

KAFKAS UNIVERSITY
Department of Physics
Undergraduate Curriculum

Year I/ Semester I						Year I/ Semester II					
Code	Course Name	Weekly Teaching Hours				Code	Course Name	Weekly Teaching Hours			
		T	A	C	ECTS			T	A	C	ECTS
PHY101	General Physics I	4	2	5	7	PHY102	General Physics II	4	2	5	7
PHY103	Physics Lab I	0	4	1	6	PHY104	Physics Lab II	0	4	1	6
MAT101	Analysis I	4	2	5	5	MAT102	Analysis II	4	2	5	5
CHEM161	General Chemistry I	4	0	4	4	CHEM162	General Chemistry II	4	0	4	4
MAT103	Analytical Geometry	2	0	2	2	MAT104	Linear Algebra	2	0	2	2
YDB101	Foreign Language I	4	0	0	2	YDB102	Foreign Language II	4	0	0	2
TDB101	Turkish Language I	2	0	0	2	TDB102	Turkish Language II	2	0	0	2
AITT111	The History of Atatürk's Principles and Reforms I	2	0	0	2	AITT112	The History of Atatürk's Principles and Reforms II	2	0	0	2
ELECTIVE COURSES						ELECTIVE COURSES					
PE113	Physical Education I	2	0	0	0	PE114	Physical Education II	2	0	0	0
FA113	Fine Arts II	2	0	0	0	FA114	Fine Arts II	2	0	0	0
ME117	Music Education II	2	0	0	0	ME114	Music Education II	2	0	0	0
Year II/ Semester I						Year II/ Semester II					
Code	Course Name	Weekly Teaching Hours				Code	Course Name	Weekly Teaching Hours			
		T	A	C	ECTS			T	A	C	ECTS
PHY201	Vibrations and Waves	4	0	4	5	PHY202	Modern Physics	4	0	4	5
PHY203	Electric Circuit Analysis	2	0	2	3	PHY204	Electronics I	3	0	3	4
PHY205	Physics Lab III	0	4	1	5	PHY206	Physics Lab IV	0	4	1	5
MAT201	Differential Equations	4	2	5	6	PHY207	Partial Differential Equations	4	0	4	5
PHY207	Mathematical Methods in Physics I	3	2	4	5	PHY208	Mathematical Methods in Physics II	3	2	4	5
PHY209	English for Physicists I	2	0	2	2	PHY210	English for Physicists II	2	0	2	2
PHY211	Basic Information Technology Usage	2	2	3	4	PHY212	Computer Programming I	2	2	3	4
Year III/ Semester I						Year III/ Semester II					
Code	Course Name	Weekly Teaching Hours				Code	Course Name	Weekly Teaching Hours			
		T	A	C	ECTS			T	A	C	ECTS
PHY301	Quantum Physics I	4	0	4	7	PHY302	Quantum Physics II	4	0	4	7
PHY303	Classical Mechanics	4	0	4	7	PHY304	Electromagnetic Theory	4	2	5	6
PHY305	Heat and Thermodynamics	4	0	4	5	PHY306	Statistical Physics	4	0	4	6
PHY307	Physics Lab V	0	4	1	5	PHY308	Physics Lab VI	0	4	1	5
PHY309	English for Physicists III	2	0	2	2	PHY310	English for Physicists IV	2	0	2	2
	Elective Course I	2	0	2	4		Elective Course II	2	0	2	4
ELECTIVE COURSES						ELECTIVE COURSES					
PHY311	Optics	2	0	2	4	PHY312	Fluid Mechanics	2	0	2	4
PHY313	Science Philosophy	2	0	2	4	PHY314	Introduction to Laser Physics	2	0	2	4
PHY315	Electronics II	2	0	2	4	PHY316	History of Science	2	0	2	4
PHY317	Computer Programming II	2	0	2	4	PHY318	X-Rays	2	0	2	4
Year IV/ Semester I						Year IV/ Semester II					
Code	Course Name	Weekly Teaching Hours				Code	Course Name	Weekly Teaching Hours			
		T	A	C	ECTS			T	A	C	ECTS
PHY401	Physics of Atoms and Molecules	4	0	4	7	PHY402	Nuclear Physics	4	0	4	5
PHY403	Solid State Physics I	4	0	4	7	PHY404	Solid State Physics II	4	0	4	6
PHY405	Final Thesis	0	2	1	4	PHY406	Final Thesis	0	2	1	5
	Elective Course III	3	0	3	6	PHY408	Physics Lab VII	0	2	1	4
	Elective Course IV	3	0	3	6		Elective Course V	3	0	3	5

							Elective Course VI	3	0	3	5
ELECTIVE COURSES						ELECTIVE COURSES					
PHY407	Computer Applications in Physics	3	0	3	6	PHY410	Theory of Relativity	3	0	3	5
PHY409	Thin Film Physics	3	0	3	6	PHY412	Introduction to Superconductivity	3	0	3	5
PHY411	Research Techniques in Physics	3	0	3	6	PHY414	Introduction to Quantum Electrodynamics	3	0	3	5
PHY413	Introduction to Astrophysics	3	0	3	6	PHY416	Introduction to Particle Physics	3	0	3	5
PHY415	Introduction to Field Theory	3	0	3	6	PHY418	Introduction to Semiconductor Physics	3	0	3	5
PHY417	Spectroscopic Techniques	3	0	3	6	PHY420	Introduction to Plasma Physics	3	0	3	5
PHY419	Neutron and Reactor Physics	3	0	3	6	PHY422	New Developments in Physics	3	0	3	5
PHY421	Introduction to Detector Physics	3	0	3	6	PHY424	Fiber Optics	3	0	3	5
PHY423	Linear Optics	3	0	3	6	PHY426	Introduction to Accelerating Physics	3	0	3	5
PHY425	Gravitation and Cosmology	3	0	3	6	PHY428	Environmental Physics	3	0	3	5
PHY427	Radiation and Health Physics	3	0	3	6	PHY430	Numerical Analysis in Physics	3	0	3	5

FiZ101 General Physics I

Vectors, Laws of motion, Rotational motion and application of other Newton's laws, Work and Energy, Linear momentum and collisions, Rotating of rigid bodies around a stationary axis, rolling motion, Angular momentum and Torque, Static equilibrium and elasticity, General Gravitational law.

KiM161 General Chemistry I

Concepts of atoms, Periodic system, Chemical equations and Quantitative relations, Chemical bonds, Gasses Liquids and Solids, Solutions, Chemical reactions

MAT101 Analysis I

Introduction to set theory, Numbers, Trigonometry, Functions, Limit and continuity, Derivative and applications, Sequences and series.

FiZ103 Physics Laboratory I

Velocity and acceleration, Motion in inclined planes (with and without friction), Simple pendulum, Projectile motion, Determination of coefficient of viscosity.

MAT103 Analytical Geometry

Vector Algebra, Coordinate Systems, Vectors in the Plane, Lines in the Plane, Curves, Conics, Coordinate Transformations.

YDB101 English I

Prepositions, Adjectives and Pronouns, Compounds of Some, Any, No, Every, Countable-Uncountable Nouns, Simple Present-Present Cont. Tenses, Modals (Can, May, Must, Have to, Should), Past form of "to be", Articles.

TDB201 Turkish Language I

Definition of Language and Problems of The Turkish Language, Language- Culture Connections, Languages, Dialect, Accent, Polish, Turkish Writing Language, Syllable Information, Structure Information, Vocabulary, Verbs and Conjugation

AITT111 The History of Atatürk's Principles and Reforms I

The demolishing process of government of Ottoman and the factors that preparing of establishment of Republic of Turkey which is new Turkish government and foundation and features of Turkish revolution

BE113 Physical Education I

Definition of physical education and sport, general purposes of physical education, Kinds of physical education applications, Definition of different sports branches.

FİZ102 General Physics II

Electric fields, Gauss law, Electrical potential, capacitance and dielectrics, Current and resistance, Circuits of direct current, Magnetic fields, Sources of magnetic field, Faraday law, Inductor, Circuits of alternating current , Electromagnetic waves, Geometric optic, Interference and refraction of light waves and polarization.

KİM162 General Chemistry II

Chemical balance, Dissolution, Acids and Bases, Redox, Chemical thermodynamic and kinetic, Electrochemistry

MAT102 Analysis II

Integral, Exponential functions, Logarithmic functions, Analytic geometry, vector analysis, Directed Derivative, Two and three dimensional integrals.

FİZ104 Physics Laboratory II

Faraday cell and charge generation, Charge distribution, Equipotentials and field gradients, Capacitance and dielectrics, Moving charges and current, capacitor charging and discharging, potential functions, Principles of electrostatic generators.

MAT104 Linear Algebra

Introduction to Matrix Algebra, Determination, Rank of a Matrix, Equivalent Matrices, Add Matrices, Systems of Linear Equations and Solution Methods, Vector Algebra, Vector Spaces, Linear Dependence and Linear Independence, Subspace, Dimension and Basis concept.

YDB102 English II

The Simple Past Tense, Comparatives and Superlatives, Past Cont. Tense, Simple Future Tense, The present Perfect-Past Perfect Tenses, Adjective Clauses.

TDB102 Turkish Language II

Pronoun, Preposition, Conjunctive, Sentence Information, Spelling Rules, Composition, Plan and Writing Sorts, Sort of Article and Its Properties, Anecdote, Conversation, Story and Poem Sort, Letter, Petition, Writing of Report Rules and Its Examples

AITT112 The History of Atatürk's Principles and Reforms II

Bringing up the process of transformation from an empire to a national state, the meaning and importance of the Turkish National Struggle for independence.

BE114 Physical Education II

Definition of physical education and sport, general purposes of physical education, Kinds of physical education applications, Definition of different sports branches.

FİZ201 Vibrations and Waves

Free oscillations of simple systems, Oscillation of systems which have a lot of freedom degree, By force oscillations, Improved waves, Reflection, Modulations, Impulses and wave packages, Two and three dimensional waves, Polarization, Interference and refraction.

FİZ203 Electric Circuit Analysis

Circuit elements, Methods of circuit solutions, Equivalent circuits, Kirchhoff laws and its applications, Circuit solutions with Thevenin Norton and superposition methods, Transformer and its study.

FİZ205 Physics Laboratory III

Resistor readings and measurement with ohmmeter, Serial and parallel connections, Analysis of mixed circuits, Open an short cut circuits and power calculations, Thevenin and Norton theories, Introducing signal generator and oscilloscope, Charging/de-charging of a capacitor over a resistor, Temporal currents in a circuit consisting of an inductance and a resistor, Analysis of filter circuits, Ohm law for alternating current, impedances.

MAT201 Differential equations

Basic concepts and definitions, mathematical models, first-order linear differential equations, separable differential equations, homogeneous differential equations, exact differential equations and integrating factors, Bernoulli, Darboux and Riccati differential equations, unsolved differential equations according to derivative, Lagrange and Clairaut equations, higher-order differential equations, the method of reduction of order, higher-order linear differential equations, homogeneous equations with constant coefficient, the method of undetermined coefficient, the method of variation of parameters.

FİZ207 Mathematical Methods in Physics I

Vector analysis, differential vector operators, integral theorems, complex numbers, complex functions, Analytic functions, complex integral and Cauchy theorem, residue method, Taylor and Laurent series.

FİZ209 Technical English I

Review of English grammar and simple translations related to physics.

FİZ211 Usage of Basic Information Technology

Basic Concepts of Computer, Usage of Internet, Windows XP, MS Word, MS Excel, MS Powerpoint.

FİZ202 Modern Physics

Relativity, Relativity of origin and axis, Moving reference systems, Classical relativity and velocity of light, Michelson Morley experiment, Postulate of relativity, Lorentz transformation and its applications, Doppler event, Relative mechanic, massless particles, photon, black body radiation, photoelectric effect, compton scattering, atomic spectra.

FİZ204 Electronic I

Circuit analysis with Laplace transformation, Frequency characteristics, many folded circuits, Backward bias, Mathematical strengthening, Circuits running with strokes, Bias circuits, Introduction to numerical electronic.

FİZ206 Physics Laboratory IV

Diode circuits, p-n junction diode characteristics, Experimental study of Zener diode, Transistors, Currents on transistors.

MAT202 Partial Differential Equations

Basic concepts, classification of equations, first-order linear partial differential equations, first-order quasi-linear partial differential equations, second-order partial differential equations, hyperbolic, parabolic and elliptic equations, the reduction to canonical form of second-order p.d.e., wave equation, boundary and initial value problems for wave equation, existence-uniqueness theorem, Cauchy problem for wave equation, the separation of variables in wave equation, heat equation, boundary and initial value problems for heat equation, the separation of variables in heat equation.

FİZ208 Mathematical Methods in Physics II

Linear vector spaces, Orthogonal Functions, Legendre Polynomials, Spherical harmonics, Hermite Polynomials, Integral transformations, Partial Differential equations

FİZ210 Technical English II

Review of English grammar and simple translations related to physics.

FİZ212 Computer Programming I

Description of Computer and Algorithm, Commands, Arithmetic Expression and Internal Functions, Control Expression, Matrix, Input and Output with Fortran, Subprograms

FİZ301 Quantum Physics I

Introduction, Black body radiation, Photoelectric effect, Rutherford atom model and Bohr theory, de Broglie Postulate and matter waves, Wave-particle duality, Wave package, Fourier series and Integral, Uncertainty principle, Schrödinger wave equation, Probability interpretation of wave function, Expected values, Momentum space, Free particle-plane wave solution, one dimensional Systems

FİZ303 Classical Mechanics

Linear motion, Energy and angular momentum, Central conservative forces, Rotating systems, Potential Theory, two body Problem, many particles systems, Rigid bodies, Lagrange mechanics, Small vibrations and Normal moods, Hamilton mechanics, Dynamic systems and its Geometry, Order and disorder in the Hamilton systems.

FİZ305 Heat and Thermodynamics

Zeroth Law and Temperature, Simple thermodynamic systems, work, heat, First Law, Ideal Gases, Reversible and irreversible systems, Heat Engines and Second Law, Entropy, Third law, Applications, Maxwell equations, thermodynamic potentials.

FİZ307 Physics Laboratory V

Damped harmonic motion, Determination of spring constant in serial and parallel connected spring, Heat engine, Efficiency of heat engines, Coefficient of performance of heat pump, Determination of load resistor for the optimum performance.

FİZ309 Technical English III

Translations related to physics.

FİZ302 Quantum Physics II

General Formalism of Quantum mechanics, wave function space, Matrix representation of linear operators, Superposition principle, commuting operators and measurement, Dirac Bra-Ket Notation, Some special operators, Spherical symmetric potential, angular momentum, eigenfunctions, Radial Schrödinger equation, Hydrogen atom, spin.

FİZ304 Electromagnetic Theory

Vector analysis, Differential calculation, Gradient, Divergence, Rotation, Fundamental Theorem of Gradient, Fundamental Theorem of Divergence, Fundamental Theorem of Rotation, Spherical polar and Cylindrical Coordination, Electrostatic, Gauss law, Electrostatic potential, Poisson and Laplace equations, Continuous charge distribution, Power and Energy in Electricity, Energy of continuous charge distribution, Capacitors, Laplace equations in one, two and three dimensions, Electrical Fields in matter, Dielectrics, Induced dipoles, Polarization, Gauss law for dielectrics, Linear dielectrics, Magnetostatic, Magnetic fields and forces, Biot-Savart Law, Ampere principle, Magnetic vector potential, Polarizability and Susceptibility.

FİZ306 Statistical Physics

Macroscopic and microscopic states, probability concepts in statistical physics, Binomial distribution, mean values, Entropy in statistical physics, entropy and thermal equilibrium, variation of entropy with energy, canonical ensemble, paramagnetism, partition function, Calculation of mean values in canonical ensemble, Distribution functions: Maxwell-Boltzmann, fermion and boson distribution functions.

FİZ308 Physics Laboratory VI

Millikan oil drop experiment, photoelectric effect, e/m experiment, Frank-Hertz experiment.

FiZ310 Technical English IV

Translations related to physics. (English-Turkish, Turkish-English)

FiZ401 Physics of Atoms and Molecules

Schrödinger equation for single electron atoms, spin, interactions, two-electron atoms, many-electron atoms, Interactions of atoms with external fields, Lasers and Molecules.

FiZ403 Solid State Physics I

Crystal structure, X-ray diffraction, Brag Law, Reciprocal lattice, Crystal bonding, Lattice Dynamics, phonons, specific heat, free electron model, Energy bands.

FiZ406 Thesis

Students prepare chosen subjects/researches in a thesis format and present under the guidance of an advisor.

FiZ402 Nuclear Physics

Rutherford alpha scattering, properties of stable nuclei, binding energy, alpha decay, natural radioactivity, Collective model, Decays and electromagnetic radiations, Nuclear forces, fluid drop model, Fermi Gas model, layered model, Nuclear spin, nuclear moments Nuclear radiations, beta decay, nuclear spectroscopy, introduction to neutron physics.

FiZ404 Solid State Physics II

Semiconductors, metals and Fermi surfaces, plasmons, polaritons, polarons, superconductivity, diamagnetism and paramagnetism, ferromagnetism, antiferromagnetism, magnetic resonance.

FiZ406 Thesis

Students prepare chosen subjects/researches in a thesis format and present under the guidance of an advisor.

FiZ408 Physics Laboratory VII

Determination of plateau region of G-M tube, Calculation of working voltage of G-M tube, Determination of background radiation, efficiency of G-M tube, $1/R^2$ law, determination of conduction type in semiconductors.

ELECTIVE COURSES

3rd Year 1st Semester

FiZ311 Optics

The electromagnetic theory of light, diffraction and reflection of light, polarization of light, interference, optical holography, geometrical optics.

FiZ313 Science Philosophy

Importance and definition of science, common sense, religion and philosophy, formal disciplines, science and language, scientific Method, its content and boundaries, various interpretations, the methods for reaching facts: observation and experiment, logical structure of measurement, scientific explanation, scientific law concept, hypothesis verification, causality principle in science, structure and functions of scientific theory; human-related problems of science, responsibility of scientist, science and humanism.

FiZ315 Electronics II

The Field-Effect Transistors (FETs), FET Biasing, transistor modeling, BJT small signal analysis, multistage systems and frequency consideration, large signal amplifier, FET small signal analysis.

FiZ317 Computer Programming II

Structured program development, Program control, Functions, Arrays, Pointers, Characters and strings, Formatted input/output, Structures, File processing, Data structures.

3rd Year 2nd Semester

FiZ312 Fluid Mechanics

Properties of fluids, molecular structure and the continuum hypothesis, the fundamental law of viscosity, pressure variation in compressible and incompressible fluids, description of fluid motion, using Lagrangian and Euler methods, principles of mass conservation and Bernoulli's equation, analysis of rotational and potential flows, stream function, velocity potential and Cauchy-Riemann conditions.

FiZ314 Introduction to Laser Physics

Basic principles of laser light, Properties of laser and physical background of laser production, laser resonators, mirrors and modes, the types of lasers, solid-state lasers, gas lasers, liquid lasers, semiconductor lasers.

FiZ316 History of Science

Development of science and technology, and their effects on human society.

FiZ318 X-rays

Electromagnetic Spectrum, Production and Properties of X-Rays, Interaction of Photons with Matter, Continuous x-ray sources and their importance, characteristics of x-ray sources and their importance, x-ray scattering.

4th year 1st Semester

FiZ407 Computer Applications in Physics

The aim of this course is to give the student a knowledge about computer systems, use of peripherals and graphical user interfaces, scientific word processing (via WORD, WORD PERFECT or LATEX), tabulation, spreadsheets (via EXCEL or PARADOX), graphical presentations, application of these facilities to simple physical problems, electronic mail and information retrieval systems (Bitnet, Internet), rudiments of programming.

FiZ409 Thin Film Physics

The growth methods of thin films (CBD, MCBD, CVD, MBA), characterization methods and their electrical and optical properties.

FiZ411 Research Techniques in Physics

Scientific Research and Other Scientific Activities: Conference, Symposium, Congress, Seminar, Panel; Selection of Subject for Research; literature search for research, planning of research; experimental set-up; preparation of any scientific paper; preparation of any thesis, preparation of conference papers and oral presentation.

FiZ413 Introduction to Astrophysics

A brief history of astronomy- Ptolemy, Galileo, Copernicus, Kepler, Newton, planetary orbits, solar system and Pluto problem, Discovery of exoplanets, introduction to black holes, pulsars, Hubble law and big bang, dark matter and dark energy.

FiZ415 Introduction to Field Theory

Canonical quantization of scalar, spin half and vector fields, Noether's Theorem and symmetries, interaction picture and Feynman rules for perturbative calculation of physical processes, renormalization, spontaneous symmetry breaking.

FiZ417 Spectroscopic Methods

Perception in microscopic and macroscopic physics, spectra and their evaluation, quantitative and qualitative analysis, types of spectrometer, new developments in spectroscopy.

FiZ419 Neutron and Reactor Physics

Historical development of nuclear energy, binding energies, interactions of neutrons, interactions of neutrons with matter, neutron optics, diffusion theory, slowing down of neutrons, fundamental principles of nuclear reactors, introduction to reactor kinematics.

FiZ421 Introduction to Detector Physics

Cross section, loss energy, Cherenkov radiation, Coulomb scattering, photon interaction, ionization detectors, gaseous ionization detectors, multi-wired proportional counters, the drift chambers, scintillation detectors, organic scintillators, inorganic crystals, photomultipliers, semiconductor detectors.

FiZ423 Linear Optic

A brief look at the history of developments in optic, study of geometric models, matrices representation of some optic systems, design of some optic systems using mirrors and lenses, optic materials, optic measurements, optic waves, polarization, interferometric techniques, interference filters, optic emission and absorption, diffraction, light sources and lasers, fiber optic system, Fourier optic, SAW apertures, optic image recording and holography.

FiZ425 Gravitation and Cosmology

Introduction to tensor algebra, Connectivity and curvature in differential geometry, gravitational fields, equivalence principle, space-time concept, action integrals in gravitational fields, variations of action integrals, Einstein field equations, symmetry analysis and conserved quantities, predictions of Einstein theory, solutions with special symmetry, Gravitational waves, black holes, relative cosmology models.

FiZ427 Radiation and Health Physics

Radiation and its properties, radioactive decays, interaction of radiation with matter, radiation measurement methods and radiation detectors, biological effects of radiation, and radiation protection, BTG, MR, PET, radiotherapy.

4th year 2nd Semester

FiZ410 Theory of Relativity

Introduction, The principles of general relativity, The field equations of general relativity, General relativity from a variational principle, The energy-momentum tensor, The Schwarzschild solution, Experimental tests of general relativity.

FiZ412 Introduction to superconductivity

Superconductivity, Meissner effect, London equation, Flux quantization and its application, Josephson tunneling and its applications, high temperature superconductivity.

FiZ414 Introduction to Quantum Electrodynamics

Solution of Klein-Gordon field, quantization of Klein-Gordon field, operator calculation of Klein-Gordon field, Dirac field, solution of Dirac field, photon field, quantization of photon field, operator calculation of photon field.

FiZ416 Introduction to Particle Physics

Accelerators, particle detectors and techniques. Strong interactions, quark model predictions. Electromagnetic interactions, Dirac-Feynman theory. Weak interactions, V-A theory, non-conservation of parity. Gauge field theories, Weinberg-Salam theory of electroweak interactions, color-gauge groups and recent models.

FiZ418 Introduction to Semiconductor Physics

The band theory of electronic conduction, fundamentals of semiconductors, pure and doped semiconductors, electrical conductivity, optic processes, diffusion, generation and recombination of majority carriers, simple semiconductor junctions, diode equation.

FiZ420 Plasma Physics

Definition of plasma, plasma parameters and their applications, equations of motion for charged particles, study of plasma as a fluid, EM waves in plasma, plasma diffusion and resistance, plasma equilibrium and stability, formation of kinetic theory of plasma.

FiZ422 New Developments in Physics

To teach the latest developments in physics.

FiZ424 Fiber Optic

Optical Fibers: Definition, structure, numerical aperture, propagation of light in optical waveguide, refractive index profile, dispersion, single-modes and multi-modes fibers, Maxwell equations, types of optical fibers, production methods of optical fibers, losses.

FiZ426 Introduction to Accelerator Physics

Main parameters of accelerators, acceleration mechanism, phase space stability, linear and ring type accelerators, basic physical properties of linacs, synchrotrons, microtrons and cyclotrons, beam energy, beam radius, beam current, beam power, emittance and admittance, general applications of accelerators.

FiZ428 Environmental Physics

Fundamentals of environmental physics, definition of energy resources- fossil fuels, hydrothermal, wind, geothermal, solar, nuclear energy- transformation processes of energy, environmental effects of energy usage, global warming and ozone layer.

FiZ430 Numerical Methods in Physics

Error in computation. Solution to linear systems of equation. Roots of polynomials and other non-linear functions. Determinants. Eigenvalue and eigenvectors. Interpolation. Numerical integration. Solution to differential equations. The method of least squares. Statistical methods and applications.

