MOLECULAR BIOLOGY AND GENETICS PROGRAMME

1. SEMESTER

General Biology I (6 ECTS)

The content of this course includes a 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.

General Chemistry (4 ECTS)

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

Mathematics (4 ECTS)

Matrix and Determinant, Vectors, Functions, Limit and Continuity, Derivative, Derivative Applications, graphics of functions, Integral, Fundamental theorems, Integral applications, Integral techniques, L'Hospital Rule, Definite Integral and its properties, Indefinite Integral

Turkish Language I (2 ECTS)

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.

English I (14 ECTS)

This course is a learner-centered, integrated-skills based course that will develop students in the four skills (reading, writing, listening and speaking) in an academic context.

2. SEMESTER

General Biology II (6 ECTS)

This course covers 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.

Fundamental Physics (4 ECTS)

This course covers Standards and units; vectors and coordinate systems; kinematics; dynamics; work, energy and power; conservation of energy; dynamics of system of particles; collisions; rotational kinematics and dynamics; oscillations; Charge and matter; electric field and Gauss' law; DC circuits; magnetic field; Ampere's law; Faraday's law; inductance; magnetic properties of matter; Maxwell's equations.

Linear Algebra (4 ECTS)

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 end 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.

Turkish Language II (2 ECTS)

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.

English I (14 ECTS)

This course is a learner-centered, integrated-skills based course that will develop students in the four skills (reading, writing, listening and speaking) in an academic context.

3.SEMESTER

Organic Chemistry I (4 ECTS)

Atomic and molecular Orbitals, hybridization, molecular geometry, Resonance and inductive effect, acid base, dipole moment, Saturated Hydrocarbons (Alkane, Cycloalkane and conformation), Unsaturated hydrocarbons (Alkenes, Alkynes), Stereo chemistry, Alcohols and Ethers, Aldehydes and Ketones, Amines, Carboxylic Acids and derivatives, Aromatic Compounds and related reactions.

Introduction to Computer Sciences (4 ECTS)

Computers, the usage of the computers in daily life, computer hardware and software, Operating systems, Input/Output and Storage, Web and the Internet, wired and wireless communication, Application softwares such as text editors, visualizations, spreadsheets, and databases, Error in computation, Introduction to scientific problem solving through algorithms.

Cell Biology (8 ECTS)

Details of prokaryotic and eukaryotic cells; Molecular analysis of cellular structure and function; Specific functions of cellular compartments and organelles; cytoskeleton and cellular movement; molecular mechanisms of cell cycle and division; cellular adhesion; structure and function of extracellular matrix; cell signaling and differentiation.

Ataturk's Principles and History of Turkish Revolution I (2 ECTS)

The declaration of the Republic; The importance of the leader and the staff in the revolution; Constitutional solutions to the problems related to the Lausanne Conference; The participation of Turkey in pacts and in international organizations; Reactions to the new governmental structure; Trials in the multi-party system; The Home and foreign policy of the Republic of Turkey; Atatürk s foreign policy to inspire confidence in the future of Turkey; Kemalism the Principles of Atatürk.

Evolution and Biodiversity (3 ECTS)

Darwinian perspective of evolution, phylogeny, sources of genetic diversity, natural selection, genetic drift, gene flow, population genetics, species concept, history of life on earth, tree of life, animal, plant and microbial diversity, ecology.

English III (4 ECTS)

This course is a learner-centered, integrated-skills based course that will develop students in the four skills (reading, writing, listening and speaking) in an academic context.

Istinye Manifesto (1 ECTS)

This course is led by Student Center. Students are required to participate social activities, social responsibility projects, part-time jobs.

4.SEMESTER

Ataturk's Principles and History of Turkish Revolution II (2 ECTS)

The declaration of the Republic; The importance of the leader and the staff in the revolution; Constitutional solutions to the problems related to the Lausanne Conference; The participation of Turkey in pacts and in international organizations; Reactions to the new governmental structure; Trials in the multi-party system; The Home and foreign policy of the Republic of Turkey; Atatürk s foreign policy to inspire confidence in the future of Turkey; Kemalism the Principles of Atatürk.

Fundamentals of Genetics (5 ECTS)

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, behaviour and population genetics and basic principles of evolutional genetics.

Microbiology (6 ECTS)

Structure of microorganisms (bacteria, yeast, fungi and viruses); bacterial and viral growth; classification of microorganisms; physiology, metabolism and genetics of microorganisms; identification and control of microorganisms; microorganism-environment interactions; microbial pathogenesis and immunology; human-microorganism interactions; microbial diseases and treatments; microbial cultures.

Biostatistics (4 ECTS)

Measurements; Data analysis and organization of biological samples; Biological and Statistical variables; Samples and populations in biology; Descriptive statistics: central tendency, dispersion, standard error, confidence limits; Graphical display of data; Concepts of probability; Probability distributions; Hypothesis testing and inference: exact binomial tests, Chi-square tests, goodness of fit tests, Fisher's test, Student's t-test, ANOVA, MANOVA, Kruskal-Wallis test, Rank tests; Regression; Correlation; Contingency tables; Power analysis.

English IV (4 ECTS)

This course is a learner-centered, integrated-skills based course that will develop students in the four skills (reading, writing, listening and speaking) in an academic context.

Istinye Manifesto (1 ECTS)

This course is led by Student Center. Students are required to participate social activities, social responsibility projects, part-time jobs.

Organic Chemistry II (4 ECTS)

Detailed structes of amines, aromatic compounds, radicals, amino acids, peptides and proteins, carbonhydrates; composition of natural compounds.

5.SEMESTER

Biochemistry I (8 ECTS)

Molecules of life; Structure and functions of amino acids; protein structure and function, enzymes and the basis of enzyme kinetics; enzymatic catalysis mechanisms; Structure and functions of carbohydrates, lipids and nucleic acids; DNA as genetic material; detailed structure of DNA and RNA; structure and functions of membranes.

Biophysics (4 ECTS)

Microscopic and sub-microscopic methods in analysis of biological structures and functions; medical scanning techniques; radiation biophysics; molecular organizations and dynamics of membranes; thermodynamic principals of life processes; biophysics of neural system and neuronal transduction.

Genetic Engineering and Biotechnology (4 ECTS)

Cutting and joining DNA; Cloning vectors: Plasmid vectors, bacteriophage and cosmid vectors, phagemids; making a gene library; recombinant selection and screening; expession in E.coli of cloned DNA molecules; DNA sequence determination; polymerase chain reaction; site-directed mutagenesis; Gene tranfer into plant and animal cells; Cell production methods in biotechnological processes; basis of fermentation technology; fundamentals of enzyme engineering; purification and recovery techniques of biomolecules; classification, operation and control of bioreactors; mixed cultures; utilization of genetically modified microorganisms; material production by plant cell cultures; material production by animal cell cultures.

Physiology (5 ECTS)

Homeostatic control mechanisms; nerve cell physiology; central nervous system; peripheral nervous system; muscle physiology; cardiovascular physiology; blood and hematopoiesis; respiration and gas exchange; the kidneys; fluid and electrolyte balance; digestion and absorption of food; metabolism and energy balance; endocrine system; endocrine control of metabolism.

Professional English I (4 ECTS)

This course is a learner-centered, integrated-skills based course that will develop students in the four skills (reading, writing, listening and speaking) in an academic and professional context.

Istinye Manifesto (1 ECTS)

This course is led by Student Center. Students are required to participate social activities, social responsibility projects, part-time jobs.

Modern Techniques in Molecular Biology (4 ECTS)

Light and electron microscopy, spectroscopic techniques in biology, circular dichroism, the principles of chromatography, protein purification using chromatographic techniques, electrophoretic methods, identification of proteins and nucleic acids by electrophoresis, radioactive labelling methods, membrane filtration and dialysis techniques, centrifugation methods, polymerase chain reaction, DNA sequencing.

6. SEMESTER

Biochemistry II (8 ECTS)

The catabolism of phosphate bond energy, glycolysis, tricarboxylic acid cycle, pentose phosphate pathway, oxidative phosphorylation, oxidation of fatty acids, oxidative degeneration of amino acids, photosynthesis, biosynthesis of carbohydrates, lipids, amino acids and nucleotides.

Molecular Genetics (5 ECTS)

Chemistry and structure of the gene; DNA replication and recombination; transcription; translation; mutation; DNA repair mechanisms; control of gene regulation in prokaryotes and eukaryotes; transposable elements; genetics of bacteria and phages; gene cloning and manipulation.

Molecular Biology of the Cell I (8 ECTS)

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.

Professional English II (4 ECTS)

This course is a learner-centered, integrated-skills based course that will develop students in the four skills (reading, writing, listening and speaking) in an academic and professional context.

Istinye Manifesto (1 ECTS)

This course is led by Student Center. Students are required to participate social activities, social responsibility projects, part-time jobs.

7. SEMESTER

Scientific Research Methodology (4 ECTS)

Responsible conduct of research (RCR): Collaborative Science, Conflicts of interests and commitment; data acquisition, management, sharing and ownership, ethical regulations in research involving human and animal subjects, mentoring; Peer review Publication practices and responsible authorship; research misconduct.

Molecular Biology of the Cell II (8 ECTS)

Membrane Structure; Membrane Transport of Small Molecules and the Electrical Properties of Membranes; Intracellular Compartments and Protein Sorting; Intracellular Membrane Traffic; Energy Conversion: Mitochondria and Chloroplasts; Cell Signaling; Cytoskeleton Structure and Function; The Cell Cycle; Molecular Mechanisms of Cell Death; Cell Junctions and the Extracellular Matrix.

Bioinformatics (5 ECTS)

Analyzing DNA, RNA and protein sequences; Access to Information; Pair-wise alignment; BLAST analysis; Multiple sequence alignment; Microarrays and Next-Generation Sequencing data analysis; Bioinformatic Approaches to RNA: Microarray and NGS; Proteomics data analysis; Bioinformatic analysis for human genome and human diseases.

8. SEMESTER

Final Project (15 ECTS)

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.

Labor Law and Occupational Health Safety (2 ECTS)

Introduction to law; definition, main features, development and sources of labor law; concepts of employee, employer, employer's representative, workplace; foundation of labor relation, labor contract; types of labor contract; duties arising from labor contract; employee's duties of doing work; obedience; loyalty; employer's duties of paying wages, protecting employees and behaving equally; termination of labor contract; work stability; severance pay; workplace occupational health and safety; safe work practices in offices, 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.

ELECTIVE COURSES SOCIAL SCIENCES

English (4 ECTS)

This course is designed to improve the students; academic writing skill not only by brainstorming, planning and drafting, but also referring outside sources and incorporating them in their essay in the form of quotations, paraphrase and summary. The general objective is student mastery in two main types of essay, viz. Cause and Effect and Argumentative essays referring outside sources.

Introduction to Psychology (4 ECTS)

This course focuses on the key concepts of psychology. This course includes psychology as a behaviour science, psychology and human, determinants of psychology of human, human behaviour and social environment; child, young, woman, adult, elderly, and retired psychology, subfields of psychology, what is applied psychology, psychological interview techniques, theories of personality, human behaviour, important psychologists around the world and Turkey, stress, conflict and management, psychiatric social work, psychopathology, mental health and illnesses, what is social psychology.

Introduction to Sociology (4 ECTS)

In this course, students are introduced with the discipline of sociology in relation to the formation of modernity. It examines some of the fundamental topics of sociology such as social transformation and inequality, poverty, ethnicity, gender, class, globalization, states, nationalism, citizenship and identities. It offers a particular focus on social transformation and problems in Turkey. The Turkish case was taken into consideration on the issues of neoliberal economy, urbanization, nationalism, political identities, citizenship and ethnicity.

Creative Writing (4 ECTS)

This course gives avid readers the skills necessary to turn a love of the written word into a practical experience. It introduces the key characteristics of creative writing, and students are supported with stage-by-stage guidance as they assimilate and put into practice a range of critical and creative methods. In addition to tutor feedback on the course assignments, participants will be encouraged to discuss one another's writing in the course forums, and will be given guidance on offering constructive and useful criticism.

Written and Oral Expression (4 ECTS)

The course aims to train students of language in understanding and processing of texts in Turkish, and the acquisition or improvement of linguistic skills: speech, writing and comprehension.

Critical Thinking (4 ECTS)

This course covers some of the most central and important skills of critical thinking, and focus on applying those strategies to understanding current issues, belief systems, and ethical positions.

TECHNICAL ELECTIVE COURSES

Introduction to Programming - Python (4 ECTS)

Introduction to Scientific and Engineering Computing; Introduction to Program Computing Environment, Variables, Operations and Simple Plot, Algorithms and Logic Operators, Flow Control, Errors and Source of Errors, Functions, Linear Algebra Applications, Solving Equations Applications, Polynomials Examples, Curve Fitting Applications, Interpolation Applications, Numerical Integration Applications, Symbolic Mathematics, ODE Solutions with built-in functions; Introduction to Python Programming Language.

Principles of Metabolism (4 ECTS)

Synthesis, breakdown and metabolism disorders in biomolecules in human metabolism; etiology of metabolic disorders like diabetes mellitus, obesity, cancer and cardiovascular disorders and the signaling pathway defects causing metabolic disorders.

Personalized Medicine, Pharmacogenetics, Health Prevention and Healthy Ageing (4 ECTS)

Science of pharmacogenomics and its application in clinical practice; genetic basis for individual differences in metabolizing enzymes, transporters, and other biochemicals impacting drug disposition and action that underpin the practice of precision (personalized) medicine.

Pathology (4 ECTS)

Basic Concepts in pathology, cellular injury and adaptation, acute and chronic inflammation, cellular response to injury and wound healing, hemodynamic disorders, immune system diseases, neoplasia, genetic and pediatric diseases, environmental and nutritional diseases, pathology of infectious diseases, coronary artery disease, hypertension, diabetes and thyroid diseases, female genital system and breast diseases.

Science and Ethics (4 ECTS)

Scientific concepts, history of science, the birth of modern science, science and society, ethics of science.

Anatomy (4 ECTS)

This course provides systematic, topographical and functional theoretical and practical knowledge of human anatomy to acquire knowledge, skills and attitudes.

DEPARTMENT ELECTIVE COURSES

Enzimology (4 ECTS)

Biology and chemistry of enzymes, laboratory and industrial techniques of enzyme purification, kinetics of enzymatic reactions: rapid equilibrium and steady-state kinetics, reversible and irreversible inactivation kinetics, enzymatic catalysis mechanisms, mechanisms to regulate enzyme activity, allosteric enzymes, industrial use of enzymes and enzyme immobilization methods, enzyme stabilization methods.

Developmental Biology (4 ECTS)

Patterns of development; life cycles of model organisms and experimental techniques; morphogenesis; germ cells and fertilization; cell differentiation and stem cells; organogenesis; development of the nervous system; growth and post-embryonic development; regeneration; evolution.

Modelling of Biological Systems (4 ECTS)

Basic concepts of quantum mechanics; application of quantum mechanics to molecular systems (semi empirical, ab initio, DFT methods); molecular mechanics methods, molecular dynamics simulations, Monte Carlo simulation, conformational analysis, calculation of the geometries and energies of stable molecules and transition structures.

Cancer Biology (4 ECTS)

Nature of cancer; oncogenes and tumor suppressor genes; signaling pathways in cancer; dysregulation of cell cycle and apoptosis; steps in tumorigenesis; treatment of cancer.

Immunology (4 ECTS)

Basic concepts in immunology; principles of innate and adaptive immunity; the generation of lymphocyte antigen receptors; development of B and T lymphocytes; antigen presentation; survival and maturation of B and T lymphocytes in peripheral tissues; T cell-mediated immunity; the humoral immune response.

Neuroscience (4 ECTS)

Cellular and structural components of the nervous system; electrical signaling in nerve cells; action potential propagation; synaptic transmission; structure and function of ion channels; sensory systems; development of the nervous system; neuronal plasticity; learning and memory; consciousness and behavior; emotions; nervous system disorders.

Cytogenetics (4 ECTS)

This course covers human chromosome structure, methodology, and techniques for the visualization of chromosome aberrations. Chromosome abnormalities will be discussed from the clinical and cytogenetic viewpoint. The course will also cover current topics in Cytogenetics, including new methodologies and their use in clinical genetics and research.

Plant Genetics (4 ECTS)

Structures of nuclear and cytoplasmic genomes; gene transfer techniques; gene expression and regulation in flowering plant development; transgenic plants and their use in biotechnology.

Protein Biotechnology (4 ECTS)

Protein sources; Steps in obtaining protein products from native environments; Therapeutic proteins: Blood products, vaccines, monoclonal antibodies, hormones; Protein-based metabolic regulators; Proteins aiming diagnosis; Enzymes hydrolyzing polymers and their applications; other proteins that have biotechnological importance.

Introduction to Human Genetics (4 ECTS)

Principles of human genetics, patterns of single gene inheritance, human molecular genetics, the human gene map, cytogenetics, the molecular and biochemical basis of genetic disease, genetic counseling, prenatal diagnosis.

Introduction to Stem Cells (4 ECTS)

The course will provide students with knowledge of wide-ranging topics related to stem cell and regenerative biology, including: a brief history of the field, research on animal models of regeneration, tissue engineering, and the political and ethical issues surrounding the stem cell debate.

Genetics of Bacteria and Virus (4 ECTS)

Diversity of bacteria and virus; their activities; interaction of bacteria and virus with their microbial environment; replication and infection of bacteria and virus; use of bacteria and virus in biotechnology.