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| | **Irbid National University** | **Logo of Faculty** |
| | **Faculty of Science and Information Technology** | |
| | **Department of Mathematics** | |

| **Course No.** | **Course Title** | **Designation** | **Prerequisite** | **Credit Hours** |
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| **Math 404151** | **Fundamentals of Mathematics** | **Compulsory major** | **Calculus (1) 404101** | **3** |
| **Course Description** | **Logic and methods of proof: Statements, algebra of statements, conditionals, logical equivalence, quantifiers, mathematical proofs. Sets: Basic notations and algebra of sets, principle of mathematical induction. Relations: Cartesian product and relations, equivalence relations, partitions. Functions: Functions and relation, one to one functions, onto functions, composition of functions. Number systems: Construction of natural numbers, integers, rational numbers, real numbers, and complex numbers.** | | | |
| **Math 404203** | **ODEs(1)** | **Compulsory major** | **Calculus (2) 404102** | **3** |
| **Course Description** | **Introduction, Classification of DEs, 1st order equations: separable, linear, Bernoulli, homogeneous, and exact equations, 2nd order equations: The methods of undetermined coefficients and variation of parameters, Higher order equations, Euler equation, Series solution of ODEs, Systems of 1st order ODEs, Applications.** | | | |
| **Math 404301** | **PDEs(1)** | **Compulsory major** | **Math. Methods 404204** | **3** |
| **Course Description** | **Introduction, Classification of 2nd order PDEs, Initial and boundary value problems, Parabolic type problems, Hyperbolic type problems, Elliptic type problems.** | | | |

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| **Math 404401** | **PDEs(2)** | **Compulsory major** | **PDEs(1)** | **3** |
| **Course Description** | **Classification of 1st order PDEs into linear, semilinear, quasilinear, and nonlinear ,The Cauchy problem, General solutions of quasilinear equations, Complete integrals of nonlinear equations, Systems of 1st order PDEs, 2nd order equations in n variables,Well posedness,Hadamard problem** | | | |

| Course No. | Course Title | Designation | Prerequisite | Credit Hours |
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| **Math 404204** | **Math. Methods** | **Compulsory major** | **Calculus (3)- 404103 ODEs(1)- 404203** | **3** |
| **Course Description** | **Series solution of ODEs near ordinary and regular singular points, Laplace transforms, Legendre equation, Sturm- Liouville BVP, Fourier series** | | | |
| **Math 404403** | **ODEs(2)** | **Compulsory major** | **ODEs(1) 404203** | **3** |
| **Course Description** | **Systems of first order ordinary differential equations: homogeneous and nonhomogeneous systems , Existence Theory: gronwall inequality, Uniquence Theorem ,Autonomous systems: Phase plane and phase portrait, stability of linear and almost linear systems** | | | |

| Course No. | Course Title | Designation | Prerequisite | Credit Hours |
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| **Math 404102** | **Calculus 2** | **Compulsory major** | **Calculus 1** | **3** |
| **Course Description** | **In this course, we introduce the following topics: Inverse trigonometric and hyperbolic functions. Techniques of integration, by parts, trigonometric integrals, trigonometric substitutions, partial fractions, quadratic expressions, general substitutions. Numerical Integration (Sympson's rule). Improper integrals. Infinite series, convergence, and divergence, convergence tests, Maclaurin and Taylor series. Polar coordinates: definition, arc length, area, conic sections.** | | | |

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| **Math 404312** | **Complex analysis (1)** | **Compulsory major** | **Calculus 3** | **3** |
| **Course Description** | **In this course, we introduce the following topics: 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.** | | | |
| **Math 404412** | **Complex analysis (2)** | **Compulsory major** | **Complex analysis (1)** | **3** |
| **Course Description** | **In this course, we introduce the following topics: The complex plane and its geometry, stereographic projection and linear fractional transformations, analytic and harmonic functions, contour integration, Cauchy's theorem, and the calculus of residues, and special functions and conformal mapping.** | | | |
| **Math 404131** | **Probability and Statistics (1)** | **College Requirement** | **-** | **3** |
| **Course Description** | **In this course, we introduce the following topics: Descriptive statistics, Probability; axioms of probability, rules of probability, conditional probability, independence. Discrete and continuous random variables, expectation, probability distributions. Sampling distributions. Point estimation: for mean and variance, the difference between two means and the ratio of two variances, testing hypotheses for small, large, and dependent samples, correlation, simple linear, and multiple regression. The goodness of fit tests.** | | | |

| Course No. | Course Title | Designation | Prerequisite | Credit Hours |
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| Math 404311 | Real Analysis I | Compulsory major | Set Theory | 3 |
| Course Description | The foundations for this work are commenced in Real Analysis, a course that develops this basic material in a systematic and rigorous manner in the context of real-valued functions of a real variable. Topics covered are: Basic set theory. The real numbers and their basic properties. Sequences: convergence, subsequences, Cauchy sequences. Open, closed, and compact sets of real numbers. Continuous functions and uniform continuity. Differentiation and Mean Value theorems. | | | |
| Math 404411 | Real Analysis II | Compulsory major | Real Analysis I | 3 |
| Course Description | This course covers the fundamentals of mathematical analysis: uniform continuity, series, Riemann integral, sequences and series of functions, uniformity, and the interchange of limit operations. | | | |
| Math 404421 | Numerical Analysis II | Compulsory major | Numerical Analysis I | 3 |
| Course Description | The course provides an introduction to interpolation methods, numerical integration, linear systems and factorizations, and numerical methods in ordinary differential equations. | | | |
| Math 404202 | Median Analysis | Compulsory major | Calculus III | 3 |
| Course Description | This course covers Double integrals, Double integrals in polar coordinates, , Triple integrals, Cylindrical coordinates, Triple integrals in spherical coordinates, Vector fields, Line integrals, Surface area, Change of variables in multiple integrals, Green's theorem, Curl and divergence. Parametric surfaces and their areas, : Surface integrals, Stokes' Theorem, The Divergence Theorem. | | | |

| Course No. | Course Title | Designation | Prerequisite | Credit Hours |
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| Math 404251 | Set Theory | Compulsory major | Foundation of mathematics | 3 |
| Course Description | As stated in the approved study plan. Introduction and paradoxes; axioms of set theory; equivalence relations and functions; partially ordered classes; lattices; well-ordered classes; the axiom of choice and related cardinals and ordinals.;principles; Dedekind cuts. | | | |
| Math 404345 | Number Theory | Compulsory major | | 3 |
| Course Description | As stated in the approved study plan. 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. | | | |

| Course No. | Course Title | Designation | Prerequisite | Credit Hours |
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| Math 404362 | Topology (1) | Compulsory major | Set theory | 3 |
| Course Description | Topological spaces: Definition and examples Open and closed sets, Subspaces, Closure of a set, Interior, boundary , exterior and derived sets Basis Definition and examples. Finite product topology. Subbasis Definition and examples of the metrics, metric spaces , Hausdorff spaces ,metrizability problems, Continuous functions, and homeomorphisms, topological property. Compactness, compactness in $n\Upsilon$ , Limit point compactness, Sequentially compact spaces, Compactness in metric spaces. | | | |

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| **Math 203462** | **Topology (2)** | **Compulsory major** | **Topology (1)** | **3** |
| **Course Description** | **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 .** | | | |

| Course No. | Course Title | Designation | Prerequisite | Credit Hours |
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| **Math 404115** | **Biostatistics College Requirement** | **Biostatistics College Requirement** | | **3** |
| **Course Description** | **Biostatistics is essential to ensuring that findings and practices in public health and biomedicine are supported by reliable evidence. This course covers the basic tools for the collection, analysis, and presentation of data in all areas of public health. Central to these skills is assessing the impact of chance and variability on the interpretation of research findings and subsequent recommendations for public health practice and policy.** | | | |

| Course No. | Course Title | Designation | Prerequisite | Credit Hours |
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| **Math 404101** | **Calculus I** | **College Requirement** | **-** | **3** |
| **Course Description** | **This course is concerned with studying single-valued functions, and it includes the following topics: limits; continuity; rates of change; rules for differentiating; differentials and local linear approximations; decreasing and increasing functions; maximum and minimum value of functions; L'Hôpital's rule, related rates; logarithmic and implicit differentiation; Rolle 's Theorem; the mean-value theorem; 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 ; area under a curve; area between two** | | | |

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| | **curves; transcendental functions: inverse functions, logarithmic and exponential functions and their derivatives and integrals; limits (the indeterminate forms); hyperbolic functions and their inverses; inverse trigonometric functions; some techniques of integration.** | | | |
| **Math 404231** | **Probability and Statistics (2)** | **Compulsory major** | **Probability and Statistics (1)** | **3** |
| **Course Description** | **In this course we focus on inferential statistics, especially the estimation and testing of statistical hypotheses and the topics will be: confidence Intervals for the Mean when $\sigma$ s is known and the calculation of sample size, confidence interval for the mean when $\sigma$ is unknown, confidence Intervals and sample Size for Proportions, confidence intervals for variances, steps in Hypothesis Testing—Traditional Method by z- test and t- test for a mean, z- test for a Proportions and $\chi^2$ - test for a variance or standard deviation, testing the difference between two means: using the z test and t –test, testing the difference between two means: dependent samples, testing the difference between proportions, testing the difference between two variances.** | | | |
| **Math 404301** | **Operation Researches** | **Compulsory major** | **Fundamental of Mathematics and Linear Algebra** | **3** |
| **Course Description** | **In this course, we introduce the following topics: Linear programming (LP), LP definition, expressing LP problems, limitations or constraints, maximization and minimization problems; linear Programming – Graphical Solutions, introduction to graphical LP maximization solution, graphical LP minimization solution, Simplex method definition, formulating the Simplex model. linear Programming; Simplex Method: Simplex method for Maximizing, Simplex maximizing example for similar limitations, Mixed limitations, example containing mixed constraints, Minimization example for similar limitations, example containing mixed limitations, Duality Theory; sensitivity analysis: changes in objective function, changes in RHS; the transportation model basic assumptions, solution methods: 1. Feasible Solution: The Northwest Method, The Lowest** | | | |

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| | **Cost Method, 2.Optimal Solution: The Stepping Stone Method, Modified Distribution (MODI) Method.** | | | |
| **Math 404442** | **Abstract Algebra (II)** | **Compulsory major** | **Abstract Algebra (I)** | **3** |
| **Course Description** | **In this course we introduce the following topics: 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.** | | | |

| **Course No.** | **Course Title** | **Designation** | **Prerequisite** | **Credit Hours** |
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| **Math 404241** | **Linear Algebra (1)** | **College Requirement** | **-** | **3** |
| **Course Description** | **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.** | | | |
| **Math 404201** | **Calculus (3)** | **Compulsory major** | **Calculus (2)** | **3** |
| **Course Description** | **Study the sequences. L'Hopital's rule. Improper integrals. infinite series, convergence and divergence, convergence tests, Maclaurin and Taylor series and. vectors: dot product, projections, cross product; parametric equations of lines; planes in 3-space; vector valued functions: calculus of vector valued functions, change of parameters, arc length, unit tangent and normal vectors.** | | | |
| **Math 404342** | **Abstract Algebra (I)** | **Compulsory major** | **Fundamental of Mathematics** | **3** |
| **Course Description** | **This course covers properties of integers, sets, groups, permutation groups, cyclic groups, Lagrange, s Theorem, subgroups, normal subgroups, quotient groups, external direct product of groups, homomorphism and isomorphism of groups, and introduction to rings and fields.,.** | | | |

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| **Math 404261** | **Euclidean geometry** | **Compulsory major** | **Set theory** | **3** |
| **Course Description** | لبناء الرّاضً لهندست إقليدش: نظام هندست إقليدش ونقائصها ، مكنات البناء الرّاضً ، خصائص النظام الرّاضً ، مسلمات هلبرث ، الهندست الحادّة التطابق : تطابق القطع المستقيمت ، السوا ، . التشابه : تشابه المضلعات ، المثلثات ، تطبيق على التشابه . المثلثات ، تطبيقات على التطابق الدائرة : أوتار . التوازي ومتوازّات الأضلع ، التكافؤ ، تكافؤ متوازّات الأضلع ، تكافؤ المثلثات مبادئ الهندست الإقليدّت : الهندست الساذّت ، . الدائرة ، السوا الحطوط والمركسُت ، المماسات الهندست التقصيت | | | |

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| **Math 404321** | **Numerical Analysis 1** | **Compulsory major** | | **3** |
| **Course Description** | This course presents numerical methods for solving mathematical problems. It deals with the theory and application of numerical approximation techniques as well as their computer implementation. It covers computer arithmetic, solution of nonlinear equations, interpolation and approximation, numerical integration and differentiation, solution of differential equations, and matrix computation. | | | |