Faculty of Arts and Sciences

Department of Mathematics

Study Plan of the Bachelor's Degree

In Mathematics

Academic Year: 2018/2019

AAU QA

QA Orginal

Vision of the Department:

Entrepreneurship and distinction in the quality of teaching and learning, scientific research and community service at local and regional levels.

Mission of the Department:

Providing local and regional communities with distinguished and qualified graduates.

Objectives of the Department:

1. Preparing professionals in mathematics equipped with mathematical knowledge and scientific skills.
2. Assisting students to deal with mathematical problems and find solutions.
3. Disseminating a mathematics culture as a free critical, and analytical ideology in the university and community.
4. Enhancing the scientific attitudes of students and fostering interest in graduate studies.
5. Providing educational institutions with highly qualified graduates in mathematics through offering training courses and designing clear research plans.
6. Participating effectively in increasing the efficiency of the academic staff in the department through offering training courses and organizing clear research plans.

Intended Learning Outcomes (ILOs):

1. Student should acquire skills of solving problems and conclusions.
2. Student should learn how to get information through conclusion and mathematical elicitation.
3. Student should know the development in mathematics and roles of Arab and Muslim scientists in this development.
4. Student should apply all methods that are convenient for learning mathematics.
5. Student should be able to understand using proofs in mathematics.
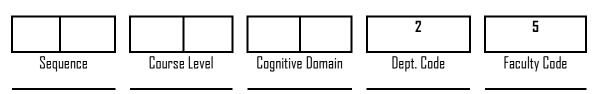6. Student should be able to solve mathematical problem through computers.

Framework

Framework of the Bachelor's Degree in Mathematics   (132   Cr. Hrs.)

Sequence	Classification	Credit Hours	Percent %
1st	University Requirements	27	20.45%
2nd	Faculty Requirements	21	15.91%
3rd	Department Requirements	69	52.27%
4th	Elective Requirements	9	6.82%
5th	Ancillary Courses	6	4.55%
Total		132	100%

Course Numbering

Sequence	Course Level	Cognitive Domain	2	5
			Dept. Code	Faculty Code

Cognitive Domains

Number	Cognitive Domain	Credit Hours
0	Pure Mathematics	30
1	Applied Mathematics	18
2	statistics and probability	9
3	Knowledge Field	9
4	Practical Materials	3
5	Ancillary Courses	6

1.   University Requirements: (27 Credit Hours)

A. **Compulsory Requirements:** (15 Credit Hours)

Course No.	Course Title	Cr. Hr.
55011102	Arabic Language (1)	3
55011103	English Language (1)	3
55011107	National Education	3
55011308	Military Sciences	3
55011110	Computer Skills	3
Total		**15**

B. **Elective Requirements**: (12 Credit Hours**) from the following list:**

Course No.	Course Title	Cr. Hr.	Prerequisite
55021101	Arabic Language (2)	3	55011101
55021102	English Language (2)	3	55011102
55021203	Principles of Psychology	3	-
55021204	Human Rights	3	-
55041203	Environment and Community	3	-
55011306	Entrepreneurship and Creativity	3	
55011204	Life Skills	3	-
55031101	Islamic Culture	3	-
55031205	Quds and Hashemite Custodianship	3	-
55041206	Health and Community	3	-
55041307	Communication and Internet	3	-
Total		**12**	

2. Faculty Requirements: (21 Credit Hours)

A. Compulsory Requirements: (21 Credit Hours)

Course No.	Course Title	Cr. hr.	Theoretical	Practical	Prerequisite
52011104	Calculus 1	3	3	-	None
52011202	Calculus 2	3	3	-	52011104
52011205	Principles of Mathematics	3	3	-	52011202
52031129	Statistics and Probabilities	3	3	-	None
52041233	History of Mathematics	3	3	-	None
71051103	General Chemistry	3	3	-	None
52012106	Linear Algebra 1	3	3	-	52011202
Total		**21**	**21**	**0**	

3. Department Requirements (78 Credit Hours)

A. Compulsory Requirements: (69 Credit Hours)

Course No.	Course Title	Cr. hr.	Theoretical	Practical	Prerequisite
52012110	Calculus 3	3	3	-	52011202
52012207	Numbers Theory	3	3	-	52011205
52013108	Mathematical Analysis 1	3	3	-	52011205
52013209	Mathematical Analysis 2	3	3	-	52013208
52014114	Complex Analysis	3	3	-	52012110 52011205
52013215	Topology 1	3	3	-	52013108

52013116	Modern Euclidean Geometry	3	3	-	52011205
52014117	Modern Algebra 1	3	3	-	52012207
52014214	Modern Algebra 2	3	3	-	52014117
52014219	Graph Theory	3	3	-	52011205
52022218	Ordinary Differential Equations 1	3	3	-	52011202
52023119	Ordinary Differential Equations 2	3	3	-	52022218
52023223	Partial Differential Equations	3	3	-	52023119
20231215	Numerical Analysis 1	3	3	-	52022218
52023225	Mathematical modeling	3	3	-	52023119
52022120	Fundamentals of Applied Mathematics	3	3	-	52011202
52032130	Probability Theory	3	3	-	52031129
52032231	Applied Statistics	3	3	-	52031129
52034132	Mathematical Statistics	3	3	-	52032130
52042134	Mathematics Teaching Methods	3	3	-	None
52042235	Mathematics Curriculum Planning	3	3	-	None
52043136	Analysis and Evaluation of Mathematics Curriculum	3	3	-	None
52054139	School Training	3	-	3	52042134 52042235
Total		**69**	**66**	**3**	

B. **Elective Requirements:** (9 Credit Hours)

Course No.	Course Title	Cr. hr.	Theoretical	Practical	Prerequisite
52012205	Advanced Calculus	3	3	-	52012110
52012215	Linear Algebra 2	3	3	-	52012106
52023222	Numerical Analysis 2	3	3	-	52023121
52013206	Non-Euclidean Geometry	3	3	-	52013116
52014218	Topology 2	3	3	-	52013215
52023228	Special functions	3	3	-	52023223
52033133	Sampling Methods	3	3	-	52031129
52033234	Design and Analysis of Experiments	3	3	-	52031129
52043137	Principles of Scientific Research	3	3	-	None
52043138	Principles of Measurement and Evaluation	3	3	-	None
Total		**30**	**30**	**0**	

4. **Ancillary Courses** (6 Credit Hours):

Course No.	Course Title	Cr. hr.	Theoretical	Practical	Prerequisite
42041108	General Physics 1	3	3	0	None
62011101	General Chemistry 1	3	3	0	None
Total		**6**	**6**	**0**	

Advisory Study Plan for the Bachelor's Degree in

First Year				
First Semester				
Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
52011104	Calculus 1	3	None	
52031129	Principle of Statistics and Probability	3	None	
62011101	General Physics 1	3	None	
71051103	General Chemistry 1	3	None	
	University Requirement	3		
	University Requirement	3		
Total		**18**		

Second Semester				
Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
52011202	Calculus 2	3	Calculus 1	
52011205	Principles of Mathematics	3	Calculus 2	Calculus 2
52041233	History of Mathematics	3	None	
	University Requirement	3		
	University Requirement	3		
	University Requirement	3		
Total		**18**		

Second Year				
First Semester				
Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
52012110	Calculus 3	3	Calculus 2	
52012106	Linear Algebra 1	3	Calculus 2	
52032130	Probability Theory	3	Principle of Statistics and Probability	
52022120	Fundamentals of Applied Mathematics	3	Calculus 2	
52042134	Mathematics Teaching Methods	3	None	
	University Requirement	3		
Total		18		

Second Semester				
Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
52022218	Ordinary Differential Equations 1	3	Calculus 2	
52012207	Number Theory	3	Principles of Mathematics	
52032231	Applied Statistics	3	Principle of Statistics and Probability	
42041108	Principle of information technology	3	None	
52042235	Mathematics Curriculum Planning	3	None	
	University Requirement	3		
Total		18		

Third Year				
First Semester				
Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
52013108	Mathematical Analysis 1	3	Principle of Mathematics	
52013116	Modern Euclidean Geometry	3	Principles of Mathematics	
52023121	Numerical Analysis 1	3	Ordinary differential Equations 1	
52023119	Ordinary differential Equations 2	3	Ordinary differential Equations 1	
52043136	Analysis and Evaluation of Mathematics Curriculum	3	None	
	University Requirement	3		
Total		**18**		

Second Semester				
Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
52023225	Mathematical modeling	3	Ordinary differential Equations 2	
52013209	Mathematical Analysis 2	3	Mathematical Analysis 1	
52023223	Partial Differential Equations	3	Ordinary differential Equations 2	
52013215	Topology 1	3	Mathematical Analysis 1	
	University Requirement	3		
	Department Requirements	3		
Total		**18**		

Fourth Year				
First Semester				
Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
52014114	Complex Analysis	3	Principles of Mathematics Or Calculus 2	
52014117	Modern Algebra 1	3	Number Theory	
52034132	Mathematical statistics	3	Probability Theory	
52054139	School Training	3	Mathematics Teaching Methods or Mathematics Curriculum Planning	
Total		12		

Second Semester				
Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
52014214	Modern Algebra 2	3	Modern Algebra 1	
52014219	Graph Theory	3	Principles of Mathematics	
	Elective Requirements	3		
	Elective Requirements	3		
Total		12		

Description of Courses offered by the

52011104   Calculus (1)   3 Credit Hours   Prerequisite: None

Limits and continuity of functions at a point and on interval, derivatives, techniques of differentiation, chain rule, implicit differentiation, Derivatives of exponential functions, derivatives of logarithmic functions, derivatives of trigonometric functions, equations of the tangent and normal, L'Hospital theorem, extreme values of functions, increasing and decreasing, concavity, maximum and minimum values, graphs of functions, integration, techniques of integration.

52011202   Calculus (2)   3 Credit Hours   Prerequisite: Calculus (1)

Techniques of integration, integration by substitution, integration by parts, trigonometric integrals, trigonometric substitutions, integration by partial fractions, area of a surface, volumes of revolution , length of a plane curve, improper integrals, polar coordinates, Series and sequences, convergence and divergence, absolute convergence and conditional convergence, alternating series, power series, Taylor and Maclurine series, differentiation and integration of power series.

52012110   Calculus (3)   3 Credit Hours   Prerequisite: Calculus (2)

Three dimensional space and vectors, cylindrical surfaces, quadric surfaces, vectors, dot product and cross product, functions of two variables: limits and continuity, differentiability, partial derivatives, integrations: double integrals in rectangular coordinates, double integrals in polar coordinates, triple integrals in rectangular and cylindrical coordinates, multiple integrals.

52012205   Advanced Calculus   3 Credit Hours   Prerequisite: Calculus (3)

double and triple integrals over general regions, double and Multiple Integrals: double Integrals, triple Integrals, triple integrals in polar coordinates, triple integrals in cylindrical coordinates, surface area, area and volume
 Line integrals: vector fields, line integrals of vector fields, fundamental theorem for line integrals, curl revisited. and divergence, Green's theorem, Stokes theorem.

52011205   Principles of Mathematics   3 Credit Hours   Prerequisite: Calculus (2)

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.

52012106   Linear Algebra (1)   3 Credit Hours   Prerequisite: Calculus (2)

Matrices and matrix operations, transpose and inverse of a matrix, determinants and their properties, vector spaces and subspaces, linearly independent and linearly dependent, row space and column space, null space of a matrix, inner product space, system of linear equations, methods of solving system of linear equations.

52012215   Linear Algebra (2)   3 Credit Hours   Prerequisite: Linear Algebra (1)

Vector Spaces, quotient spaces, linear independence and bases, dual spaces, inner product spaces, matrix of a linear transformation, matrix representation, change of basis and similarity, forms of linear transformations.

52012207   Number Theory   3 Credit Hours   Prerequisite: Principles of Mathematics

Division algorithm, divisibility, greatest common divisor and least common multiple, prime numbers and their distribution, Diophentine equations, fundamental theorem of arithmetic, linear congruence equations, tests of divisibility, remainder theorem, application of number theory.

52013112   Modern Euclidean Geometry   3 Credit Hours   Prerequisite: Principles of Mathematics

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.

52013206   Non-Euclidean Geometry   3 Credit Hours   Prerequisite: Modern Euclidean Geometry

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.

52014117   Modern Algebra (1)   3 Credit Hours   Prerequisite: Number Theory

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

52014214   Modern Algebra (2)   3 Credit Hours   Prerequisite: Modern Algebra (1)

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.

52013215   Topology (1)   3 Credit Hours   Prerequisite: Mathematical Analysis (1)

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.

52014218   Topology (2)   3 Credit Hours   Prerequisite: Topology (1)

Separation axioms T2, T3, T4 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.

52013108   Mathematical Analysis (1)   3 Credit Hours   Prerequisite: Principles of Mathematics

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 sequential 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.

52013209   Mathematical Analysis (2)   3 Credit Hours   Prerequisite: Mathematical Analysis (1)

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 Rm (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.

52014114   Complexl Analysis   3 Credit Hours   Prerequisite: Principles of Mathematics or Calculus 3

Complex numbers system, analytic functions (exponential and logarithmic functions, trigonometric and hyperbolic functions), exponential form: powers and roots, Cauchy theorem, Cauchy integral formula, Series and sequence, residue theorem with applications.

52014219   Graph Theory   3 Credit Hours   Prerequisite: Principles of Mathematics

Fundamental concepts of graphs and digraphs, trees, matchings, factorizations, connectivity, networks, graph colorings, planar graphs, Eulerian and Hamiltonian graphs, etc.

52022218   Ordinary Differential Equations (1)   3 Credit Hours   Prerequisite: Calculus 2

Solutions of first order differential equations with applications, solutions of second order differential equations with applications, systems of differential equations, series solutions, Laplace transform.

52023119   Ordinary Differential Equations (2)   3 Credit Hours   Prerequisite: Ordinary Differential Equations (1)

Existence and uniqueness theory to ordinary differential equations, systems ordinary equations, Frobenius method to solve ordinary differential equations, Stability Theory to non linear ordinary differential equations, etc.

52023223   Partial Differential Equations   3 Credit Hours   Prerequisite: Ordinary Differential Equations (2)

Some physical models: Heat and wave equations, Laplace equations, Fourier series, solutions of PDE's by Fourier and Laplace transform, separation of variables, equations involving rectangles and circles, systems of first order PDE's, existence and uniqueness.

52023121   Numerical Analysis (1)   3 Credit Hours   Prerequisite: Ordinary Differential Equations (1)

Elementary introduction to numerical analysis, linear and nonlinear equations, numerical methods for linear problems which do not contain exact solutions or too difficult to solve analytically, error analysis, solutions of nonlinear problems: Fixed-point iteration, Taylor polynomial, Bisection method, Newton-Raphson method, etc.

52023222   Numerical Analysis (2)   3 Credit Hours   Prerequisite: Numerical Analysis (1)

Review of properties and the numerical methods, advance methods for solving nonlinear equations, representation of numbers and analysis of errors, solution of systems of linear equations: Lagrange polynomials, Newton polynomials, etc., numerical differentiation, numerical integration.

52022120   Fundamentals of Applied Mathematics   3 Credit Hours   Prerequisite: Calculus (2)

Taylor and power series, Fourier sine and cosine series, discrete Fourier transform, continuous Fourier transform, Laplace series, Laplace transform, Z-transform, applications.

52022225   Mathematical modeling   3 Credit Hours   Prerequisite: Ordinary Differential Equations (2)

Compartmental models, growth and decay of a single population, interacting populations, phase plane, linear and non-linear analysis, extended population models, act.

52023228   Special functions   3 Credit Hours   Prerequisite: Partial Differential Equations

function, relation between Gamma and Beta Error and complementary error functions, Gamma function, Beta functions, applications, Bessel functions, Bessel's differential equation, Euler function, Legendre function, etc.

52031129   Principle of Statistics and Probability   3 Credit Hours   Prerequisite: Calculus (2)

Describing Statistical Data by tables, graphs and numerical Measures, Measures of Central Tendency and Deviation, Counting methods, The Variance, binomial and Normal distribution, probabilities Laws, Random Variables, Sampling distributions, testing of statistical hypotheses for two populations, correlation and regression, correlation coefficient.

52032130   Probability Theory   3 Credit Hours   Prerequisite: Principle of Statistics and Probability

Random variables, statistical distributions, randomized experiments, principles of probability, conditional probability, Bayes theorem, expected value of a discrete random variable, probability distributions, inferential statistics, null and alternative hypothesis, test function, power of the test, etc.

52032231   Applied Statistics   3 Credit Hours   Prerequisite: Principle of Statistics and Probability

Estimation (Point and Interval), Elements of Testing Hypotheses (one-Tail Test, Two-Tail Test), Statistical Inference about one and two Populations Parameters.

52034132   Mathematical Statistics   3 Credit Hours   Prerequisite: Probability Theory

basic probability theory, discrete, continuous, and mixed random variables, expected values, moments, univariate probability distributions including the hypergeometric distribution, Bernoulli and binomial distributions, geometric and negative binomial distributions, Poisson distribution, discrete and continuous uniform distributions, exponential and gamma distributions, chi- square distributions, and normal distributions, joint probability

distributions including the multivariate hypergeometric distribution, multinomial distribution, and bivariate normal distribution, covariance and correlation, and conditional probability distributions.

52041233   History of Mathematics   3 Credit Hours   Prerequisite: None

Indians, Muslims and Europeans, Developing of Mathematics through Early Civilization, Babylonians, Egyptians, Greeks, Arithmetic, Algebra, geometry, Trigonometry, Euclidean geometry. Numbers System,

52042134   Mathematics Teaching Methods   3 Credit Hours   Prerequisite: None

Nature of Mathematics, Standards of School Mathematics, Components of Mathematical Knowledge, Planning for Teaching Mathematics, Teaching Mathematical Concepts, Principles and Algorithms, Some Teaching Methods.

52042235   Mathematics Curriculum Planning   3 Credit Hours   Prerequisite: None

Concept of Curriculum Planning, Elements of Planning, Principles of Planning, Types of Planning, The Important of Planning.

52043136   Analysis and Evaluation of Mathematics Curriculum 3 Credit Hours   Prerequisite: None

Concept of Content Analysis, School Curriculum Analysis, Analysis Approaches (Quantitative and qualitative), Analysis Tools, Validity, reliability, Class of Analysis, Developing the Analysis standards of each element of Curriculum and the Evaluation Methods.

52054139   School Training   3 Credit Hours   Prerequisite: Mathematics Teaching Methods or Mathematics Curriculum Planning
Attending class Room session one day a week at Secondary or Essential School, Writing Report about classroom visit by the student, preparing study plan and teaching students, the student should be observed by one of department staff.

62011101   Physics 1   3 Credit Hours   Prerequisite: None

Physics and Measurement, Vectors, Motion in one Dimension, Motion in Two Dimensions, The Laws of Motion, Circular Motion, and other applications of Newton's Laws, Work and Energy, Linear Momentum and Collisions, Rotation of rigid object about a fixed axis, Rolling Motion and angular Momentum, Torque.

42041108   Principle of information technology   3 Credit Hours   Prerequisite: None

This course provides students with knowledge of the terminology, processes, and components associated with information technology, information Systems concepts, components, tools, applications. The course will provide an introductory understanding of computer hardware (units that comprise a computer system), numbering system and knowledge of how data is prepared for computer, instruction processed at a basic machine level, software (operating systems, Database, and web development and applications), introduces the networking,

Internet, and the basics of the information security, in addition to web searching. Students will apply their gained knowledge in a series of assignments.

71051103   General Chemistry (1)   3 Credit Hours   Prerequisite: None
This course covers concepts and principles in general chemistry, chemical calculations, chemical reactions in aqueous solutions, periodic table and electron structure of the atom, chemical bonding types, physical properties of solutions, speed of chemical reactions, equilibrium in chemical solutions.

52033234   Design and Analysis of Experiments   3 Credit Hours   Prerequisite: None

This course covers advanced statistical methods, design and analysis for research, Tools and Terminology of Experience Design: randomization, sectors and experimental replication. Random design, variance analysis, generalized error type 1, orthogonal comparisons, linear regression Designs: random sectors, Latin square, multiple measurements, etc.

52043137   Principles of Scientific Research   3 Credit Hours   Prerequisite: None
This course covers the foundations of the theory of science and epistemology - Research ethics - quantitative research methodology, formulation of research questions, research design, data collection methods and statistical analytical methods - qualitative research orientation/methodology including the formulation of research questions and research design, data collection and analysis methods - critical examination of scientific literature.

52033133   Sampling Methods   3 Credit Hours   Prerequisite: None

Techniques of statistical sampling in finite populations with applications in the analysis of sample survey data. Topics include simple random sampling for means and proportions, stratified sampling, cluster sampling, two-stage sampling, non-response, and categorical data analysis in complex surveys, etc.