Study Plan
B.Sc. in Mathematics

Requirements for the B.Sc. Degree in Mathematics

All students working for their Bachelor's Degree in Mathematics must successfully complete 132 credit hours distributed as follows:-

Requirements	*Credit Hours*
University Requirements	27
Faculty Requirements	21
Specialization Requirements	84
Total	**132**

University Requirements

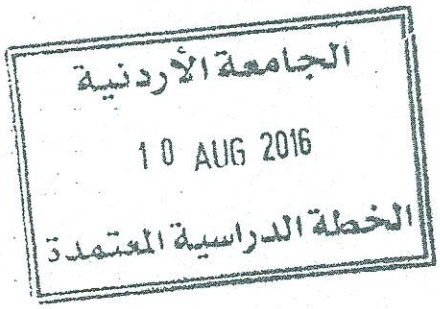
(a) **Obligatory** : 12 credit hours

(b) **Electives** : 15 credit hours

Faculty Requirements

(a) **Obligatory** : 21 credit hours

(b) **Electives** : none



Specialization Requirements

1. ***Obligatory: (66) credit hours selected from the following:***

Course Number	*Title*	*Credit Hours*	*Prerequisite*
0301102	Calculus-II	3	0301101
0301201	Calculus-III	3	0301102
0301211	Principles of Mathematics	3	0301102
0331212	Real Analysis	3	0301211
0301221	Ordinary Differential Equations-I	3	0301102
0301241	Linear Algebra-I	3	0301101
0331261	Modern Euclidean Geometry	3	0301211
0331301	Advanced Calculus	3	0301201
0331311	Mathematical Analysis-I	3	0331212
0331321	Partial Differential Equations-I	3	0301221
0341332	Statistical Techniques	3	0301131
0301333	Probability Theory	3	0301201
0331341	Modern Algebra-I	3	0301211
0301342	Number Theory	3	0301211
0301361	General Topology-I	3	0331212
0301411	Mathematical Analysis-II	3	0331311
0331412	Complex Analysis	3	0331212
0331431	Mathematical Statistics	3	0301333
0301441	Linear Algebra-II	3	0301241
0331442	Modern Algebra-II	3	0331341
0301472	Numerical Methods	3	0331321
0341473	Mathematical Packages	3	0331301

2. *Elective Courses: 18 credit hours selected from the following:*

Course Number	*Title*	*Credit Hours*	*Prerequisite*
0341271	Principles of Optimization	3	0301241
0331334	Stochastic Processes	3	0301333
0341336	Design and Analysis of Experiments	3	0301333
0301338	Applied Probability	3	0301333
0301371	Mathematical Programming	3	0301241
0301381	Teaching Mathematics	3	0331301
0331413	Basics in Functional Analysis	3	0331212
0331421	Ordinary Differential Equations-II	3	0301221
0331422	Partial Differential Equations-II	3	0331221
0301424	Special Functions	3	0331321
0331432	Time Series	3	0301333
0331443	Combinatorial Analysis	3	0301241
0301444	Matrix Theory	3	0301241
0301445	Graph Theory	3	0301241
0301446	Cryptography Theory	3	0301342
0301451	Foundations of Mathematics	3	0331212
0331461	Non- Euclidean Geometry	3	0331261
0331462	General Topology-2	3	0301361
0301471	Methods in Applied Mathematics	3	0331412
0301481	History of Mathematics	3	0331301
0302331	Electricity and Magnetism	3	0331321

Department of Mathematics

Courses Offered by the Department of Mathematics

Course Number	*Title*	*Credit Hours*	*Prerequisite*
0331099	Mathematics Remedial	3	--
0301101	Calculus-I	3	--
0301102	Calculus-II	3	030101
0331103	Mathematics for Business Administration and Social Sciences	3	--
0301131	Principles of Statistics	3	--
0301201	Calculus-III	3	0301102
0301202	Engineering Mathematics-I	3	0301201
0301211	Principles of Mathematics	3	0301102
0331212	Real Analysis	3	0301211
0301221	Ordinary Differential Equations-I	3	0301102
0301241	Linear Algebra-I	3	0301101
0331261	Modern Euclidean Geometry	3	0301211
0341271	Principles of Optimization	3	0301241
0331301	Advanced Calculus	3	0301201
0331302	Engineering Mathematics-II	3	0301202
0331311	Mathematical Analysis-I	3	0331212
0331321	Partial Differential Equations-I	3	0301221
0341332	Statistical Techniques	3	0301131
0301333	Probability Theory	3	0301201

Course Number	*Title*	*Credit Hours*	*Prerequisite*
0331334	Stochastic Processes	3	0301333
0341336	Design and Analysis of Experiments	3	0301333
0301338	Applied Probability	3	0301333
0331341	Modern Algebra-I	3	0301211
0301342	Number Theory	3	0301211
0301361	General Topology-I	3	0331212
0301371	Mathematical Programming	3	0301241
0301381	Teaching Mathematics	3	0331301
0301411	Mathematical Analysis-II	3	0331311
0331412	Complex Analysis	3	0331212
0331413	Basics in Functional Analysis	3	0331212
0331421	Ordinary Differential Equations-II	3	0301221
0331422	Partial Differential Equations-II	3	0331221
0301424	Special Functions	3	0301221
0331431	Mathematical Statistics	3	0301333
0331432	Time Series	3	0301333
0301441	Linear Algebra-II	3	0301241
0331442	Modern Algebra-II	3	0331341
0331443	Combinatorial Analysis	3	0301241
0301444	Matrix Theory	3	0301241
0301445	Graph Theory	3	0301241
0301446	Cryptography Theory	3	0301342
0301451	Foundations of Mathematics	3	0301211
0331461	Non-Euclidean Geometry	3	0331261
0331462	General Topology-II	3	0301361
0301471	Methods in Applied Mathematics	3	0331412
0301472	Numerical Methods	3	0331321
0341473	Mathematical Packages	3	0331301
0301481	History of Mathematics	3	0331301

Course Description

0301099 **Mathematics Remedial** **(3 Credit Hours)**
Prerequisite: (None)

Algebraic expressions; factorization; exponents; logarithms; cartesian coordinates; straight lines; parabolas; equations: linear, linear and quadratic, exponential, logarithmic; inequalities; functions; sequences; Binomial theorem.

0301101 **Calculus-I** **(3 Credit Hours)**
Prerequisite: (None)

Functions: domain, operations on functions, graphs of functions; trigonometric functions; limits: meaning of a limit, computational techniques, limits at infinity, infinite limits; continuity; limits and continuity of trigonometric functions; the derivative: techniques of differentiation, derivatives of trigonometric functions; the chain rule; implicit differentiation; differentials; Roll's Theorem; the mean value theorem; the extended mean value theorem; L'Hopital's rule; increasing and decreasing functions; concavity; maximum and minimum values of a function; graphs of functions including rational functions (asymptotes) and functions with vertical tangents (cusps); antiderivatives; the indefinite integral; the definite integral; the fundamental theorem of calculus ; the area under a curve; the area between two curves; transcendental functions: inverse functions, logarithmic and exponential functions; derivatives and integrals; limits (the indeterminate forms); hyperbolic functions and their inverses; inverse trigonometric functions.

0301102 **Calculus-II** **(3 Credit Hours)**
Prerequisite: (0301101)

Techniques of integration: integration by substitution; integration by parts, integrating powers of trigonometric functions, trigonometric substitutions, integrating rational functions, partial fractions, rationalization, miscellaneous substitution; improper integrals; application of definite integral: volumes, length of a plane curve, area of a surface of revolution polar coordinates and parametric equations: polar coordinates, graphs in polar coordinates, area in polar coordinates; infinite series: sequences, infinite series, convergence tests, absolute convergence, conditional convergence; alternating series; power series: Taylor and Maclurine series, differentiation and integration of power series.

and Social Sciences
Prerequisite: (None)

Linear functions: Graphs, solving system of linear functions. Economic applications. Non-linear functions: Quadric, exponential and logarithmic, economic applications. Differentiation: Rules for differentiation, derivatives of exponential and logarithmic functions, optimization, economic applications. Partial derivatives: several variable functions, optimization, Lagrange multipliers. Integration: definite and indefinite. Matrices: Basic properties, inverses, Cramer's rule.

0301131 **Principles of Statistics** **(3 Credit Hours)**
Prerequisite: (None)

Describing statistical data by tables, graphs and numerical measures, Chebychev's inequality and the empirical rule, counting methods, combinations, permutations, elements of probability and random variables, the binomial, the Poisson, and the normal distributions, sampling distributions, elements of testing hypotheses, statistical inference about one and two populations parameters.

0301201 **Calculus-III** **(3 Credit Hours)**
Prerequisite: (0301102)

Three dimensional space and vectors rectangular coordinates in 3-space; spheres, cylindrical surfaces; quadric surfaces; vectors: dot product, projections, cross product, parametric equations of lines. planes in 3-spaces; vector -valued functions: calculus of vector valued functions, change of parameters, arc length, unit tangent and normal vectors, curvature, functions of two or more variable: domain, limits, and continuity; partial derivatives; differentiability; total differentials; the chain rule; the gradient; directional derivatives; tangent planes; normal lines; maxima and minima of functions of two variables; Lagrange multipliers; multiple integrals: double integral, double integrals in polar coordinates; triple integrals; triple integrals in cylindrical and spherical coordinates; change of variables in multiple integrals; Jacobian .

0301202 **Engineering Mathematics-I** **(3 Credit Hours)**
Prerequisite: (0301201)

Ordinary differential equations, linear differential equations of second and higher order, systems of differential equations, phase plane, stability, series solutions of differential equations, orthogonal functions, Laplace transforms, linear systems of equations, matrices and determinants.

Prerequisite: (0301102)

Logic: axioms and theorems, negations, quantifiers. Algebra of sets: union, intersection, symmetric difference, difference, complement. Functions: domain and range, different classes of functions including 1-1 and onto, graph of a function. Relations on sets: equivalence relations and equivalence classes, partial order relation, total order relation. Cardinality of sets: finite sets, countable sets, uncountable sets.

0101212 **Real Analysis** **(3 Credit Hours)**
Prerequisite: (0301211)

The completeness property of R. The archimedean principle in R. Limit of a sequence. convergent sequences. Monotone and bounded sequences. Cauchy sequences. Subsequences and limit points. Bolzano--Weierstrass Theorem. Open sets , closed sets, bounded sets and compact sets in R. Limits of real valued functions. Definition of limits by neighborhoods. Definition of limits by sequences. Continuous functions on R. Sequence definition and neighborhood definition of continuity. Boundedness of continuous functions on compact intervals. The extreme value theorem. The intermediate value theorem. Uniformly continuous functions. The sequencial criterion for uniform continuity. The derivative of functions. Rolles Theorem Mean value theorem. Generalized Mean value theorem. Taylor Theorem with remainder. L' Hospital's rule.

0301221 **Ordinary Differential Equations-I** **(3 Credit Hours)**
Prerequisite: (030102)

Solutions of differential equations (first order, second order, and higher orders) with applications to mechanics and physics, series solutions, Laplace transform method.

0301241 **Linear Algebra-I** **(3 Credit Hours)**
Prerequisite: (0301101)

Systems of linear equations; matrices and matrix operations; homogeneous and nonhomogeneous systems; Gaussian elimination; elementary matrices and a method for finding A^{-1}; 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.

Prerequisite: (0301211)

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

0341271 **Principles of Optimization** **(3 Credit Hours)**
Prerequisite: (0301241)

Optimization methods and techniques for solving problems in business, engineering, sciences, sports, and several other areas. Introduction to linear optimization, integer linear optimization and network optimization. Model formulation, solution techniques and algorithms, and the use of modeling softwares.

0331301 **Advanced Calculus** **(3 Credit Hours)**
Prerequisite: (0301201)

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

0331302 **Engineering Mathematics-II** **(3 Credit Hours)**
Prerequisite (0301202)

Vector differential calculus, line and surface integrals, integral theorems, Fourier series, Fourier integrals, Fourier transforms, partial differential equations.

0331311 **Mathematical Analysis-I** **(3 Credit Hours)**
Prerequisite: (0331212)

Functions of bounded variation on [a,b]. Continuous functions of bounded variation. Riemann integral ,the definition. Existence of Riemann integral. Basic properties of Riemann integral. Classes of Riemann integrable functions (step functions, continuous functions, monotone functions). Mean value theorems for Riemann integral. Fundamental theorem of calculus. The Riemann-Stieltjes integral,the definition. Basic properties of R-S integral. Integration by parts. Continuous functions and the R-S integral. Monotone functions and the R-S integral. Mean value theorems for R-S integral. The fundamental theorem for R-S integral. Linear transformations on R^n and their matrix representation(fast revision). Functions from R^n to R^m (basic setup and examples). The derivative of vector valued functions of several variables,The definition. directional derivatives. Differentiability implies continuity. Partial derivatives. Matrix representation of the derivative. The gradiant and its properties. The chain rule. The mean value theorem. Higher order derivatives (the second). Inverse and implicit mapping theorems (statements). Taylor series in two variables.

0331321 **Partial Differential Equations-I** **(3 Credit Hours)**
Prerequisite: (0301221)

Classification; some physical models (heat, wave, Laplace equations); separation of variables; Sturm-Liouville BVP; Fourier series, integrals and transforms; Homogeneous and nonhomogeneous problems, Infinite domain problems, BVP involving rectangular and circular regions; special functions (Bessel and Legendre); BVP involving cylindrical and spherical regions.

0341332 **Statistical Techniques** **(3 Credit Hours)**
Prerequisite: (0301131)

Simple and multiple regression, correlation coefficient, the analysis of variance of one and two-factor experiments, the Latin squares, Chi square test for homogeneity, independences, and goodness of fit, non-parametric statistics: the sign test, Wilcoxon rank sum test, Wilcoxon signed rank test, and Mann-Whiteny test, Spearman correlation coefficient.

0301333 **Probability Theory** **(3 Credit Hours)**
Prerequisite: (0301201)

Distributions of random variables; conditional probability and stochastic independence; some special distributions (discrete and continuous distributions); univariate, bivariate and multivariate distributions; distributions of functions of random variables (distribution function method, moment generating function method, and the Jacobian transformation method); limiting distributions.

0331334 **Stochastic Processes** **(3 Credit Hours)**
Prerequisite: (0301333)

Markov chains, transition probability, classification of states, branching and queueing chains, stationary distributions of Markov chain, Markov pure jump processes; second order processes, mean and covariance functions, Gaussian Process and Wiener process.

0341336 **Design and Analysis of Experiments** **(3 Credit Hours)**
Prerequisite: (0301333)

Basic ideas and tools for good experimentation: Randomization, Blocking and Replication. One way completely randomized design for fixed / random effects experiments. Analysis of Variance, Comparison of Multiple Treatment Means and the Generalized Type I error rate. Orthogonal contrasts. Simple Linear regression and The Analysis of covariance. Hierarchical (nested) designs. Randomized Complete and Incomplete Block Designs. Latin square and Cross

0301338 **Applied Probability** **(3 Credit Hours)**
Prerequisite: (0301333)

Revision of probability distributions, queueing theory, reliability theory, quality control and acceptance sampling, information theory and coding.

0331341 **Modern Algebra-I** **(3 Credit Hours)**
Prerequisite: (0301211)

Groups and subgroups; cyclic groups; permutation groups; isomophisms of groups; direct product of groups; cosets, and Lagranges theorem; normal subgroups and factor groups; homomorphisms of groups; the first isomorphism theorems

0301342 **Number Theory** **(3 Credit Hours)**
Prerequisite: (0301211)

Division algorithm; divisibility; greatest common divisor and least common multiple; Diophentine equations; prime numbers and their distribution; fundamental theorem of arithmetic; congruence; linear congruence equations; Chinese remainder theorem; tests of divisibility. Fermat little theorem; Wilson's theorem; arithmetic functions; cryptography as an application of number theory.

0301361 **General Topology-I** **(3 Credit Hours)**
Prerequisite: (0331212)

Topological spaces; open sets; boundary; interior; accumulation points; topologies induced by functions; subspace topology; bases and subbases; finite products; continuous functions; open and closed functions homeomorphisms; separation axioms; countability axioms; metric spaces, connectedness and compactness.

0301371 **Mathematical Programming** **(3 Credit Hours)**
Prerequisite: (0301241)

Formulation of linear problems; the simplex method; the geometry of the simplex method; duality in linear programming; the dual simplex method; sensitivity analysis; introduction to graphs; network flows.

0301381 **Teaching Mathematics** **(3 Credit Hours)**
Prerequisite: (0331301)

Nature of mathematics; mathematics curriculum; learning mathematics; teaching strategies; teaching mathematical concepts; principles and generalizations; algorithms and skills; teaching problem solving; proofs; planning for effective teaching evaluation.

0301411 **Mathematical Analysis-II** **(3 Credit Hours)**
Prerequisite: (0331311)

Liminf and limsup of sequences of real numbers. The definition using limit points. Basic properties of liminf and limsup. Series of real numbers: the definition and the algebraic properties. Convergence: the definition and the basic properties. Absolute and conditional convergence. Tests of absolute convergence (the general form: using liminf, and limsup.) (Ratio, nth root and comparison tests) Rearrangements of series. Abel test. Dirichlet test. Cesaro summablilty. Infinite product and its relation to infinite series. Sequences of functions, the definition and examples. Pointwise convergence. Uniform convergence. Uniform convergence and continuity on [a,b]. Uniform convergence and integrabilty on [a,b]. Uniform convergence of sequences of derivatives. Dini's Theorem. Uniform convergence and interchange limit theorems. Series of functions: definition and basic properties. Pointwise and uniform convergence of series of functions. Weierstrass M-test. Uniformly convergent series of continous functions. Uniformly convergent series of integrable functions. Interchange of summation and integration. The space C[a,b],the definition, metric and algebraic properties. The Weierstrass approximation theorem. Improper integral: Kinds of improper integral. Tests of convergence of improper integrals. Examples of functions represented by improper integral. (Gamma function, Beta function, Laplace transform)

Prerequisite: (0331212)

The structure of complex numbers (modulus, conjugate, polar form, roots, regions). Complex valued functions. (examples, limits, continuity). The derivative of a complex valued function. Formulas for differentiation. Cauchy -Riemann equations. Analytic functions (definition and basic properties). Harmonic functions (definition and basic properties). Elementary complex valued functions (exponential, trigonometric, hyperbolic, and logarithmic functions: their definitions and basic properties and inverse functions). Branches of logarithmic functions. Contours and contour integration. The Cauchy-Goursat theorem. Simply and multiply connected regions. The Cauchy integral formula. Morera's Theorem. Maximum modulus principle. Entire functions and Liouville's theorem. The fundamental theorem of algebra. Sequences and series of complex numbers (limits, convergence) Taylor series Laurent series. Absolute and uniform convergence of power series. Integration and differentiation of power series. Series representations of analytic functions on regions. Residues and Residue theorem. Poles. Residues at poles. Computations of residues. Improper integrals of the form $\int_0^{\infty} f(z)dz$

0301413 **Basics in Functional Analysis** **(3 Credit Hours)**
Prerequisite: (0301212)

Norms on vector spaces. Examples of norms. Relation between norm and metric on vector spaces. Equivalent norms. Sequences in Normed spaces. Convergence of sequences in Normed spaces (strong convergence). Complete Normed spaces. Examples of complete Normed spaces. Finite dimensional Normed spaces. Compactness of the unit ball in Normed spaces. Linear operators on Normed spaces. Continuous linear operators. Bounded linear operators. Norms on Bounded linear operators.

0331421 **Ordinary Differential Equations-II** **(3 Credit Hours)**
Prerequisite: (0301221)

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.

0331422 **Partial Differential Equations-II** **(3 Credit Hours)**
Prerequisite: (0331221)

First order differential equation in two independent variables; semilinear and quasilinear equations; first order non-linear equations; second order linear equations; canonical forms; Green's function method; transforms method.

0301424 **Special Functions** **(3 Credit Hours)**
Prerequisite: (0301221)

Series solutions of differential equations. Gamma and Beta functions, Legendre polynomials and functions, Bessel functions, Hermite and Laguerre polynomials, Chebyshev polynomials, Hyper geometric functions. Other special functions. Hyper-geometric functions. Other special functions.

0331431 **Mathematical Statistics** **(3 Credit Hours)**
Prerequisite: (0301333)

Estimation: point estimation, confidence interval; statistical test: Neyman-Pearson Theorem, UMP test; likelihood ratio tests, chi-square tests, SPRT; non -parametric methods; Sufficient statistics and its properties; complete statistics exponential family; Fisher Information and the Rao-Cramer inequality.

0331432 **Time Series** **(3 Credit Hours)**
Prerequisite: (0301333)

Descriptive techniques; types of variations: trend, cycle and seasonal fluctuations, autocorrelation; probability models for time series; stationary processes; autocorrelation function; estimation in time domain; fitting an autoregressive process; fitting a moving average process; forecasting; box and Jenkin`s methods; stationary processes in the frequency domain; spectral analysis.

0301441 **Linear Algebra-II** **(3 Credit Hours)**
Prerequisite: (0301241)

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.

0331442 **Modern Algebra-II** **(3 Credit Hours)**
Prerequisite: (0331341)

Rings, subrings, integral domains, factor rings and ideals. Ring homomorphisms; polynomial rings; factorization of polynomials; reducibility and irreducibility tests; divisibility in integral domains; principal ideal domains and unique factorization domains.

0331443 **Combinatorial Analysis** **(3 Credit Hours)**
Prerequisite: (0301241)

Principles of enumeration; finite difference calculus; generating function; principles of inclusion and exclusion; introduction to the theory of graphs; circuits and graph coloring; trees, Euleran and Hamiltonian Graphs.

0301444 **Matrix Theory** **(3 Credit Hours)**
Prerequisite: (0301241)

Kronecker product of matrices; matrix functions; matrix equations, matrix differential equations; eigenvalues and eigenvectors; the characteristic polynomial; the minimal polynomial; Cayley-Hamilton theorem; canonical forms; Gershgorin's discs; strictly diagonally dominant matrices; Hermitian and unitary matrices; Schur's triangularization theorem; the spectral theorem for normal matrices; positive semidefinite matrices; quadratic forms; the polar decomposition and the singular value decomposition; the Moore-Penrose generalized inverse; matrix norms; QR factorization.

0301445 **Graph Theory** **(3 Credit Hours)**
Prerequisite: (0301241)

Definition of graphs multigraphs and digraphs. Examples on graphs multigraphs and digraphs. Important type of graphs such as: Complete Graphs, Null Graphs, Paths, Cycles, Wheels, Bipartite Graphs, Complete Bipartite Graphs, Hypercubes and Trees. Operations on graphs such as: Complement of a graph, Union of two graphs, Join of two graphs, Cartesian product of two graphs. Subgraphs and Induced Subgraphs. Isomorphisms, Adjacency and Incidence Matrices. Connected Graphs, Eulerian Graphs, and Hamiltonian Graphs. Planar Graph and Crossing number. Domination number, Clique number, Chromatic number, and Independence number. Matchings and Hall's marriage theorem. Applications such as: Network Flow Problem, Four Color Problem, Traveling Salesman Problem, and Minimum Connector Problem. (If time permit)

0301446 **Cryptography Theory** **(3 Credit Hours)**
Prerequisite: (0301342)

Classical Cryptosystems such as: Shift ciphers, Affine ciphers, The Vigen`ere cipher, Substitution ciphers, The Playfair cipher, ADFGX cipher, and Block ciphers. One time pad, Pseudo-Random Bit Generation, and Linear feedback shift register. World War II ciphers such as: Enigma and Lorenz. Public key cryptosystems, The RSA, Primality testing and attack on RSA, The AlGamal Public key cryptosystem. Symmetric block cipher systems such as: DES and Rijndael. Digital Signatures such as: RSA signatures, The AlGamal signature scheme, and Hash functions. Elliptic curves and elliptic curves cryptosystems. (If time permit)

0301451 **Foundations of Mathematics** **(3 Credit Hours)**
Prerequisite: (0301211)

Introduction and paradoxes; axioms of set theory; equivalence relations and functions; partially ordered classes; lattices; well-ordered classes; the axiom of choice and related principles; Dedekind cuts; cardinals and ordinals.

0331461 **Non- Euclidean Geometry** **(3 Credit Hours)**
Prerequisite: (0331261)

Study of the parallel postulate and some of its equivalent statements. Hyperbolic geometry and some related theorems. Elliptic geometry and some related theorems. Spherical geometry.

0331462 **General Topology-II** **(3 Credit Hours)**
Prerequisite: (0331361)

Separation axioms T_2, T_3, T_4 and some examples and theorems related to them. Compact spaces and some related theorems, Connected spaces and some related theorems. Metric spaces and some related examples and theorems. Sequences and their convergence in topological spaces.

0301471 **Methods in Applied Mathematics** **(3 Credit Hours)**
Prerequisite: (0331412)

Integral equations; integral transforms; asymptotic techniques: algebraic equations and integrals; complex analytic methods: conformal mapping and harmonic analysis.

0301472 **Numerical Methods** **(3 Credit Hours)**
Prerequisite: (0331302)

Numerical analysis; numerical methods in linear algebra; numerical methods for ordinary and partial differential equations.

Prerequisite: (0331301)

Mathematica package is 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. The selected topics can cover a wide range of mathematical topics such as geometry, calculus, linear algebra, linear programming, differential equations, probability, statistics, number theory, Fourier and Laplace transforms. The course starts with training on using the package and ends with writing Mathematica programs to solve some specific Mathematical problems.

0301481 **History of Mathematics** **(3 Credit Hours)**

Prerequisite: (0331301)

Evolution of some mathematical concepts, facts and algorithms in arithmetic, algebra, trigonometry, Euclidean geometry, analytic geometry and calculus through early civilizations, Egyptians, Babylonians, Greeks, Indians, Chinese, Muslims and Europeans, evolution of solutions of some conjectures and open problems.

الخطة الانتقالية

نظراً لتعديل اسم مادة "الرزم البرمجية في الرياضيات -١" في الخطة الجديدة مع الإبقاء على وصف المادة، فإنه يسمح للطلبة القدامى بتسجيل المادة الجديدة

الخطة الحالية	الخطة الجديدة
٠٣٣١٤٧٣ الرزم البرمجية في الرياضيات -١	٠٣٤١٤٧٣ الرزم البرمجية في الرياضيات