Al-Balqa' Applied University

Curriculum for the Bachelor degree in

Mathematics

The curriculum for the B.S.c. degree in Mathematics consists of (132) credit hours distributed as follows:-

Course No.	Requirements	Credit Hours (Cr. H.)
1	University Requirements • Compulsory • Elective	 21 6
2	Faculty Requirements	20
3	Specialization Requirements • Compulsory • Elective	 63 12
4	Supportive Specialization Requirements	10
Total		132

Curriculum for the Bachelor Degree in Mathematics

First: University Requirement (27 Cr. H.)

A: Compulsory Requirements (21 Cr. H.):

Course No.	Course Title	Cr. H.	Weekly Hours		Prerequisite
			Lecture	Lab.	
35005101	Computer Skills (1)	3	--	6	--
35003101	Arabic (1)	3	3	--	--
35003102	Arabic (2)	3	3	--	35003101
35004101	English (1)	3	3	--	--
35004102	English (2)	3	3	--	35004101
35001101	Military Sciences	3	3	--	--
35002100	National Education	3	3	--	--

B: Elective University Requirements: (6 Cr. H.)

The student is allowed to select (6 Cr. H.) from the university elective courses other than those offered by his/her faculty.

Course No.	Course Title	Cr. H.
36001101	Communication Skills	3
36002102	Educational Psychology	3
36003103	Jordanian society	3
36004104	Sport for All	3
36005105	Islamic Education	3
36006106	Administration & Economic Concepts	3
36007107	Agriculture in Jordan	3
36008108	Environment and Society	3

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Second: Faculty Requirements: (20 Cr .H.)

Course No.	Course Title	Cr. H.	Weekly Hours		Prerequisite
			Lecture	Lab.	
30202101	Calculus (1)	3	3	0	--
30202102	Calculus (2)	3	3	0	30202101
30201101	General Physics (1)	3	3	0	--
30201111	General Physics Lab. (1)	1	0	3	30201101*
30201102	General Physics (2)	3	3	0	30201101
30201112	General Physics Lab. (2)	1	0	3	30201102*
30202131	Probability & Statistics	3	3	0	30202102
30801101	Computer Skills (2)	3	2	3	35005101

*: or parallel

Third: Specialization Requirements: (75 Cr .H.)

A- Compulsory Requirements: (63 Cr .H.)

Course No.	Course Title	Cr. H.	Weekly Hours		Perquisites
			Lec.	Lab	
30202201	Intermediate Analysis	3	3	0	30202102
30202203	Ordinary Differential Equations (1)	3	3	0	30202102
30202241	Linear Algebra (1)	3	3	0	30202102
30202251	Foundations of Mathematics	3	3	0	30202102
30202252	Discrete Mathematics	3	3	0	30202102
30202261	Modern Euclidean Geometry	3	3	0	30202102
30202301	Advanced Calculus	3	3	0	30202201
30202303	Special Functions and Fourier Analysis	3	3	0	30202203
30202304	Partial Differential Equations (1)	3	3	0	30202203
30202311	Mathematical Analysis (1)	3	3	0	30202251
30202312	Complex Analysis (1)	3	3	0	30202251
30202321	Numerical Analysis	3	3	0	30202201
30202333	Applied Probability	3	3	0	30202251 30202131
30202342	Abstract Algebra (1)	3	3	0	30202241

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Course No.	Course Title	Cr. H.	Weekly Hours		Perquisites
			Lec.	Lab	
30202361	General Topology (1)	3	3	0	30202251
30202371	Mathematical Programming Packages	3	2	3	30202201 30801203
30202431	Statistical Techniques	3	3	0	30202333
30202472	Methods of Applied Mathematics	3	3	0	30202304
30202473	Mathematical Modeling	3	3	0	30202304 30801360
30202474	Computations in Applied Mathematics	3	3	0	30202304
30202499	Graduation Project	3	-	-	90 Cr. H.

B: Elective Specialization Requirements: (12) Cr. H. to be selected from the following list:

Course No.	Course Title	Cr. H.	Weekly Hours		Perquisites
			Lec.	Lab	
30202302	Integral Transforms and Integral Equations	3	3	0	30202203
30202381	Financial Mathematics	3	3	0	30202131 30801360
30202403	Ordinary Differential Equations (2)	3	3	0	30202203
30202404	Partial Differential Equations (2)	3	3	0	30202304
30202405	Fuzzy Calculus and Its Applications	3	3	0	30202203 30202311
30202411	Mathematical Analysis (2)	3	3	0	30202311
30202412	Complex Analysis (2)	3	3	0	30202312
30202441	Linear Algebra (2)	3	3	0	30202241
30202442	Abstract Algebra (2)	3	3	0	30202342
30202461	General Topology (2)	3	3	0	30202361
30202481	Actuarial Mathematics	3	3	0	30202333
30202495	Special Topics in Applied Mathematics	3	3	0	Department Approval

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Fourth: Supportive Specialization Requirements: (10 Cr. H.)

Course No.	Course Title	Cr. H.	Weekly Hours		Prerequisite
			Lecture	Lab.	
30801203	Object Oriented Programming	3	3	0	30801101
30801204	Object Oriented Programming Lab.	1	0	3	30801203*
30801360	Operation Research	3	3	0	30202102
30201201	Mathematical Physics (1)	3	3	0	30201102

*: or parallel

Curriculum for the Bachelor Degree in Mathematics

First Year					
First semester			**Second Semester**		
Course No.	**Course title**	**Cr. H.**	**Course No.**	**Course title**	**Cr. H.**
30202101	Calculus (1)	3	30202102	Calculus (2)	3
30201101	General Physics (1)	3	30201102	General Physics (2)	3
30201111	General Physics Lab. (1)	1	30201112	General Physics Lab. (2)	1
35005101	Computer Skills (1)	3	30801101	Computer Skills (2)	3
35003101	Arabic (1)	3	35003102	Arabic (2)	3
35004101	English (1)	3	35004102	English (2)	3
Total		**16**	**Total**		**16**

Second Year					
First semester			**Second Semester**		
Course No.	**Course title**	**Cr. H.**	**Course No.**	**Course title**	**Cr. H.**
30202201	Intermediate Analysis	3	30202203	Ordinary Differential Equations (1)	3
30202251	Foundations of Mathematics	3	30801360	Operation Research	3
30202241	Linear Algebra (1)	3	30201201	Mathematical Physics (1)	3
30202252	Discrete Mathematics	3	30202131	Probability & Statistics	3
30801203	Object Oriented Programming	3	30202261	Modern Euclidean Geometry	3
30801204	Object Oriented Programming Lab.	1	35002100	National Education	3
Total		**16**	**Total**		**18**

Curriculum for the Bachelor Degree in Mathematics

Third Year					
First semester			Second Semester		
Course No.	Course title	Cr. H.	Course No.	Course title	Cr. H.
30202311	Mathematical Analysis (1)	3	30202303	Special Functions and Fourier Analysis	3
30202321	Numerical Analysis	3	30202304	Partial Differential Equations (1)	3
30202333	Applied Probability	3	30202312	Complex Analysis (1)	3
30202301	Advanced Calculus	3	30202342	Abstract Algebra (1)	3
--	Elective University Requirements	3	30202371	Mathematical Programming Packages	3
--	Elective Specialization Requirements	3	--	Elective Specialization Requirements	3
Total		18	Total		18

Fourth Year					
First semester			Second Semester		
Course No.	Course title	Cr. H	Course No.	Course title	
30202361	General Topology (1)	3	30202474	Computations in Applied Mathematics	3
30202472	Methods of Applied Mathematics	3	30202499	Graduation Project	3
30202431	Statistical Techniques	3	--	Elective University Requirements	3
30202473	Mathematical Modeling	3	--	Elective Specialization Requirements	3
35001101	Military Sciences	3	--	Elective Specialization Requirements	3
Total		15	Total		15

Curriculum for the Bachelor Degree in Mathematics

Course Description

3020210 Calculus (1) 3(3-0)

Functions: domain, operations on functions, graphs of functions, trigonometric functions; limits and continuity; the derivative: techniques of differentiation, the chain rule, implicit differentiation; differentials; Roll's theorem; the main value theorem; L'Hôpital's rule; increasing and decreasing functions; concavity; maximum and minimum values of a function, graphs of including rational functions; the indefinite integral; the fundamental theorem of calculus; the area between two curves; inverse functions; logarithmic and exponential functions; hyperbolic functions.

30202102 Calculus (2) 3(3-0)

Techniques of integration; improper integrals; applications of the definite integrals Polar coordinates; parametric equations; Infinite series: geometric, p-harmonic, simple comparison tests, formal power series for some elementary functions, Taylor series; topics in analytic geometry: circle, parabola, ellipse, hyperbola.

30201101 General Physics (1) 3(3-0)

Measurements; motion in one dimension; vectors; motion in two dimension; laws of motion; work and energy; potential energy and conservation of energy; linear momentum and collisions; rotation; simple harmonic motion.

30201111 General Physics Lab. (1) 1(0-0)

Significant figures & errors; measurements and uncertainties; kinematics of rectilinear motion; vectors; conservation of energy; force and motion; friction; simple harmonic motion; simple pendulum; rotational motion; speed of transverse mechanical waves; centripetal force; specific heat.

30201102 General Physics (2) 3(3-0)

Electric field; Gauss' law; electric potential; capacitance and dielectrics; current and resistance; direct current circuits; magnetic fields; sources of the magnetic fields; Faraday's law; alternating current; electromagnetic waves.

30201112 General Physics Lab. (2) 1(0-3)

Galvanometer, Ammeter and Voltmeter; electric field mapping; Ohm's law; specific charge of copper ions; electric equivalent of heat; the potentiometer; the bridge method; Kirchhoff's rules; parallel plate capacitor; the RC circuit; power transfer and voltage attenuators; tangent galvanometer.

30202131 Probability and Statistics 3(3-0)

Introduction to probability; random variables (discrete and continuous); probability and distribution functions; mathematical expectation; descriptive statistics; random sampling' estimation of parameters (one point estimation and confidence intervals); hypothesis testing; regression and correlation.

Curriculum for the Bachelor Degree in Mathematics

Course Description

30801101 Computer Skills (2) 3(2-3)

Introduction to data structures, problem specification and program design, analysis, testing, verification, and correctness of algorithms, logical and physical representation of data, data structure operations, linked lists, queues, stacks, searching and sorting, tree data structures, this course is taught based on C++ programming language.

30202201 Intermediate Analysis 3(3-0)

Three dimensional space: rectangular coordinates, spheres, cylindrical surfaces, quadratic surfaces; vectors: dot product, projections, cross product; parametric equations of lines; planes in 3-space; vector valued functions: calculus of vector valued functions, change of parameters, arc length, unit tangent and normal vectors, curvature; functions of two or more variables: domain, limits, and continuity, partial derivatives, the gradient, directional derivatives, tangent planes, normal lines; maxima and minima of functions of two variables; Lagrange multiplier; multiple integrals and triple integrals.

30202203 Ordinary Differential Equations (1) 3(3-0)

Introduction and classification; solutions of first order differential equations and their applications; (Growth and decay problems and linear motion problem); solutions of second and higher order linear differential equations and their applications (Spring problem and projectile problems); series solutions of differential equations; Laplace transform and its applications.

30202241 Linear Algebra (1) 3(3-0)

Systems of linear equations; matrices and matrix operations; homogeneous and nonhomogeneous systems; Gaussian elimination; elementary matrices and a method for finding inverse; determinants; Euclidean vector spaces; linear transformations from R^n to R^m and their properties; general vector spaces; subspaces; basis; dimension; row space; column space; null space of a matrix; rank and nullity; inner product spaces; eigenvalues and diagonalization; linear transformations.

30202251 Foundations of Mathematics 3(3-0)

Logic and proofs; quantifiers; rules of inference mathematical proofs; set operations; relations; artesian prpoduct and relations; equivalence relations; partitions; functions: onto functions, one-to-ıe functions; ininduced set functions; cardinality; equipotence of sets; finite an infinite sets; ɔuntable sets; topology of R.

30202252 Discrete Mathematics 3(3-0)

Logic; methods of proof; Boolean algebra; sets; relations; functions; ordered relations; counting principles; discrete probabilities; mathematical induction; recursive relations; permutations; graphs; trees; introduction to group theory.

Curriculum for the Bachelor Degree in Mathematics

Course Description

30202261 Modern Euclidean Geometry 3(3-0)

Axiomatic systems: consistency, independence and completeness, finite projective geometry, a brief critique of Euclid, the postulates of connection, the measurement of distance, ruler postulate, order relations, plane-separation postulate, space-separation theorem, angles and angle measurement, protractor postulate, further properties of angles, triangles and polygons, congruence postulate, parallel postulate, similarity, Pythagorean theorem, theorems of Ceva and Menelous, Morley's theorem, Erdös-Mordell theorem, circles, central and inscribed angles, cyclic quadrilaterals, Simson line, nine point circle, lines and planes in space.

30202301 Advanced Calculus 3(3-0)

Vector differential calculus: gradient, divergence, curl, vector integral calculus: line integral, surface integral, Green's theorem, Stoke's theorem, divergence theorem; implicit and inverse function theorem; Leibnitz theorem; Calculus of variation (functionals of one variable).

30202303 Special Functions and Fourier Analysis 3(3-0)

Power series solutions of differential equations; Gamma and Beta Functions; Euler product and Euler's integral for the Gamma function; Hypergeometric functions; Bessel Functions; Neumann ploynomials and Neumann series; Legendre and associated Legendre functions; confluent Hypergeometric functions; Chebyshev, Laguerre and Hermite polynomials with applications; Fourier integrals and applications.

30202304 Partial Differential Equations (1) 3(3-0)

First order partial differential equations in two independent variables; semilinear and quasilinear partial differential equations, non-linear first order partial differential equations; second order partial differential equations; canonical forms; existence and uniqueness theorems for initial and boundary value problems; Orthogonal sets of functions; Fourier series; Fourier Integrals; Separation of variables; transforms methods; partial differential equations in polar form.

30202311 Mathematical Analysis (1) 3(3-0)

Real numbers: order, absolute value, bounded subsets, completeness property; supremum and infimum; sequences: limit, Cauchy sequence, recurrence sequence, increasing and decreasing sequence: functions; limit, continuity at a point, continuity on an interval, uniform continuity; differentiability; the relation between the continuity and differentiability; Rolle's theorem; mean value theorem; applications of mean value theorem.

30202312 Complex Analysis (1) 3(3-0)

Complex numbers: geometric interpretation, polar form, exponential form; analytic functions; functions of complex variables: exponential and logarithmic functions, trigonometric and hyperbolic functions; definite integrals; Cauchy theorem; Cauchy integral formula; sequences and series, convergence of series and sequences; Taylor series; uniform convergence; differentiation and integration of power series; zeros of analytic functions: singularity; principle parts; residues; poles; residue theorem, evaluation of improper integrals; integration through a branch cut.

Curriculum for the Bachelor Degree in Mathematics

Course Description

30202321 Numerical Analysis 3(3-0)

Error analysis; solving non-linear equations in one variables; interpolation and polynomial approximation; curve fitting techniques; numerical differentiation and integration, numerical methods for initial value problems.

30202333 Applied Probability 3(3-0)

Distributions of random variables; conditional probability and stochastic independence; probability distributions; distribution of functions of random variables; queueing theory; reliability theory; quality control and acceptance sampling; information theory and coding.

30202342 Abstract Algebra (1) 3(3-0)

Groups and subgroups; cyclic groups; permutation group; isomorphisms groups; direct product of groups; cosets and Lagrange's theorem; normal subgroups, quotient groups, first isomorphism theorem; rings and subrings; integral domains and quotient rings; integral domains and ideals; fields.

30202361 General Topology (1) 3(3-0)

Topological spaces; open sets; closure, interior and boundary of set; accumulation point; topologies induced by functions; subspace topology; bases and subbases; finite product of topological spaces; open and closed functions, homeomorphism; separation axioms; metric spaces; connectedness and compactness.

301505371 Mathematical Programming Packages 3(3-0)

Computer packages: Mathmatica, Mathcad, Maple. One of these packages may be used in a computer lab to illustrate selected mathematical concepts, explore some mathematical facts, build algorithms for problem solving cases; do numerical and analytical computations; do simulation studies and plot graphs.

30202431 Statistical Techniques 3(3-0)

Estimation: point estimation, confidence intervals; Cramer and Rao's inequality; hypothesis testing; UMP test; likelihood ratio test; chi-square tests; SPRT; nonparametric methods; Sufficient statistics and its properties; complete statistics exponential family; Fisher information; Information theory.

30202472 Methods of Applied Mathematics 3(3-0)

Analytical methods for the formulation and solution of initial and boundary value problems for ordinary and partial differential equations; Green's function method, Perturbations techniques; Techniques include the use of complex variables, generalized eigenfunction expansions, transform methods and applied spectral theory, linear operators, nonlinear methods, asymptotic and approximate methods; integral equations; systems of differential equations and stability.

30202473 Mathematical Modeling 3(3-0)

Basic principles; model construction: examples, Markov chain models, models of linear optimization, models involving chance choice and competition, models of growth processes, models of epidemics, rumors and queues, practical aspects of model building.

Curriculum for the Bachelor Degree in Mathematics

Course Description

30202474 Computations in Applied Mathematics 3(3-0)

Introductory methods in both theory and implementation of numerical linear algebra, approximation theory, ordinary differential equations, and partial differential equations. The course covers methods such as direct and iterative solution of large linear systems; eigenvalue and vector computations; function minimization; nonlinear algebraic solvers; preconditioning; time-frequency transforms (Fourier, Wavelet, etc.); root finding; data fitting; interpolation and approximation of functions; numerical quadrature; numerical integration of systems of ODEs (initial and boundary value problems); finite difference, element, and volume methods for PDEs; level set methods. Programming is a significant part of the course.

30202499 Graduation Project 3(-)

Students are supposed to write graduation projects in applied mathematics under the supervision of a faculty member. At least two weeks prior to registration in the semester when such a course is to be selected, an interested student must submit to the department chair and the supervisor is written request for permission to select a project on the appropriate form available in the departmental office. The request will include s dissertation of the proposal project. The department chair will review the proposal with faculty members to ascertain availability of relevant faculty supervision.

30202302 Integral Transforms and Integral Equations 3(3-0)

Integral transforms; Fourier transform; Laplace transform; Mellin transform; Linear integral equations with separable kernels; Approximation methods for solving integral and integro-differential equations for both initial and boundary value problems; solving integral and integro-differential equations by Laplace and Fourior transforms.

30202381 Financial Mathematics 3(3-0)

Mathematical and statistical techniques in compound interest; disconnected cash flow; valuation of cash flows of insurance contracts; analysis and valuation of annuities; bonds, loans and other securities; curves and immunization; stochastic rate models; actuarial applications.

30202403 Ordinary Differential Equations (2) 3(3-0)

Linear ordinary differential equations; existence and uniqueness theorems; infinite series solutions (Frobenious method); Bessel functions and Legendre Polynomials; Strum-Liouville theory; Green's functions; linear systems with constant coefficients; non-linear differential equations and stability; almost linear systems, the fundamental theorem of nonlinear systems, Liapunov's theory for stability; periodic solutions and limit cycles.

30202404 Partial Differential Equations (2) 3(3-0)

Heat, wave and potential equations in infinite domains (two and three dimensions); interior Dirichlet problem for a circle; Dirichlet problems in an annulus; spherical harmonies; A nonhomogenous Dirichlet problem; systems of partial differential equations; existence and uniqueness theorems.

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Course Description

30202405 Fuzzy Calculus and Its Applications 3(3-0)

Fuzzy sets theory; operations on fuzzy sets; Zadeh's extension principal and its properties; fuzzy real and complex numbers; intervals analysis; arithmetic operations on fuzzy real and complex numbers; fuzzy differentiations and integrations; fuzzy differential equations; fuzzy differential inclusions; applications to real world problems.

30202411 Mathematical Analysis (2) 3(3-0)

Infinite series and infinite product; sequences of functions; pointwise and uniform convergence; interchange of limits theorem; series of functions; theorem of uniform convergence; power series; Fourier series; differentiation and integration of sequence of functions; multiple integrals; improper integrals.

30202412 Complex Analysis (2) 3(3-0)

Residues and Poles: Evaluation of improper real integrals; improper integrals involving sines and cosines; definite integrals involving sines and cosines; integration through a Branch cut; logarithmic residues and Rouche's theorem; mapping by elementary functions; conformal mappings and transformations of harmonic functions; singularities and the argument principle.

30202441 Linear Algebra (2) 3(3-0)

Vector spaces; subspaces; quotient spaces; linear independence and bases; dual spaces; inner product spaces; orthonormal bases; linear transformations; eigenvalues, eigenvectors and determinants of linear transformations; matrix representation; change of basis and similarity; invariant subspaces; canonical forms of linear transformations; diagonal form; triangular form; nilpotent transformations; Jordan form; companion matrices; commutators; the trace functional and Jacobson's lemma; normal transformations and the spectral theorem.

30202442 Abstract Algebra (2) 3(3-0)

Ring homomorphisms; polynomial rings; factorization of polynomials; reducibility and irreducibility tests; divisibility in integral domains; principal ideal domains and unique factorization domains; algebraic extension of fields; introduction to Galois theory.

30202461 General Topology (2) 3(3-0)

Local bases, first countable spaces; second countable spaces; separable spaces; connected spaces and their properties; components; locally connected spaces; path-wise connected; compact spaces and their properties; compactness in R^n; countably compact spaces; metric spaces; metric topologies; equivalent metrics; continuity and uniform continuity of functions on metric spaces; compactness of metric spaces.

30202481 Actuarial Mathematics 3(3-0)

Mathematical and statistical techniques in utility theory; premium formula, mortality rates, selection and underwriting; investment of funds, sources of profit and loss; assets and liabilities, models of lifetime; death and survival probabilities; present value of annuity function, their expected values and variance; use of life tables and commutation functions; net premium values.

Curriculum for the Bachelor Degree in Mathematics

Course Description

30202495 Special Topics in Applied Mathematics 3(3-0)

This course will be a study of one of the modern topics in applied mathematics to be supervised by the instructor.

30801203 Object Oriented Programming 3(3-0)

Object-oriented (OO) programming environment, OO building blocks, input/output, loops, decisions, functions, arrays and strings, data structures, encapsulation, advanced variables, object oriented programming, useful OO features, classes and objects, inheritance, polymorphism, method overloading, handling exceptions, thread programming and multithreading, this course is taught based on C# language.

30801204 Object Oriented Programming Lab. 1(0-3)

Practical applications to cover the theoretical topics discussed in Object Oriented Programming course.

30801360 Operation Research 3(3-0)

Introduction to the field of operational research, methods of operations research, models and modeling, general problem formulation, graphical solution of two dimensional LPs, simplex method, simplex algorithm, simplex algorithm software programs, duality, sensitivity analysis, network programming, integer programming, nonlinear programming, transportation problem, assignment problem.

30201201 Mathematical Physics (1) 3(3-0)

Series, vector analysis, matrices, eigen-value problems, complex numbers.