King Abdulaziz University
Mathematics Department

Descriptions of Mathematics Courses

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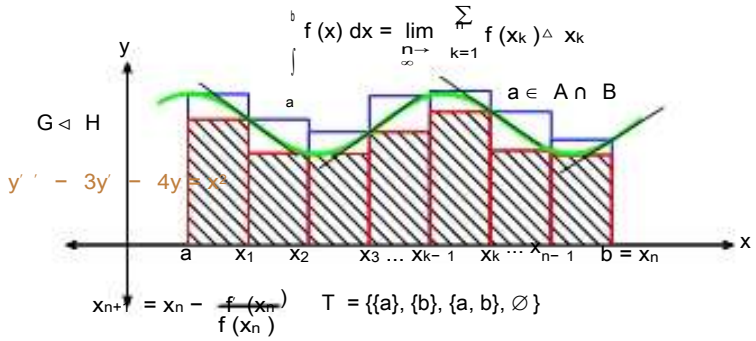

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Calculus I

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
1	MATH 110	Calculus I	3	-	3	-

Objectives of the course

To show the importance of calculus in science and engineering and the correlation between them. To provide the basic principles of calculus and its applications.

To improve the students logical thinking and mathematical skills to solve mathematical problems.

Course description

Basic concepts of algebra: Real number system, exponents, operations on polynomials, and factoring.

Equations and inequalities: Solving first and second degree equations and inequalities .

Line and graphs of second degree equations:

Functions: Definition, ways of representing a function, graph, domain, and range of a function. Types of functions, polynomials, power functions, rational functions, algebraic functions, and trigonometric functions and their identities. Transformations of functions, combinations (algebra) and composition of functions.

The limit of a function: Definition, one-side limit, infinite limits, and vertical asymptote. Limit laws, limits for trigonometric functions, and the squeeze theorem.

Continuity: Continuity at a point, types of discontinuity, continuity on an interval, all theorems of continuity, and the Intermediate Value Theorem.

Limits at infinity: Definition, laws, horizontal asymptote, and infinite limits at infinity.

Derivatives: Definition, interpretations of the derivative as the slope of the tangent and rate of change.

The derivative as a function: Identify the graph of the derivative of a function, notations, and how a function can fail to be differentiable.

Derivatives of polynomials :

The product and quotient rules:

Derivative of trigonometric:

The chain rule:

Implicit differentiation:

Higher derivative:

Some application of differentiation:

The definite integrals: Riemann sum, evaluating integral, and properties of the definite integral. The fundamental theorem of calculus:

Indefinite integrals:

The substitution method:

Main text book

[1] H. Anton, I. Bivens, and S. Davis. Calculus, 8th Edition. John Wiley and Sons, 2005.

Subsidiary Books

[1] James Stewart. Calculus Early Transcendentals, 5th edition. Thomson, 2003.

[2] R. Larson, R. Hostetler, and B. Edwards. Calculus, 7th edition . Houghton Mifflin Company, 2002. [3] H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002.

[4] E. Swokowski, M. Olinic, and D. Pence Calculus, 6th Edition. PWS Publishing Company,1994.

Calculus II

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
2	MATH 202	Calculus II	3	2	4	MATH 110

Objectives of the course

To show the importance of calculus in science and engineering and the correlation between them. To provide the basic principles of calculus and its applications.

To improve the students logical thinking and mathematical skills to solve mathematical problems.

Course description

Inverse Functions: Exponential function. Derivatives and integrations of exponential functions. Inverse functions. Logarithmic Functions. Derivatives and integrations of Logarithmic Functions. Inverse Trigonometric Functions. Hyperbolic Functions. Indeterminate forms and L'Hospital's rule.

Applications of differentiation: Related rates, Linear approximations and differentials. Rolle's Theorem and the Mean Value Theorem. Maximum and minimum values, absolute and local extreme values, the extreme value theorem, Fermat's theorem, critical numbers, finding the absolute extreme of a function on closed interval, and increasing/decreasing test. Concavity and inflection points. Curve sketching of elementary functions. Optimization problems.

Techniques of integration: Integration by part.Trigonometric integrals.Trigonometric substitution. Integration of rational function by partial fractions. Improper Integrals

Application of integration: Areas between curves. Volumes, cross-section methods, disk, and washer methods. Volumes by cylindrical shells. Arc length. Area of a surface of revolution. Work.

Main text book

[1] H. Anton, I. Bivens, and S. Davis. Calculus, 8th Edition. John Wiley and Sons, 2005.

Subsidiary Books

[1] James Stewart. Calculus Early Transcendentals, 5th edition. Thomson, 2003.

[2] R. Larson, R. Hostetler, and B. Edwards. Calculus, 7th edition . Houghton Mifflin Company, 2002. [3] H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002.

[4] E. Swokowski, M. Olinic, and D. Pence Calculus, 6th Edition. PWS Publishing Company,1994.

Calculus III

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
3	MATH 203	Calculus III	3	2	4	MATH 202

Objectives of the course

To show the importance of calculus in science and engineering and the correlation between them. To provide the basic principles of calculus and its applications.

To improve the students logical thinking and mathematical skills to solve mathematical problems.

Course description

Parametric equations and polar coordinates: Curves defined by parametric equations. Calculus with parametric curves,tangents, areas, arc length, and surface area. Polar coordinates, definition, polar curves, symmetry, and tangents to polar curves. Areas and length in polar coordinates. Conic sections. Conic sections in polar coordinates.

Vectors and geometry of space: Three-dimensional coordinate systems. Vectors. The dot product. The cross product. Equations of lines and planes. Cylinders and quadric surfaces. Cylindrical and spherical coordinates.

Partial derivatives: Functions of several variables. Limits and continuity. Partial derivatives. Tangent planes and linear approximations. The chain rule. Directional derivatives and the gradient vector. Maximum and minimum values.Lagrange multiplies.

Multiple integrals: Double integrals over rectangles.Iterated integrals. Double integrals over general regions. Double integrals in polar coordinates. Application of double integrals. Surface Area. Triple integrals. Triple integrals in cylindrical and spherical coordinates. Change of variables in multiple integrals

Main text book

[1] H. Anton, I. Bivens, and S. Davis. Calculus, 8th Edition. John Wiley and Sons, 2005.

Subsidiary Books

[1] James Stewart. Calculus Early Transcendentals, 5th edition. Thomson, 2003.

[2] R. Larson, R. Hostetler, and B. Edwards. Calculus, 7th edition . Houghton Mifflin Company, 2002. [3] H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002.

[4] E. Swokowski, M. Olinic, and D. Pence Calculus, 6th Edition. PWS Publishing Company,1994.

Differential Equations I

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
4	MATH 204	Differential Equations I	3	-	3	MATH 202

Objectives of the course

To introduce the basic concepts of differential equations and their applications in science and engineering. To improve the students logical thinking and skills to solve differential equations problems.

To study first order ordinary differential equations, higher order linear ordinary differential equations, and Laplace transform to obtain solutions.

Course description

Basic concepts and terminology:

Existence and uniqueness theorem:

Methods of solution for first order differential equations: Applications.

Higher order linear ordinary differential: Methods of solution, Cauchy-Euler equation.

Laplace transform : Laplace transform and its applications to linear ordinary differential equations.

Main text book

[1] R. Nagle, E. Saff and A. Snider. Fundamentals of Differential Equations and boundery value problems. Addision-Wesley, 2000.

Subsidiary Books

[1] S. L. Ross. Introduction to Ordinary Differential Equations. John Wiley, New York 1998. [2]

M. R. Spiegel. Applied Differential Equations . Prentice Hall, Inc., New Jersey, 1981. [3] D. A.

Marcus. Differential Equations: An introduction. WCB Pub. Com., 1991.

[4] W. E. Boyce and R. C. Diprima. Elementary Differential Equations and Boundary Value Problems. John Wiley and sons, Inc. New York, 1997.

[5] D. G. Zill. A First Course in Differential Equations. PWS. Kent Pub. Com., 1993.

[6] D. Rainville and P. E. Bedient. Elementary Differential Equations. MacMillan Publishing Co., Inc., New York, 1995.

[7] E. Kreyszig. Advanced Engeering Mathematics, 7th Edition. John Wiley and sons, New York, 1993.

Linear Algebra

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
5	MATH 241	Linear Algebra	3	-	3	MATH 202

Objectives of the course

To introduce the basic topics of linear algebra such as matrices, vector spaces, linear transformations, bases and dimension.

To develop the students skills to solve linear equations in variables. To

teach how to find eigenvalues and eigenvectors.

Course description

Introduction to systems of linear equations: Gaussian elimination and Gauss-Jordan elimination for solving equations

Matrices: Operations on matrices, properties of matrix operations, inverse of a matrix.

Determinant of a matrix: Elementary row operations, properties of determinants, Cramer's rule.

Vector spaces: Subspaces, linear combinations, linear independence, bases and dimensions.

Rank of a matrix: The coordinates, change of bases

Linear transformations: Kernel, range, nullity of a linear transformation, linear transformations and matrices, symmetric matrices.

Eigenvectors : Introduction to eigenvalues, eigenvectors and eigenspaces .

Main text book

[1] R. Larson, and B.Edwards Elementary Linear Algebra, 5th Edition . D.H. Heath and Company, 2004.

Subsidiary Books

[1] David C. Lay. Linear Algebra and its Applications. Addison Wesley, 2003. [2]

H. Anton. Elementary Linear Algebra . John Wiley 2001.

[3] S. Lipschutz. Theory and problems of Linear Algebra. Schaum's Outline Series, 2000.

Fundamentals of Mathematics

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
6	MATH 251	Fundamentals of Mathematics	3	-	3	MATH 101

Objectives of the course

To introduce the fundamentals concepts of mathematics.

To develop the skills to understand the logical and abstract concepts of contemporary mathematics. To develop the techniques to understand mathematical hypotheses, theorems, and proofs.

Course description

Logical statements: Symbols, notations, methods of proof, truth tables, quantifiers.

Sets: Basic operations on sets, De Morgan's laws.

Relations: Equivalence relations, equivalence classes, partial ordering.

Functions: Types of functions, composition of functions, graphs, inverse functions.

Binary operations: Types and examples.

The division algorithms: The greatest common divisor, Euclidean algorithms.

Mathematical induction:

Main text book

[1] P. Fletcher, H. Hoyle, and C. Patty Foundations of Discrete Mathematics. PWS-Cant Pub. Co., 1991.

Subsidiary Books

[1] K. h. Rosen. Discrete Mathematics and its Applications, 5th Edition . McGraw-Hill, 2004.

[2] R. Johnsonburg. Discrete Mathematics, 6th Edition . Prentice Hall 2004.

[3] K. Devlin. Sets, Functions and Logic. Chapman and Hall, 1995.

[4] S. Epp. Discrete Mathematics with Applications. PWS-Cant Pub. Co., 1990.

[5] S. Lipschutz. Set Theory and Related Topics. Schaum's Outline Series, 1998.

[6] L. Lesniak. Discrete Structures, Logic, and Computability. Jones and Bartlett Publishers, 2002.

Geometry

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
7	MATH 261	Geometry	3	-	3	MATH 251

Objectives of the course

To introduce the fundamentals concepts of mathematics. To improve the students logical thinking and imagination. To review the basic concepts of plane geometry.

Course description

Definitions of geometric terms:
Congruence of Triangles:
Perpendicularity in space geometry:
Parallelism in space:
Parallels and parallelograms:

Similar Triangles:
Area,Perimeter and Circumference:
Surface area and Volume:

Main text book

[1] H.Lewis Geometry a contemporary course, 4th Edition. McCormick-Mathers Publishing co., 1978.

Subsidiary Books

[1] C.Wylie,JR Foundation of Geometry . McGraw-Hill co., .

Series and Vector Calculus

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
8	MATH 304	Series and Vector Calculus	3	2	4	MATH 203

Objectives of the course

To show the importance of calculus in science and engineering and the correlation between them. To provide the basic principles of calculus and its applications.

To improve the students logical thinking and mathematical skills to solve mathematical problems.

Course description

Infinite sequences and series: Sequences, definition, monotone, and bounded. Series, definition, geometric, and telescoping. The integral test, p-series. The comparison tests. Alternating series. Absolute convergence and the ratio and root tests. Power series. Representations of functions as power series. Taylor and Maclaurin series. The Binomials series. Applications of Taylor polynomials.

Vector functions: Vector functions and space curves. Derivatives and integrals of vector functions. Arc length and curvature. Motion in space, velocity and acceleration. Kepler's Laws of Planetary Motion.

Vector calculus: Vector fields. Line integrals. The fundamental theorem for line integrals. Green's theorem. Curl and divergence. Parametric surfaces and their areas. Surface integrals. Stokes' theorem. The divergence theorem

Main text book

[1] H. Anton, I. Bivens, and S. Davis. Calculus, 8th Edition. John Wiley and Sons, 2005.

Subsidiary Books

[1] James Stewart. Calculus Early Transcendentals, 5th edition. Thomson, 2003.

[2] R. Larson, R. Hostetler, and B. Edwards. Calculus, 7th edition . Houghton Mifflin Company, 2002. [3] H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002.

[4] E. Swokowski, M. Olinic, and D. Pence Calculus, 6th Edition. PWS Publishing Company,1994.

Differential Equations II

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
9	MATH 305	Differential Equations II	3	-	3	MATH 204

Objectives of the course

To improve the students logical thinking and skills in solving differential equations problems. To introduce the series solutions method for solving ordinary differential equations.
To introduce the basic concepts of special functions and orthogonal polynomials.

Course description

Series solutions about an ordinary point and a singular point:
The method of Frobenius:
Solution about the point at infinity:
Some special equations with variable coefficients:

Gamma and Beta functions:
Bessel and hypergeometric functions:
Orthogonal polynomials and general properties :
Legender, Hermite and Laguerre polynomials :

Main text book

[1] M. Greenberg. Advanced Engineering Mathematics, 2nd Edition. Prentice Hall, 1998.

Subsidiary Books

[1] R. K. Nagle, E. B. Saff and A. D. Snider Fundamentals of Differential equations and boundary Value Problems. Addison-Wesley Longman, 2000.

[2] A. L. Rabenstein. Introduction to Ordinary Differential Equations. Academic Press.

[3] D. Rainville and P. E. Bedient. Elementary Differential Equations . MacMillan Publishing Co., Inc., New York, 1995.

[4] S. L. Ross. Introduction to ordinary differential equations. John Wiley and Sons,Inc. New York 1998. [5]

T. Myint-U. Ordinary differential equations. North-Holland, Inc., 1978.

[6] D. G. Zill. A First Course in Differential Equations. PWS. Kent Pub. Com., 1993.

[7] W. E. Boyce and R. C. Diprima. Elementary Differential Equations and Boundary value problems. John Wiley and Sons,Inc. New York 1997.

Real Analysis I

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
10	MATH 311	Real Analysis I	3	-	3	MATH 304,MATH 251

Objectives of the course

To introduce the system of real numbers and the completeness axiom.

To treat some concepts studied in calculus rigorously and correlate them with concepts studied in other courses. To introduce the methods and strategies of solving problems and writing proofs.

Course description

The real number system: The algebraic properties, the order properties, the completeness axiom and its consequences.

Sequences of real numbers:Convergent sequences, limit theorems, monotone sequences, subsequences, limit superior and inferior of a sequence, Cauchy sequences.

Topology of the real line:Open sets, closed sets, limit point of a set, Bolzano-Weierstrass Theorem, compact sets, Heine-Borel Theorem.

Limits and continuity:Limit of a function, continuous functions, and uniform continuity.

Differentiation:The derivative, the Mean-Value Theorem, L'Hospital's Rule.

Main text book

[1] R. G. Bartle and D. G. Sherbert. Introduction to Real Analysis,3rd Edition. John Wiley and Sons,Inc. New York, 2000.

Subsidiary Books

[1] M. Stoll. Introduction to Real Analysis, 2nd Edition. Addison-Wesley Longman, Boston, 2001.

[2] K. A. Ross. Elementary Analysis: The Theory of Calculus . Springer-Verlag, New York 1980.

Real Analysis II

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
11	MATH 312	Real Analysis II	3	-	3	MATH 311

Objectives of the course

To continue the treatment of MATH 311 rigorously.

To extend the concepts of analysis for the space R to the space R^n .

To practice the methods and strategies of solving problems and writing proofs.

Course description

Riemann Integration:

Series of real numbers:

Sequences and series of functions:

Topology of R^n :

Completeness and compactness in R^n :

Continuity and uniform continuity of functions on R^n :

Differentiability of functions of two-variables:Inverse Function Theorem and Implicit Function Theorem.

Main text book

[1] R. G. Bartle . Elements of Real Analysis,2nd Edition. John Wiley and Sons,Inc. New York, 1976.

Subsidiary Books

[1] M. Stoll. Introduction to Real Analysis, 2nd Edition. Addison-Wesley Longman, Boston, 2001.

[2] K. A. Ross. Elementary Analysis: The Theory of Calculus . Springer-Verlag, New York 1980.

[3] R. G. Bartle and D. G. Sherbert. Introduction to Real Analysis,3rd Edition. John Wiley and Sons,Inc. New York, 2000.

[4] G. Folland. Advanced Calculus. Pearson Education, Boston, 2002.

Mathematical Software and Programming

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
12	MATH 331	Mathematical Software and Programming	3	-	3	MATH 304,CS201

Objectives of the course

To provide the students with basic skills in using mathematical software and programming package. Using new mathematical software and programming package must be approved by the department board.

The detailed course content together with objectives and references should be approved by the department board every time a new mathematical software and programming package is offered.

Course description

An introduction to the use of mathematical software and programming package:

Using mathematical software and programming package for writing mathematical documents, symbolic computing, numerical computing, and programming. :

Applied Mathematics

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
13	MATH 332	Applied Mathematics	3	-	3	MATH 304

Objectives of the course

The purpose of this course is to teach areas in applied mathematics that are not covered by pure mathematics courses.

Course description

The course content together with objective and references should be approved by the department board every time a new subject is offered:

Mathematics of Finance

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
14	MATH 333	Mathematics of Finance	3	-	3	MATH 202

Objectives of the course

To introduce the students to the mathematics of finance and its use in banks, business, and trade.

Course description

Elements of Investments:

Portfolio Theory:

Debt Securities:

Security Analysis:

Derivative Markets:

Active Investment Management:

Main text book

[1] Z. Bodie, A. Kane,and A. J. Marcus. Essentials of Investments, 7th Edition. McGraw Hill, 2008.

Subsidiary Books

[1] Ken Binmore, Joan Davies. Calculus: Concepts and Methods. Cambridge, 2000. [2]

Steven Roman. The Mathematics of Finance . Irvine, CA, 1993.

[3] Robert Baxter. Finance Mathematics, 6th Edition. Medford, OR, 1992.

[4] Frank Ayres. Theory and Problems of Mathematics of Finance . Schaum's Outline Series, McGraw-Hill, 1963.

[5] Paul Hummel and Charles Seebeck Mathematics of Finance, 3rd Edition. McGraw-Hill, 1971.

Abstract Algebra I

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
15	MATH 342	Abstract Algebra I	3	-	3	MATH 251

Objectives of the course

To introduce the basic concepts of abstract algebra.

To develop the students abstract and logical thinking capabilities.

To develop the students mathematical ability to handle abstract proofs.

Course description

Binary operations:

Groups: Subgroups, and basic properties. Generators, cyclic subgroups.

Permutations and Cayley's Theorem:

Normal subgroups, factor groups:

Isomorphism theorems of groups.:

Rings, subrings, ideals, division rings, and fields.:

Homomorphisms between rings:

Main text book

[1] J. B. Fraleigh. A First Course in Abstract Algebra, 7th Edition. Addison-Wesley Publishing Co. London, 2003.

Subsidiary Books

[1] W. K. Nicholson. Introduction to Abstract Algebra. PWS-Kent Publishing Co. Boston, 1993. [2] I. N. Herstein. Topics in Algebra . John Wiley and Sons, 1975.

[3] N. Jacobson. Basic Algebra I. W. H. Freeman and Co., San Francisco, 1980. [4] Paul M. Cohn. Basic Algebra . Springer-Verlag N. Y., 2002.

Abstract Algebra II

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
16	MATH 343	Abstract Algebra II	3	-	3	MATH 342

Objectives of the course

To introduce the basic concepts of abstract algebra.

To develop the students abstract and logical thinking capabilities.

To develop the students mathematical ability to handle abstract proofs.

Course description

Finitely generated abelian groups: Direct products.

The fundamental theorem of abelian groups : Without proof.

A review of groups of small orders and the theory of p-groups:

Sylow's Theorems :Without proofs, applications to finite groups.

Rings: Ideals and factor rings. Integral domains.

Homomorphisms between rings:

Isomorphism theorems of rings:

Rings of polynomials:Irreducible polynomials, Eisenstein criterion.

Unique factorization domains and Euclidean domains:

Introduction to field theory:

Main text book

[1] J. B. Fraleigh. A First Course in Abstract Algebra, 7th Edition. Addison-Wesley Publishing Co. London, 2003.

Subsidiary Books

[1] W. K. Nicholson. Introduction to Abstract Algebra. PWS-Kent Publishing Co. Boston, 1993. [2] I. N. Herstein. Topics in Algebra . John Wiley and Sons, 1975.

[3] N. Jacobson. Basic Algebra I. W. H. Freeman and Co., San Francisco, 1980. [4] Paul M. Cohn. Basic Algebra . Springer-Verlag N. Y., 2002.

Training

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
17	MATH 390	Training	1	2	2	-

Objectives of the course

To train the student to transmit what he has studied.

To train the student to prepare lectures note and to develop the student teaching capabilities.

Course description

Directed Readings in intermediate and high school mathematics as well as the textbooks of MATH 101, MATH202, MATH203, and MATH 304:

Participating in tutorial classes of MATH 101 and MATH 202 under the supervision of a faculty member :

References

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Topics in Differential Equations

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
18	MATH 406	Topics in Differential Equations	3	-	3	Department approval

Objectives of the course

The purpose of this course is to teach areas in differential equations that are not covered in the other differential equations courses.

Course description

The course content together with the objectives and references should be approved by the department board every time a new subject is offered:

Complex Analysis

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
19	MATH 413	Complex Analysis	3	-	3	MATH 311

Objectives of the course

To recognize the importance and usefulness of complex analysis.

To extend some concepts studied in Math 311 and calculus courses.

To introduce the methods and strategies of solving problems and writing proofs.

Course description

The complex number system: Algebraic properties, polar and exponential forms, powers and roots, complex domain.

Complex functions:Limits, continuity, Cauchy-Riemann equations, analytic functions.

Elementary functions and their properties:Exponential, trigonometric, hyperbolic, logarithmic, inverse trigonometric and inverse hyperbolic functions.

Complex Integration:Contours, contour integrals, antiderivatives, Cauchy Integral Theorem, Cauchy Integral formula and its consequences.

Convergence of complex sequences and series:Taylor and Laurent series. Classification of singularities.

Calculus of residues:

Main text book

[1] J. W. Brown and R. V. Churchill. Complex Variables and Applications, 7th Edition. McGraw-Hill Company, New York, 2004.

Subsidiary Books

[1] E. B. Saff and A. D. Snider. Fundamentals of Complex Analysis for Mathematics, Science, and Engineering, 3rd Edition . Prentice-Hall, New Jersey, 2003.

[2] R. P. Boas. Invitation to Complex Analysis . Random House, New York, 1987.

[3] J. E. Marsden and M. J. Hoffman. Basic complex Analysis, 2nd Edition . W. H. Freeman and Company, New York, 1987.

Topics in Analysis

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
20	MATH 414	Topics in Analysis	3	-	3	Department approval

Objectives of the course

The purpose of this course is to teach areas in analysis that are not covered in the other analysis courses.

Course description

The course content together with the objectives and references should be approved by the department board every time a new subject is offered:

Numerical Analysis

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
21	MATH 421	Numerical Analysis	3	-	3	MATH 331,MATH 204, MATH 241

Objectives of the course

To provide the numerical methods of solving the non-linear equations, interpolation, differentiation, and integration. To improve the student's skills in numerical methods by using the numerical analysis software and computer facilities.

Course description

Numerical solutions of non-linear equations: Bisection method, Newton-Raphson method, secant method, convergence.

Interpolation:Lagrange, Newton divided difference formulas.

Numerical differentiation:First derivative, higher derivatives.

Numerical integration:Trapezoidal rule, Simpson's rule, Gaussian integration.

Algorithms and programs:

Main text book

[1] R. Burden, and J. D. Faires. Numerical Analysis. PWS-Kent Publishers, 1993.

Subsidiary Books

[1] V. A. Patel. Numerical Analysis. Harcourt Brace, College Publishers, 1994.

[2] W. Cheney and D. Kincaid. Numerical Mathematics and Computing. Brooks/Cole Publishing Company, 2003.

Topics in Numerical Analysis

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
22	MATH 423	Topics in Numerical Analysis	2	1	3	Department approval

Objectives of the course

The purpose of this course is to teach areas in numerical analysis that are not covered in the other numerical analysis courses.

Course description

The course content together with the objectives and references should be approved by the department board every time a new subject is offered:

Advanced Mathematical Software

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
23	MATH 434	Advanced Mathematical Software	3	-	3	MATH 331

Objectives of the course

Students will learn mathematical software as a means of doing mathematics by computer. Using new mathematical software package must be approved by the department board.

The detailed course content together with objectives and references should be approved by the department board every time a new mathematical software package is offered.

Course description

The topics, which the students will learn, include: functions and their graphs; polynomials; rational functions; trigonometric expressions; manipulation and simplification of expressions; computing limits, derivatives and integrals; series; vectors and matrices; parametric curves and surfaces; linear systems; vector spaces; eigenvalues and eigenvectors; numerical calculations; operating on algebraic expressions; and generating graphics. :

Number Theory

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
24	MATH 444	Number Theory	3	-	3	MATH 251

Objectives of the course

To give a simple account of classical number theory and its fascinating properties.

Course description

Divisibility Theory:

Theory of primes:

Congruences:

Quadratic residues:

Diophantine equations:

Number-theoretic functions:

Main text book

[1] David Burton. Elementary Number Theory. Allyn and Bacon, 1976.

Subsidiary Books

[1] Niven and H. Zuckerman. An Introduction to the theory of Numbers, 3rd Edition. John Wiley, New York, 1972.

Topics in Algebra

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
25	MATH 445	Topics in Algebra	3	-	3	Department approval

Objectives of the course

The purpose of this course is to teach areas in algebra that are not covered in the other algebra courses.

Course description

The course content together with the objectives and references should be approved by the department board every time a new subject is offered:

Euclidean and Non-Euclidean Geometry

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
26	MATH 462	Euclidean and Non-Euclidean Geometry	3	-	3	MATH 251

Objectives of the course

To increase the student knowledge about geometry and its applications. To improve the students skills in geometry.
To study the fundamental concepts of geometry and design theory.

Course description

Axiomatic approach to Euclidean geometry:
Use of logic in mathematical reasoning:
Hilbert's formulation:

Removal of parallel axiom:
The discovery of non-Euclidean geometries:
Independence of parallel postulate:
Loboachevskian and Hyperbolic Geometry :

Main text book

[1] M. J. Greenberg. Euclidean and Non-Euclidean Geometry. Freeman, New York,1993.

Subsidiary Books

[1] R. L. Faber. Foundations of Euclidean and Non-Euclidean Geometry. Marcel-Dekker, New York, 1993.
[2] C.Wylie,JR Foundation of Geometry . McGraw-Hill co., .

Differential Geometry

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
27	MATH 463	Differential Geometry	3	-	3	MATH 204 MATH 304

Objectives of the course

To study the basic principles of differential geometry which relate curves and surfaces in space. To study parametric representations of curves and surfaces.

To recognize curves on surfaces and various types of curvatures and geodesics.

Course description

Introduction to Manifolds:

Functions of Several Variables and Mappings:

Differentiable Manifolds and Submanifolds:

Vector Fields on a Manifold:

Tensors and Tensor Fields on a Manifold:

Integration on Manifolds:

Differentiation on Riemannian Manifolds:

Curvature:

Main text book

[1] W. M. Boothby. An Introduction to Differentiable Manifolds and Riemannian Geometry, Revised Second Edition. Academic Press, 2003.

Subsidiary Books

[1] M. do Carmo. Differentiable curves and surfaces. Prentice Hall, New Jersey, 1976.

[2] A. Gray. Modern Differential Geometry of curves and surface with Mathematica, 2nd Edition. CRC Press, Boca Raton, FL, 1998.

[3] B. O' Neill. Elementary Differential Geometry. Academic Press, INC, California, 1966.

General Topology

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
28	MATH 464	General Topology	3	-	3	MATH 311

Objectives of the course

To deal with abstract mathematical concepts.

To develop the skills of writing clear and precise proofs. To

study topological spaces and metric spaces.

To study continuous functions, connectedness, compactness, and separation axioms.

Course description

Definition of a topology: Open sets, closed sets, interior, closure, and boundary of a set.

Dense sets and separable spaces:

Bases and second countable spaces:

Finite product of spaces:

Subspaces:

Continuous functions and Homeomorphisms:

Separation axioms: T_0 , T_1 , T_2 , regular, T_3 , normal, and T_4 spaces

Metric spaces: Definitions of compact and connected spaces

Main text book

[1] Paul E. Long. An Introduction to General Topology. Charles E. Merril Publishing Company, 1971.

Subsidiary Books

[1] B. Mendelson. Introduction to Topology. Allen and Bacon, 1962.

[2] S. Lipschutz. General Topology. Schaum's Outline Series, 1965.

[3] J. R. Munkres. Topology: A First Course. Prentice- Hall, California, 1977.

[4] C. W. Patty. Foundations of Topology. PWS- Kent Publishing Co., 1993.

Discrete Mathematics

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
29	MATH 471	Discrete Mathematics	3	-	3	MATH 251

Objectives of the course

To improve the student's logical thinking and dexterity in solving problems. To introduce the basic concepts discrete mathematics and its applications. To apply all of these by using the computers software.

Course description

Permutations and selections:

Binomial coefficient: Identities involving binomial coefficients

Selections with repetition allowed:

Multinomial coefficients:

The Pigeonhole Principle:

Partitions of integers:

Principle of Inclusion and Exclusion:

Derangements:

Partitions of sets:

Stirling numbers of the second kind:

Elementary graph theory: Special graphs. Simple applications. Associated matrices. Walks and connectivity. Eulerian and Hamiltonian graphs. Planar graphs .Trees. Spanning trees Paths and components in graphs

Algorithms to determine components: Shortest and longest path algorithms. Floyd's algorithm

Main text book

[1] R. P. Grimaldi. Discrete and Combinatorial Mathematics, 4th Edition. Longman Higher Education, 1998.

Subsidiary Books

[1] J. P. Tremblay and R. Menorah. Discrete Mathematical Structures with Applications to CS. McGraw-Hill International, 1987.

[2] N. Biggs. Discrete Mathematics. Oxford University Press, 1993.

[3] K. H. Rosen. Discrete Mathematics and its Applications. McGraw-Hill Higher Education, 2000.

[4] P. Fletcher, H. Hoyle and C. W. Patty. Foundations of Discrete Mathematics. PWS- Kent Publishing Co., 1991.

[5] L. Lesniak. Discrete Structures, Logic, and Computability. Jones and Bartlett Publishers, 2002.

History of Mathematics

Number	Course and Code	Course Title	Number of Units			Pre-requisetes
			Th.	Pr.	Credit	
30	MATH 481	History of Mathematics	2	-	2	-

Objectives of the course

To improve the students understanding of the historical development of mathematics. To emphasize the role of mathematics in the rise of science.

Course description

Historical development of geometry, arithmetic, algebra, and calculus from ancient times to 20th century:

Main text book

[1] Howard Eves. An Introduction to the History of Mathematics, 4th Edition. Holt, Rinehart, and Winston, New York 1998.

Subsidiary Books

[1] Carl B. Boyer. A History of Mathematics. Oxford University Press, 1993.

Project in Mathematics

Number	Course and Code	Course Title	Number of Units Th.	Pr.	Credit	Pre-requisetes
31	MATH 482	Project in Mathematics	3	-	3	Department approval

A supervised project emphasizes problems identification and formulation. It includes both oral and written reports of results by the students. Every project topic should be approved by the department board.