE UNIVERSITY
FACULTY OF ENGINEERING AND NATURAL SCIENCES
DEPARTMENT OF BIOINFOMATICS AND GENETICS

1st Semester

Atatürk's Principles and History of Turkish Revolution 1

The Collapse of the Ottoman Empire, Tanzimat and Reform Edict, I. and II. Constitutional Era, Tripoli, and Balkan Wars, World War I, Mudros Armistice, War of Independence; Amasya Circular, National Congresses, Establishment of Turkish Grand National Assembly, Declaration of Republic.

Calculus 1

Analytic geometry. Functions, graphs, limits, and continuity. Derivatives, differentiation rules, chain rule, implicit differentiation. Applications of derivatives. Definite integrals, indefinite integrals. Applications of integrals. Transcendental functions.

Physics 1

Analysis of the physical world using Newton's laws of motion, conservations laws (conservations of energy, linear momentum, and angular momentum) and their applications, kinematics, work and energy, momentum, collisions, rotational motion and dynamics and torque. Lectures will focus on both the conceptual understanding of these topics and quantitative problem-solving skills.

Computer Literacy

Introduction to computer main components and terminology, E-mail and instant messaging fundamentals, mobile and cloud computing fundamentals, online organization applications, Google applications and services: Docs, Sheets, Slides, Drive, Calendar, Keep, Scholar; Apple apps and services, Office apps: Creating documents programs, spreadsheet / graphic, and calculation programs, Creating presentations programs, Computer security fundamentals.

General Chemistry

Properties of Matter and Measurement, Atoms and Atomic Theory, Chemical Reactions, Introductions to Aqueous Solutions, Gases, Chemical Bonding, Molecular Geometry, Acids and Bases, Common Ion Effect -Buffered solutions, Solution Concentration, Chemical Kinetics, Liquids and Solids, Oxidation-reduction, and Electrochemistry.

General Biology 1

General introduction to biologic sciences while presenting different organisms (prokaryotes, eukaryotes, fungi, animals, virus); information about basic macromolecules that form the building block of organisms and a brief introduction of cells.

Manifest of İstinye 1

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Turkish Language 1

The relationship between language and thought, the relationship between language and culture, the importance of language in social life, the languages of the world and the place of Turkish among these languages; Turkish situation and problems; Turkish spelling rules; effective reading and listening; general rules of written and oral expression; intellectual order, paragraph, and forms of expression; official correspondence.

2nd Semester

Atatürk's Principles and History of Turkish Revolution 2

Political revolutions, political parties and attempts to transition to multi - party political life, revolutions in the field of law, regulation of social life, innovations in economic field, Turkish foreign policy in the period 1923-1938, Post-Atatürk Turkish Foreign Policy.

Linear Algebra with Applications

Matrices and System of Equations, Systems of Linear Equations, Row Echelon Form, Matrix Algebra, Elementary Matrices, Determinants, The Determinant of a Matrix, Properties of Determinants, Cramer's Rule, Vector Spaces, Definition of Vector Space, Subspaces, Linear Independence, Basis and Dimension, Change of Basis, Row Space and Column Space, Linear transformations, Matrix Representations of Linear Transformations, Orthogonality, The Scalar Product, Orthogonal Subspaces, Inner Product Spaces, Orthonormal Sets, The Gram-Schmidt Orthogonalization Process, Eigenvalues and Eigen vectors, Diagonalization.

Computational Mathematics

Logic and proofs; sets, functions, sequences, sums; algorithms, the growth of functions, complexity of algorithms; elementary number theory and cryptography; recursive algorithms; basics of counting; advanced counting techniques; relations; graphs and trees.

Calculus 2

Integration techniques, generalized integrals, sequences, infinite series, power series, parametric curves, polar coordinates, and integration in polar coordinates.

General Biology 2

Plant biology (transport, nutrition, hormones, reproduction), animal systems (endocrine system, immune system, nervous system, digestive system, urinary system, reproductive system, respiratory system, and circulation system), cellular respiration, photosynthesis, cell cycle, mitosis and meiosis, brief introduction to central dogma.

Turkish Language 2

Definition and characteristics of language. Languages of the world, The place of the Turkish language among world languages, Historical development of Turkish language. Turkish grammar and parts of Turkish grammar, expression types: written expression and verbal lecture, spelling rules and practice, punctuation marks.

3rd Semester

Bioinformatics 1

Historical introduction and overview of bioinformatics, the collection and storage of all types of biological sequences, techniques behind the pairwise alignments of sequences, probability, and statistical analysis of sequence alignment results, various algorithms for multiple sequence alignment, sequence database search techniques -BLAST, FASTA, FASTQ- and phylogenetic tree construction and its analysis, next generation sequencing technologies.

Molecular Cell Biology

Molecular analysis of cellular structure and function; Cells and Genomes; Cell Chemistry and Bioenergetics; DNA, Chromosomes, and Genomes; DNA Replication, Repair, and Recombination; Molecular Mechanisms of Transcription and Translation; Control of Gene Expression.

Computational Thinking

Python programming language and its structure, object-oriented programming methods with simple programs and examples.

Basic Genetics

Basic concepts of Mendelian genetics; chromosome theory in heredity; structure and function of genes; gene expression and its regulation; mutations and chromosomal defects; mutation types; DNA repair mechanisms, development, behavior and population genetics and basic principles of evolutionary genetics.

4th Semester

Bioinformatics 2

Next generation sequencing technologies, machine learning algorithms for sequence analysis, computational assembly of genomic sequences, gene finding, advanced functional genomics, expression analysis, the future of bioinformatics as proteomics and neuroinformatics.

Introduction to Data Science With R- Language

Basic concepts and ideas of a statistical computing environment, fundamental functions, and syntax, importing common types of data sets into R, performing descriptive statistics, generating diverse graphs, multiple linear regression.

Organic Chemistry

Structure of atom, orbitals, electronic configuration, theory of chemical bonding, hybridization theory of molecular orbital, polar covalent bonds acids and bases, saturated hydrocarbon introduction to organic reactions, non-saturated hydrocarbons, stereochemistry, organohalogen, nucleophilic substitution and elimination reactions.

Molecular Genetics

Structure of genes, replication, molecular basis of transcription and translation, recombination at molecular level, mutation and DNA repair, molecular basis of protein synthesis, regulation of gene function in bacteria, organization of eukaryotic genomes and regulation of expression, transposons, phage genetics, gene cloning and manipulation, molecular genetics of development, cancer at molecular level.

Manifest of İstinye 2

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5th Semester

Genomics & Proteomics

Fundamental technological concepts of genomics, functional genomics and proteomics methods using real-world approaches, technical foundation on genomics and proteomics, with particular emphasis on experimental design, data handling and data processing, omics field approaches.

General English 1

The English of the terms and concepts encountered in various branches and proper use of these terms, Turkish-English bilingual translations, English language training for students with simple forms and intending to develop over time.

Human Genetics

DNA and RNA structure, chromosomes, human genome organization and gene expression, mutations in human genome and DNA repair, genetic mapping, genome project, determination of human disease genes, molecular pathology, genetic analysis in individuals and populations, cancer genetics, complex diseases, genetic manipulation, gene therapy and other genetically based therapeutic approaches, pharmacogenetics.

Biochemistry 1

Properties and interaction of biomolecules, properties of water, amino acids and their properties, protein synthesis, structure and function of proteins, enzymes, enzyme kinetics, protein metabolism, ammonia metabolism and urea cycle, nucleotides and nucleic acids, structural properties of nucleotides, signal molecules.

Recombinant DNA Technology

Fundamental techniques of genetic engineering; manipulation of DNA in vitro, transformation techniques, library construction and screening methods, expression systems and host-vector systems. Recent applications of recombinant DNA technology in the analysis of biological processes, diagnosis of human diseases, isolation of human genes, DNA finger printing, gene therapy and the development of commercial products.

6th Semester

Statistics & Probability

Sample space, probability, conditional probability, counting, combinatorics, discrete/continuous random variables, conditioning, independence, expectation, variance, covariance, Bayesian inference, sampling distributions, hypothesis testing, confidence intervals, and linear regression.

General English 2

The English terms and concepts encountered in depth and Turkish-English bilingual translations used in order to use the concepts correctly, mastering professional English language on grammatical structures of sentences, spelling and pronunciation.

Molecular Biology Laboratory Techniques

Structures of biological macromolecules, their synthesis, basic genetic mechanisms, control of gene expression, mobile DNA elements, control of DNA replication, basis of genetic engineering, embryonic cells, and fertilization.

Biochemistry 2

Importance of macromolecules in nutrition and body mass index, structural properties of carbohydrates, carbohydrate metabolism, oxidative phosphorylation, and oxygen metabolism, anaplerotic reactions, structural properties of lipids, lipid metabolism, biochemical mechanisms in food transport and storage.

Manifest of İstinye 3

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7th Semester

Biological Data & Data Mining

Introduction to MySQL and different data types, machine learning methods for data mining, creating database using MySQL and SQLite containing different types of biological data, mining the heterogeneous biological data using machine-learning methods such as Support Vector Machines and Multiple Regressions and applying these methods on experimental data in order to classify and prediction gene function and regulation.

Computational Modeling & Simulation

Introduction to methods and standards for locating and using information in the discipline of modeling and simulation, discrete event simulation, continuous simulation, simulation software design, distributed simulation, mathematical and algorithmic foundations, and applications of computational modelling (learning models from data/machine learning, inverse problem, artificial intelligence) and computer simulation (numerical simulation, forward problem, logic).

Business Law, Occupational Health and Safety 1

Introduction to law; definition, main features, development and sources of labor law; concepts of employee, employer, employer's representative, foundation of labor relation, labor contract; types of labor contract; duties arising from labor contract; loyalty; employer's duties of paying wages, termination of labor contract; work stability; severance pay; workplace occupational health and safety; industry and construction as well as how to identify and prevent or correct problems associated with occupational safety and health in these locations as well as in the home; implementation of safe healthy practices at work and at home.

8th Semester

Graduation Project

A project is designed on a specific topic in an area of molecular biology and biotechnology for individual students to carry out laboratory studies under the supervision of a faculty member. A written final report and a presentation is required.

Business Law, Occupational Health and Safety 2

Introduction to law; definition, main features, development and sources of labor law; concepts of employee, employer, employer's representative, foundation of labor relation, labor contract; types of labor contract; duties arising from labor contract; loyalty; employer's duties of paying wages, termination of labor contract; work stability; severance pay; workplace occupational health and safety; industry and construction as well as how to identify and prevent or correct problems associated with occupational safety and health in these locations as well as in the home; implementation of safe healthy practices at work and at home.

Manifest of İstinye 4

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DEPARTMENT ELECTIVE COURSE DESCRIPTIONS

Human and Computer Interactions

Consider usability, task analysis, contextual design, query techniques and focus groups, information architecture, types of interfaces, prototyping, analytical usability evaluation, evaluation of safety-critical systems, user testing, universal access, cross-cultural design and internationalization, psychology of HCI, technical writing.

Quantum Mechanism and Modeling

Basic mathematical tools of quantum mechanics with a special emphasis on the connection between physical phenomena and mathematical modelling, Hilbert space as a particular case of a linear vector space, general properties of representation theory discussed for the case of finite groups and are applied to quantum mechanical systems. Representations of the continuous groups and its discussion relation with invariance under translations and rotations, general theory of angular momentum applied to cases of physical interest.

Drug Design & Pharmacokinetics

The role that pharmacokinetics play in all aspects of drug administration, distribution, metabolism, and excretion and how these effects can be modelled and predicted graphically and mathematically, modeling as therapeutic regimen design, drug development, clinical pharmacology, and drug safety, providing a broad and relevant appreciation of the importance of pharmacokinetics.

Neurobiology

Introduction to neuroscience, principles of neuroscience, understanding of body and brain functions at the molecular, cellular, and systemic levels, neural circuits and physiology in body homeostasis, comparative nervous systems, tools of neurobiology, nervous system function and development, endocrinology, cardiorespiratory physiology, and associated diseases.

Basics AI (neural networks)

Introduction to neural networks and their use in understanding human and non-human animal cognition, simple auto-associative, feed-forward, and recurrent network architectures, and Hebbian, back-propagation, and unsupervised training methods, recent developments in deep neural networks, use of neural networks as tools for understanding cognition and for instantiating cognitive theories.

Cell & Tissue Engineering

Application of engineering principles, combined with molecular cell biology, to develop fundamental understanding of property-function relationships in cells and tissues, exploitation of this understanding to manipulate cell and tissue properties rationally to alter, restore, maintain, or improve cell and tissue functions as well as to design bioartificial tissue substitutes, general understanding of the repair mechanisms of wounds and how tissue engineering being used in the development of new therapies involving the creation of tissues and organs that can replace the originals, damaged or malfunctioning, due to disease or accident, techniques to produce porous biodegradable scaffolds, basic techniques of cell culture and analysis of biological tissue.

Design And Analysis of Algorithms

Techniques for designing algorithms and for analyzing the time and space efficiency of algorithms, algorithm design techniques as divide-and-conquer, greedy algorithms, dynamic programming, randomized algorithms and parallel algorithms, algorithm analysis such as computational models, best/average/worst case analysis, and computational complexity (including lower bounds and NP-completeness).

Green Biotechnology

Fundamental knowledge of processes of plant function including how plants and other photosynthetic organisms interact with each other and their surrounding environment, and responses to environmental disturbances induced by human impacts, most recent aspects of plant biotechnologies in terms of strategies and methodologies such as GMO use and regulations, genome editing technologies or synthetic biology, various strategies used to set up research or industrial projects.

New Insights in Genetics & Bioinformatics