Transilvania University of Brasov, Romania
Study program: Mathematics and Computer Science

Faculty: Mathematics and Computer Science
Study period: 3 years (bachelor)

1st Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mathematical Analysis	AMA1	6	3	3	-	-

Course description (Syllabus): This course provides a rigorous introduction to real analysis, beginning with the structure of the real line and fundamental notions of topology. Students study convergence of sequences and series, limits, continuity, Darboux properties, connectedness, compactness, and uniform continuity. The course further develops differentiation, including the fundamental theorems of differential calculus, followed by integration and the fundamental theorems of integral calculus. Additional topics include sequences and series of functions, power series, Fourier series, and special functions such as the Beta and Gamma functions. Emphasis is placed on mathematical rigor, proof-based reasoning, and the development of analytical problem-solving skills.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Algebra	ALG1	5	2	2	-	-

Course description (Syllabus): This course offers a rigorous introduction to linear algebra, focusing on the structure and behavior of vector spaces and linear transformations. Students begin with matrices and determinants, including fundamental properties, Laplace expansion, matrix rank, and inverses, followed by a systematic study of linear systems and classical theorems such as those of Cramer, Rouché, and Kronecker–Capelli. The course develops the theory of vector spaces, bases, dimension, linear independence, Euclidean structures, and the Gram–Schmidt orthonormalization process. Further topics include linear morphisms, kernels, images, isomorphisms, eigenvalues and eigenvectors, diagonalization, and the Jordan canonical form. The final part of the course introduces linear, multilinear, and quadratic forms, with emphasis on canonical reduction, Sylvester's theorem, and Hermitian quadratic forms. Throughout, students strengthen proof-based reasoning and gain essential algebraic tools for advanced mathematical study.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Synthetic Geometry	GES1	5	2	2	-	-

Course description (Syllabus): This course provides a rigorous introduction to the axiomatic foundations of geometry, beginning with general axiomatic theories and the classical systems of Hilbert and Birkhoff, together with their main consequences. Building on these foundations, the course develops key topics of Euclidean geometry, including convexity, concyclicity, collinearity, concurrency, metric relations, vector relations, and geometric loci. A significant component is devoted to geometric transformations, covering Euclidean isometries, homotheties, and inversion, culminating with the study of the conformal group. Emphasis is placed on logical structure, proof techniques, and the interplay between algebraic and geometric methods in modern synthetic geometry.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Algorithms and Programming	IAP1	5	2	1	2	-

Course description (Syllabus): This course introduces fundamental principles of algorithm design and analysis, beginning with basic notions, algorithm components, pseudocode conventions, and the role of variables. Students learn to evaluate the efficiency of iterative algorithms and compute time complexities across a variety of problems. The course examines classical search and sorting algorithms, followed by major algorithmic paradigms such as Divide et Impera, Greedy methods, and Dynamic Programming. Additional topics include graph algorithms and numerical algorithms, emphasizing both theoretical understanding and practical problem-solving skills. Through analysis and structured reasoning, students develop a solid foundation for advanced algorithmic study.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Data Structures	SD1	4	2		1	-

Course description (Syllabus): This course introduces foundational concepts in data structures and algorithmic implementation, beginning with pseudocode, one-dimensional and two-dimensional arrays, and basic complexity analysis, followed by practical C++ applications. Students explore modular programming using functions and user-defined structures, then study essential data structures such as linked lists, stacks, and queues. The course includes an introduction to the STL library and its core components, along with hashing techniques and hash tables. Further topics cover fundamental graph theory, tree representations and traversals, heaps and priority queues, and binary search trees, including Red-Black tree

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Ethics and academic integrity I	*EF01*	*2*	*1*	-	*1*	-

Course description (Syllabus): This course introduces students to scientific writing and document preparation using LaTeX. It covers the LaTeX working environment, mathematical formulas, scientific symbols, and the structure of professional documents such as articles and books. Students learn to incorporate images, tables, and graphical elements, create presentations using Beamer, and design academic posters. The course concludes with practical guidelines for writing and formatting a scientific paper. Emphasis is placed on clarity, typographic standards, and effective scientific communication.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
English Language (1)	*LE1*	*2*	*1*	*1*		

Course description (Syllabus): This course offers a structured review of essential English grammar topics, focusing on accurate usage and communicative clarity. Students study fundamental and advanced verb tenses, the passive voice, and a range of modal verbs used to express ability, obligation, possibility, and deduction. The course also covers relative clauses, as well as the correct use of pronouns and determiners.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Physical Education and Sport 1	EF01	1	-	1	-	-

Course description (Syllabus): This course introduces fundamental techniques and motor skills specific to team handball, beginning with basic positions, movement patterns, and coordinated locomotion. Students practice ball-handling skills through introductory games, developing two-handed catching and passing, as well as one-handed passes from above the shoulder and specialized passes performed from various body positions. The course advances to shooting techniques, including grounded shots with crossed steps and shots using the added-step method. Learning culminates in a practical assessment involving rule application and game behavior, where students demonstrate technical execution, tactical understanding, and basic refereeing skills in bilateral play.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Real Analysis	AMR1	7	3	3	-	-

Course description (Syllabus): This course provides a rigorous introduction to multivariable analysis and modern geometric calculus. It begins with topological, metric, normed, and inner-product spaces, emphasizing their interrelations and fundamental concepts such as open and closed sets, compactness, connectedness, sequences, and the Borel–Lebesgue theorem. Students study limits and continuity in general spaces, followed by partial derivatives, differentiability, higher-order differentials, Taylor polynomials in several variables, and methods for identifying extrema. The course explores the implicit function theorem, local inversion, and constrained extrema. Additional topics include integrals depending on parameters, improper parameter integrals, multiple Riemann integrals and their computation, line integrals of the first and second kind, path-independence, and Green's formula. The course concludes with surface integrals and the fundamental integral theorems of vector calculus, including Stokes and Gauss–Ostrogradski.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Analytical Geometry	GEA2	6	2	2	-	-

Course description (Syllabus): This course offers a rigorous study of affine and Euclidean geometry in vector spaces, beginning with geometric free vectors, affine spaces, and their structural properties. Students analyze collinearity and coplanarity, coordinate systems, Cartesian frames, and scalar, vector, and mixed products, together with their extensions to Euclidean affine spaces. The course develops the geometry of lines and planes in space, including angles, distances, and m-planes in $\mathbb{R}^n$, followed by affine coordinate changes, affine transformations, and Euclidean isometries with a full classification of planar isometries. Further topics include conic sections—properties, canonical forms, classification, centers, axes, and asymptotes—and quadric surfaces, studied through reduced equations and

general forms such as the sphere. The course concludes with an introduction to submanifolds in affine spaces and methods for generating geometric surfaces, emphasizing both algebraic and geometric techniques.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Algebraic Structures	ALG2	5	2	2	-	-

Course description (Syllabus): This course provides a foundational introduction to abstract algebra, beginning with sets, functions, relations, and equivalence classes, followed by composition laws and the structure of monoids. Students develop the theory of groups, including morphisms, subgroups, factor groups, Lagrange's theorem, and isomorphism theorems, together with permutation groups and Cayley's theorem. The study of finite groups is continued with Cauchy's theorem and related structural results. The second part of the course focuses on rings and fields, covering ring elements of special types, subrings, ideals, morphisms, factor rings, and the isomorphism theorems for rings. The course concludes with polynomial rings in one and several variables, the division algorithm, and factorization techniques in polynomial rings. Emphasis is placed on rigorous argumentation, algebraic structures, and their interconnections.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Computer Networks	RC1	5	2	-	2	-

Course description (Syllabus): This course provides a comprehensive introduction to computer networks, covering fundamental concepts, network classifications, and performance criteria. Students study communication media, network architectures, and the lower layers of network design, including the Physical and Data Link layers. The course examines routing protocols, IPv4 and IPv6 addressing, subnetting, and the Transport layer through the TCP and UDP protocols. Higher-layer functionality is explored through the Session and Presentation layers and through key Application-layer protocols such as HTTP, SSH, FTP, SMTP, POP3, and DNS. Additional topics include network security and encryption algorithms, wireless networks, sensor networks, cloud computing principles, and delay-tolerant networking. Emphasis is placed on understanding protocols in context, analyzing network behavior, and developing foundational skills for modern network systems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Object Oriented Programming	IP03	5	2	-	2	-

Course description (Syllabus): This course introduces students to fundamental and intermediate concepts in Python programming, beginning with syntax, data types, variables, and core control structures such as conditionals, loops, and comprehensions. Students learn to design and use functions, explore parameter handling, scope, and lambda expressions, and work extensively with Python's built-in data collections. The course develops practical computational skills through NumPy, covering arrays, vectorized operations, advanced indexing, slicing, and matrix computations. Visualization techniques are introduced through Matplotlib, including basic plotting, styling, subplots, and exporting graphics. The final part of the course provides a solid foundation in object-oriented programming, covering classes, objects, methods, encapsulation, inheritance, and application structuring using classes and libraries. Emphasis is placed on writing clean, modular, and efficient Python code.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
English Language (2)	LE2	2	1	1	-	-

Course description (Syllabus): This course explores a range of contemporary themes in English language, culture, and communication through units. Each module develops reading, vocabulary, and communicative competence while engaging with modern social issues, media influences, identity, and linguistic expression. Students analyze authentic texts, discuss cultural perspectives, and practice oral and written skills aimed at improving fluency, accuracy, and critical thinking in English.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Physical Education and Sport 2	EF2	1	-	1	-	-

Course description (Syllabus): This course introduces fundamental techniques and motor skills specific to team handball, beginning with basic positions, movement patterns, and coordinated locomotion. Students practice ball-handling skills through introductory games, developing two-handed catching and passing, as well as one-handed passes from above the shoulder and specialized passes performed from various body positions. The course advances to shooting techniques, including grounded shots with crossed steps and shots using the added-step method. Learning culminates in a practical assessment involving rule application and game behavior, where students demonstrate technical execution, tactical understanding, and basic refereeing skills in bilateral play.

2st Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Differential equations	ED1	6	2	2	-	-

Course description (Syllabus): This course provides a comprehensive introduction to ordinary differential equations, partial differential equations, and integral equations. It begins with first-order differential equations and higher-order equations with variable or constant coefficients, then develops the theory of dynamical systems, including symmetric systems and qualitative analysis of trajectories. Students study first-order linear, quasilinear, and nonlinear partial differential equations, together with methods for investigating stability of solutions in dynamical systems. The final part of the course introduces linear and nonlinear Volterra integral equations, linear Fredholm equations, and the classical Fredholm alternatives. Emphasis is placed on analytical techniques, solution methods, and the theoretical foundations underlying applied models.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Differential geometry	GED3	6	2	2	-	-

Course description (Syllabus): This course provides a rigorous introduction to the differential geometry of curves and surfaces in Euclidean spaces. It begins with the study of curves defined parametrically or implicitly, including planar and spatial cases, with emphasis on arcs, tangency, osculating circles, envelopes, evolutes, involutes, and the Frenet frame. Students examine existence theorems and global properties of planar and spatial curves, together with curvature, torsion, and notable classes of special curves and approximation methods. The second part of the course focuses on the geometry of surfaces, covering surface curves, the first and second fundamental forms, isometries, conformal mappings, principal curvatures and directions, Gaussian and mean curvature, asymptotic curves, lines of curvature, and geodesics. The course concludes with the Gauss–Bonnet theorem and the study of surfaces of constant curvature, highlighting the deep interplay between intrinsic and extrinsic geometry.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Complex Analysis	ANC3	5	2	2	-	-

Course description (Syllabus): This course offers a rigorous introduction to complex analysis, beginning with the structure of the complex numbers, basic topological notions in $\mathbb{C}$, and the geometry of the extended complex plane with its spherical representation. Students study complex functions, limits, continuity, and the class of holomorphic functions, including rational, Möbius, exponential, and logarithmic functions. The course develops the theory of complex integration, covering paths in the complex plane, Cauchy's integral theorem and formulas, the maximum modulus principle, and Schwarz's lemma. Further topics include Taylor and Laurent series, isolated singularities, and the residue theorem together with its applications to complex integrals. The course concludes with conformal representation and mapping of simply connected domains. Emphasis is placed on rigorous reasoning, analytic structure, and geometric interpretation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Logic and set theory	LOG3	5	2	2	-	-

Course description (Syllabus): This course provides a rigorous foundation in the logical and structural principles underlying modern mathematics. It begins with elementary mathematical logic, including propositions, predicates, and the relationships between direct, converse, and contrapositive theorems. Students then study sets and functions, operations on sets, characteristic functions, Cartesian products, binary relations, equivalence relations, ordered sets, ordered morphisms, inductively ordered sets, and Zorn's Lemma. The course continues with the theory of lattices, covering semilattices, lattices, sublattices, morphisms, ideals, filters, and special classes such as modular, distributive, complemented, and Boolean lattices. The next component develops number systems axiomatically: natural numbers with Peano's axioms, integers, and rationals, together with their operations, order relations, and division algorithms. The course concludes with cardinal numbers, including cardinal equivalence, finite and countable sets, the Cantor–Bernstein theorem, infinite sets, and the inclusion–exclusion principle with applications. Emphasis is placed on rigorous proof techniques and the structural understanding of fundamental mathematical objects.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
WEB Programming	PW1	3	2	-	2	-

Course description (Syllabus): This course provides a practical and structured introduction to modern web development. Students begin with HTML5 for creating semantic and accessible web pages, followed by core principles of responsive web design and styling using CSS3. The course introduces the W3.CSS standard and the Bootstrap 5 framework for building adaptive layouts and user interfaces. Students further develop dynamic functionality through JavaScript and server-side scripting with PHP, integrating MySQL databases to construct interactive and data-driven web applications. Emphasis is placed on clean design, standards-compliant code, and the development of fully functional web projects.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Physical Education and Sport 2	EF2	2	-	2	-	-

Course description (Syllabus): Education / develop basic motor skills and specific of branches / sports events; Formation of a system of motion skills and general (basic and specific application or utility samples / sports branches); Appropriation of means and structures for learning exercises, strengthening and improving the technical elements specific sports games; To acquire notions on the drives methodical approach in the learning , strengthening and improving sports gaming elements and specific procedures; Capacity building for the implementation of the bilateral learn in the game

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Partial differential equations	ECP2	5	2	2	-	-

Course description (Syllabus): This course introduces second-order partial differential equations and their role in mathematical physics. Topics include quasilinear PDEs, canonical forms, well-posed problems, and fundamental existence and uniqueness results. Students study elliptic, hyperbolic, and parabolic equations through the Laplace, wave, and heat models, emphasizing harmonic functions, Green's formulas, Fourier series, Fourier transforms, and classical solution methods such as D'Alembert's and Duhamel's formulas. Applications to boundary and initial value problems in various physical contexts are highlighted throughout.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Measure theory	AMM5	5	2	2	-	-

Course description (Syllabus): This course provides a rigorous introduction to measure theory and Lebesgue integration. Students begin with algebras and σ-algebras, outer measures, the construction of Lebesgue outer

measure in $\mathbb{R}^n$, Carathéodory's theorem, measure extension, and the Lebesgue measure. The course develops the theory of measurable functions, including step functions, general properties, and modes of convergence for sequences of measurable functions. Students then study the Lebesgue integral for nonnegative step functions, nonnegative measurable functions, and general measurable functions, together with the relationship between the Riemann and Lebesgue integrals. The final module introduces L^p spaces, p-integrable functions, Hölder and Minkowski inequalities, and the structure of L^p as Banach spaces.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Numerical analysis	AMN1	5	2	1	1	-

Course description (Syllabus): This course introduces numerical methods for solving linear and nonlinear systems, with emphasis on matrix techniques and approximation methods. Students study types of matrices—diagonal, triangular, banded, and sparse—and matrix transformations used in solving linear systems, including LU factorization, Gaussian elimination, pivotal condensation, and iterative methods such as Jacobi and Gauss–Seidel. The computation of determinants and matrix inverses is examined through both direct and iterative approaches. The course also addresses nonlinear equations and systems, focusing on Newton's method, convergence analysis, and modified Newton techniques for improved numerical stability. The final component covers numerical integration, including basic quadrature formulas such as the trapezoidal and Simpson rules. Throughout, the course emphasizes algorithmic implementation, convergence properties, and the accuracy of numerical approximations.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Data Bases	BD1	5	2	-	2	-

Course description (Syllabus): This course introduces the fundamental concepts, models, and techniques used in database systems. Students explore the evolution of data organization, the structure and components of database management systems, and the advantages and limitations of DBMS architectures. The course develops data modeling skills with emphasis on the relational model, relational algebra, SQL querying, and the DDL/DML sublanguages. Students study Codd's rules and the normalization process, including functional dependencies and normal forms up to the fifth form. Additional topics include views, triggers, stored procedures, physical database design, storage structures, indexing methods, and data security. The course concludes with an introduction to non-relational databases and data representation formats such as XML and JSON. Emphasis is placed on conceptual modeling, query formulation, and practical database design.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Financial Mathematics	MF4	5	2	2	-	-

Course description (Syllabus): This course introduces the fundamental concepts and computational methods of financial mathematics. Students begin with simple and compound interest, equivalent financial operations, and the distinction between real and nominal interest rates in the context of currency depreciation. The course develops the theory of discounting through simple and compound discount, together with equivalence relations under discount regimes. Additional topics include installment payments, deferred and immediate annuities, fractional payments, and equivalent cash-flow operations. The final module focuses on loan amortization methods and repayment structures. Emphasis is placed on understanding financial models, applying formulas correctly, and analyzing real-world financial transactions.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Theoretical Mechanics	MT4	5	2	2	-	-

Course description (Syllabus): This course provides a rigorous introduction to classical mechanics, beginning with vector algebra and vector analysis as foundational tools. Students explore elements of field theory, the theory of moments, and the motion of a point in various coordinate systems, followed by the kinematics of rigid bodies and Euler angles. The course develops the dynamics of a material point and the universal law of gravitation. The analytic formulation of mechanics is introduced through D'Alembert's principle, virtual displacements and velocities, and the derivation of Lagrange's equations. Further topics include Hamilton's canonical system, first integrals, the Hamilton–Jacobi equation, and integral variational principles. Emphasis is placed on mathematical formulation, physical interpretation, and the transition from classical to analytic mechanics.

3st Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Probabilities Theory	AMP6	5	2	1	1	-

Course description (Syllabus): This course introduces the fundamental concepts of probability theory, including probability spaces, independent events, and conditional probability. Students study random variables, distribution functions, discrete and continuous models, numerical characteristics such as mean and variance, and characteristic functions. Additional topics include probabilistic inequalities, convergence of random variables, the Law of Large Numbers, and the Central Limit Theorem. Emphasis is placed on rigorous reasoning and the mathematical foundations of stochastic phenomena.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Functional Analysis	AMF7	5	2	2	-	-

Course description (Syllabus): This course provides an introduction to functional analysis, focusing on normed vector spaces, continuous linear applications, and the Hahn–Banach theorem. Students study Banach spaces, the uniform boundedness principle, the closed graph theorem, and the open mapping theorem. Further topics include the spectrum of bounded linear operators, compact operators and their spectral properties, the Fredholm alternative, and integral equations. The course concludes with fundamental concepts of duality in functional analysis. Emphasis is placed on abstract methods, operator theory, and applications to analysis.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Optimization Technics	TO6	5	2	1	1	-

Course description (Syllabus): This course introduces the fundamental methods of linear programming and optimization. Students begin with graphical techniques and algebraic formulations, followed by the simplex algorithm and approaches based on elementary transformations and penalty methods. The course covers the two-phase method, duality theory, and the dual simplex algorithm, as well as reoptimization and parametric programming. Additional topics include classical transportation problems and their solution methods. Emphasis is placed on algorithmic reasoning, problem formulation, and practical optimization strategies.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mathematical Software	MMA	5	2		1	-

Course description (Syllabus): This course introduces students to essential computational, editing, and decision-support software used in mathematical modeling and optimization. It begins with scientific document preparation in LaTeX, followed by symbolic and numerical computation using Wolfram Alpha and geometric visualization through GeoGebra. The course then focuses on applied optimization tools in QM, covering linear, integer, and mixed-integer programming, as well as classical transportation problems. Additional modules introduce network analysis, including shortest-route algorithms and minimum spanning trees, and decision analysis techniques for evaluating alternatives under uncertainty. Emphasis is placed on practical software skills, problem formulation, and the computational implementation of mathematical models.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Abstract Algebra	ALG5	5	2	2	-	-

Course description (Syllabus): This course introduces core concepts in algebraic number theory and field theory. Topics include arithmetic in integral domains, properties of ideals, Euclidean and principal ideal domains, factorial domains, and Eisenstein's irreducibility criterion. Students study arithmetic functions—multiplicative functions, Euler's function, Möbius inversion—and congruences in $\mathbb{Z}$, including Fermat's and Euler's theorems, linear and quadratic congruences, and the Legendre symbol. The final part covers field extensions, including algebraic, finite, separable, and normal extensions, Galois extensions, Galois groups, and the fundamental theorem of Galois theory.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practice	PRAC	5	-	-	-	8

Course description (Syllabus): Placing students in real situations of software development ; Qualified company personal attendance to student's practical training; Practicing the competences regarding human relations within working conditions; Increasing students' motivation regarding their theoretical and practical preparation by offering them a better knowledge about their future profession; Preparing young graduates for the work market, by acquiring practical experience during the period of university studies; Supervising and validation of the students activity both by the university mentor and the person appointed by the company.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Complements of Mathematical Analysis	AM10	6	2	2	-	-

Course description (Syllabus): This course deepens key topics in real analysis and algebra, beginning with extended convergence criteria for sequences and series, continuity and differentiability properties, convexity, inequalities, extrema, and Riemann integrability, including asymptotic behavior of integral sequences. Students develop problem-solving techniques in real analysis and review quadratic functions, matrices, determinants, and linear systems. Additional modules introduce combinatorics, probability, composition laws, groups, and higher-degree polynomial equations. Emphasis is placed on analytical reasoning, algebraic methods, and applications across mathematical problem solving.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Variational Calculus	CV4	6	2	2	-	-

Course description (Syllabus): This course provides a rigorous introduction to the calculus of variations and the functional analytic tools underlying variational methods. Students begin with metric and normed spaces, continuous and differentiable functionals, quadratic and integral functionals, and first- and second-order variations. The course develops necessary and sufficient conditions for extrema of differentiable functionals, followed by classical variational problems with fixed endpoints, the Euler–Lagrange equation, its generalizations, and applications such as the brachistochrone and minimal-surface-of-revolution problems. Additional topics include isoperimetric problems, Lagrange multipliers, Euler–Poisson and Euler–Ostrogradski equations, links to Sturm–Liouville theory, and variational problems with free endpoints. The course concludes with direct methods in the calculus of variations, including Euler's finite-difference method, Ritz's method, and variational techniques for Sturm–Liouville problems.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mathematical statistics	AMS8	6	2	1	1	-

Course description (Syllabus): This course introduces the fundamentals of probability and mathematical statistics. Students study probability spaces, random variables, distribution functions, and density functions, together with classical discrete and continuous distributions and their numerical characteristics. The course develops methods for representing and analyzing experimental data and introduces core estimation theory, including unbiased, consistent, efficient, and sufficient estimators. Parameter estimation techniques such as the method of moments and maximum likelihood are examined in detail. The final module covers confidence intervals and hypothesis testing, with applications to the normal distribution and population proportions. Emphasis is placed on rigorous reasoning, statistical interpretation, and practical applications.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Mathematical models to Machine Learning	MMML	6	2		2	-

Course description (Syllabus): This course provides the mathematical and computational foundations of machine learning. Students begin with introductory concepts, linear algebra and analytic geometry tools, matrix decompositions, and vector calculus essential for optimization and model formulation. Core probabilistic notions and classical distributions are introduced to support statistical learning methods. The course develops continuous optimization techniques used in training machine learning models and includes practical programming in Python along with key data-analysis libraries. Applications focus on linear and logistic regression and methods for dimensionality reduction. Emphasis is placed on mathematical understanding, algorithmic reasoning, and hands-on implementation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practical Coordination for Bachelor Thesis	ELLC	6	-	-	-	4

Course description (Syllabus): Placing students in real situations of software development ; Qualified company personal attendance to student's practical training; Practicing the competences regarding human relations within working conditions; Increasing students' motivation regarding their theoretical and practical preparation by offering them a better knowledge about their future profession; Preparing young graduates for the work market, by acquiring practical experience during the period of university studies; Supervising and validation of the students activity both by the university mentor and the person appointed by the company ; Providing detailed and reliable information regarding the future students profession.