202112-3		Introduction to Mathematics	3

This course introduces a collection of several basic topics which serve in general the most courses of mathematics. This basic topics are: Linear equations and Inequalities, Mathematical Induction, The Binomial Theorem, Partial Fractions, The Theory of Equations, an Introduction to Analytic Geometry and Conic sections.

2021204-4		Calculus I	4

This course covers several techniques in calculus (Functions-combination of functions – inverse function- Exponential and Logarithmic Functions-Trigonometric Functions and their Inverse- Hyperbolic Functions and their Inverse). The Concept of Limit- Computation of Limits, -Limits Involving Infinity-Asymptotes-Continuity. Tangent Lines and Rates of Change. This course focus also on Introduction to Techniques of Differentiation, The Product and Quotient Rules-Derivatives of Exponential Functions- Derivatives of Logarithmic Functions Derivatives of Trigonometric Functions- Derivatives of Inverse Trigonometric Functions. Derivatives of Hyperbolic Functions, Derivatives of Inverse Hyperbolic Function- the Chain Rule, Parametric differentiation, Implicit Differentiation-Maximum and Minimum Values-Increasing and Decreasing Functions, Concavity and the Second Derivative Test, L'Hospital's Rule- Indeterminate Forms, Rolle's Theorem- Mean-Value Theorem, Maclurin's and Taylor'sTheorem.

2022104-4	Calculus II	4	4	0	2021204-4

This course covers basics of calculus and how they can use to solve several problems. The course focuses on The Fundamental Theorem of Calculus, The Indefinite Integrals and The Net Change Theorem, studying most known techniques of integration (The Substitution Rule, Trigonometric Integrals, Integration by Parts, Trigonometric Substitution and Integration of Rational Functions by Partial Fractions), Improper integrals and applications of integration (Area Between Curves, Volume, Volumes by Cylindrical Shells, Average Value of a Function and Arc Length of Curves). The course focuses also on the link between theory and practice.

2022107-4	Probability and Statistics	4	4	0	2021204-4

This course provides an elementary introduction to probability and statistics with some applications. The course include: Descriptive statistics: describing data sets, interpret examples of methods for summarizing data sets, including common graphical tools. Demonstrate measure of central tendency, and measures of dispersion. Probability theory: Describe the random experiments, sample or outcome spaces (discrete and continuous cases), events and their algebra, combinatorics, Study and derive probability measures, conditional probability, law of total probability, Bayes' theorem, independent events. Demonstrate random variables and their distributions, probability mass functions (discrete), probability density function (continuous), cumulative distribution function, Compute some of statistical properties of random variables (mathematical expectation, median, mode, variance, standard deviation, moments, the probability generating function, the moment generating function, the characteristic function). State and use Markov's inequality, Chebyshev's inequality. The other topics covered some of discrete probability distributions such as discrete uniform, Bernoulli, Binomial, negative binomial, geometric and Poisson distributions, and some of continuous probability distributions such as uniform, gamma, exponential and normal distributions.

2022106-3	Set Theory	3	3	0	202112-3

This course contains: Introduction to Mathematical Logic, Sets and its Properties, Operations on Set, Cartesian product, Relations on sets, Equivalence Relations, Equivalence Classes, Partial and total order relations, Partition, Mappings, Injective mapping, Surjective mapping, Bijective mapping, Inverse of mapping, Composition of mappings, Binary operations on sets and Algebraic structures.

2022103-3	Geometry	3	3	0	202112-3

This course includes the following topics: Vectors in the space, Coordinate systems, Cartesian, Cylindrical, Spherical and polar Coordinates and its transformation from one to the other. Dot and Cross product of vectors in the space. Application of Dot and Cross Product. Straight-line in a space, Conical sections in space (parabola-ellipse- hyperbola), Sphere and Rotational surfaces, Solid Sections in the space.

2022202-4	Calculus III	4	4	0	2022104-4

This course covers some topics in advanced calculus (real functions of several variables, limits, continuity, partial derivatives and differentials, Jacobin matrix, chain rule, directional derivatives, Gradients Tangent Planes and Normal Vectors, maximum and minimum of Functions of Two Variables, Lagrange multipliers). The course focuses also on Double Integrals over Non-rectangular Regions, Double Integrals in Polar Coordinates, Triple Integrals- Triple Integrals in Cylindrical Coordinates and Spherical Coordinates, Change of Variables in Multiple Integrals, Jacobins, Line Integrals, Existence of Anti-derivative, Surface Area and Surface Integrals, Green's Theorem in Vector Form, Divergence Theorem and Stokes' Theorem.

2022201-4	Ordinary differential equations	4	4	0	2022104-4

This course provides an introductions of ordinary differential equations. Study the first order differential equation and the methods for solving it such as: Separation of variables, homogeneous equations, exact equations, linear equations, Bernoulli's Equations and Riccati' Equation. Illustrate the nonlinear first order differential equation and the methods for solving it. Study the second and higher order differential equation with constant and variable coefficient, Homogeneous and non-homogeneous equations, Operators method, undetermined coefficient, variation of parameters method for solving the higher order differential equations. Use the power series for solving the ordinary differential equations. Study the Laplace transform and using the Laplace for solving the differential equation.

2022204-3	Linear Algebra	3	3	0	202112-3

This course develops fundamental algebraic tools, Determinants and Matrices (proprieties and operations), Systems of linear equations, Homogeneous Systems of linear equations, Real vector spaces, Subspaces, Linear independence, Bases and dimension, Raw space, Column space, Null space, Linear transformations, Kernel and Range of linear transformations, Matrices of linear transformations, Eigenvalues and Eigenvector, Diagonalization.

2022203-4	Mechanics	4	4	0	2022104-4

This course provides an introduction to vectors algebra. Explore effect of the forces on rigid bodies in equilibrium and analyze the sets of forces in plane. Study a balance of forces and centre of gravity. Provide an understanding of friction, forces distribution and momentum in the plane. Dynamics of the physical point "movement in a straight line", Newton's laws are also included. Study and derive the motion of projectiles in the plane, polar coordinates, circular motion, and the movement in resistive medium. From which emerge an understanding of the simple harmonic motion and damped harmonic motion.

2023103-4	Partial differential equations	4	4	0	2022201-4

In this course, we will study the total differential equations and methods for solving them, definition of partial differential equations (PDEs), formation of PDEs, solving PDEs of the first order in different ways, solving PDEs of second order with constant coefficients homogeneous and non-homogeneous. We explain the method for solving PDEs of second order with constant coefficients with irregular order homogeneous and non-homogeneous and solve PDEs with variable coefficients. We explain the method of separation of variables to solve PDEs. Solving hyperbolic, Elliptic and parabolic PDEs and PDEs of non-linear first order. Solving PDEs by using Laplace transformation.

2023102-3	Real Analysis1	3	3	0	2022104-4

This course covers the following fundamentals of mathematical analysis: The topology of the real line and some useful elementary inequalities are mentioned. They cover the properties of the real numbers, sequences of real numbers, limits of functions, continuity, differentiability and some applications of differentiation such as mean value theorems, L'Hospital's rule and Taylor's theorem.

2023101-3	Theory of Statistics	3	3	0	2022107-4

This course will provide topics contains: Multivariate random variables (Joint Probability Functions for Discrete Multivariate Random Variables and Continuous Multivariate Random Variables), Conditional Probabilities -Mixed Moments, Correlation Coefficient - Conditional Mixed Moments – Independence of Random Variables , Distributions of Functions of Random Variables, Distribution Function Method, Transformation Method, Moment Generating Function Method, Some concepts of statistical inference (Population – Sample – Sample Mean – Sample Variance – Statistic – Estimator), Properties of The Good Estimator (Unbiasedness - sufficiency – constancy), Cramer-Rao Inequality – Efficiency of an Estimator – Efficient Estimator, Some methods of point estimation (Method of Moments - Maximum Likelihood Method), the basic concept of hypothesis testing.

2023106-3	Group Theory	3	3	0	2022106-3

The main objective of this course is studying: Groups, Subgroup, Permutation groups, Cyclic groups. Order of elements in groups. Cosets, Lagrange's theorem, Normal subgroup, Factor Groups. Homomorphism of groups. Fundamental isomorphism theorems and Automorphisms.

2023201-4	Mathematical Methods	4	4	0	2023103-4

In this course we explain the Strum- Liouville problem (ordinary and singular), properties of Eigen function, Eigen values and orthonormal set of function. Analyze Fourier series for functions of periodic, Fourier coefficients, odd and even function and their properties, the Half – Range Series, sine, cosine series, the series containing only odd harmonics or even harmonics. Demonstrate Fourier transforms, their properties and the solution of the initial boundary value problems for PDEs using Fourier transforms. Study gamma and beta functions, relation between gamma and beta functions, hyper geometric functions and it's properties, Bessel functions, the recursion relation, orthogonal and normalized of the Bessel functions, Analyze Hermite functions and it's properties, the recursion relation of the Hermit functions.

2023202-4	Real Analysis 2	4	4	0	2023102-3

This course covers the following fundamentals of mathematical analysis: Riemann integrals, improper integrals, sequences and series of functions, uniformity and the interchange of limit operations. Also, it covers an introduction to measure theory such as Lebesgue integral, Lebesgue measure and measurable functions.

2023203-3	Ring Theory	3	3	0	2023106-3

This course provides an introduction to Ring Theory. The main objective of this course is studying the elementary theorems and properties of Ring Theory such as: Definitions, Examples, Subring, Zero Divisors, Nilpotent, Idempotent, Units, Integral Domains, Division Ring, Field, Characteristic of a Ring, Ideals, Quotient Ring, Ring Homomorphism (and Isomorphism), Isomorphism Theorems, Prime Ideal, Maximal Ideal, Principal Ideal Ring, Characteristic of a ring and Factorization in Integral Domains.

2023204-3	Fluid Mechanics	3	3	0	2022203-4

The course provides an introduction to fundamental concepts of fluid mechanics. Provides an understanding of potential velocity and vortex. Establishes the equations of motion for viscous and perfect fluids in terms of stress. Introduces the equation of motion for Newtonian fluids if the body force is conservative. Study the motion of the fluid in two dimensionsand define the stream function. Study and analyze the complex potential in Cartesian coordinates and polar coordinates. Deduce a complex potential for a source, sink and dipole.

2023205-2	Programming Language	2	1	3	

The aim of this course is to introduce students to the fundamental concepts of scientific programming using MATLAB or similar programming languages and utilize the computational experience to help students to explore a wide range of mathematical concepts. It aims also at teaching students the basics of MATLAB programming language and encourage them to use MATLAB M-files to write their own codes.

2024101-3	General Topology	3	3	0	2022106-3

This course will provide an introduction to general topology. The course will begin with a brief review of basic set theory. Topics covered include topological spaces, Base, Sub base, topological properties (Continuity, connectedness, compactness, separation axioms) and their application to problems, some of the major theorems in general topology.

2024102-3	Complex Analysis	3	3	0	2023202-4

This course provides an introduction to the algebraic and geometric structure of the complex number system. We consider function of a complex variables and develop a theory of differentiation for them and so we introduce analytic functions which play a central role in complex analysis. We consider various elementary functions of complex variables and study the analyticity of that functions such as: Exponential, Trigonometric, Hyperbolic and the Logarithmic function and its branches. Integrals are extremely important in the study of functions of a complex variable, The theory of integration, to be develop, the theorems are generally concise and powerful and most of the proofs are simple. We devoted to series representation of analytic functions we turn to Taylor's and Maclaurin series but if a function fail to be analytic at a point then we apply the Laurent series. Integration, Differentiation. Multiplication and division of power series also provided. We develop also the theory of residues when the function fails to be analytic at a finite number of points interior on a simple closed contour which each of those points contributes to the value of the integral.

2024103-3	Numerical Analysis	3	2	1	2022204-3 & 2022201-4

The objectives of this course for the students are: What is the numerical analysis, the relationship between numerical analysis and other branches of science, the errors, linear systems of equation, solution of nonlinear equations, finite differences and interpolation, numerical differentiation, numerical integration and numerical solution of ordinary differential equations.

2024114-3	Tensors	3	3	0	2022204-3 & 2022202-4

Tensor analysis is a natural aid in forming mental pictures of physical and geometrical ideas. The course focuses to impart useful skills on the students in order to enhance their Mathematical ability in applying vector technique to solve problems in applied sciences and to equip them with necessary skill required to cope with higher levels courses in related subjects. Topics to be covered in this course include, basic vectors algebra, coordinate bases, gradient, divergence, and curl, Green's, Gauss' and Stokes' theorems. The metric tensor, Christoffel symbols and Riemann curvature tensor.

2024110-3	Applications of Algebra	3	3	0	2023203-3

This course introduce the students to cryptography and coding theory as applications of abstract algebra through presenting some simple cryptosystems, some techniques of cryptanalysis and linear codes, group codes.

2024111-3	Optimization Theory	3	2	1	2022204-3 & 2022201-4

This course introduces students to the fundamentals of linear and nonlinear optimization theory and methods. Topics include unconstrained and constrained optimization, The course is divided into five main parts: Linear programming (simplex method, duality theory, stativity analysis), unconstrained nonlinear programming (optimality conditions, descent algorithms and convergence theorems), constrained nonlinear programming (Lagrange multipliers, Karush-Kuhn-Tucker conditions), Dynamic programming and Integer programming. Students will also use MATLAB's optimization toolbox to obtain practical experience with the material.

2024112-3	Applied Stochastic Processes	3	3	0	2022107-4

This course introduces random processes and their applications. firstly consider probability generating functions and the concept of using conditioning for calculating expectation, variance and then probabilities. Then, present stochastic processes and their types. After that, look at both discrete-time Markov chains and continuous ones. Then, study in some details one of the most common continuous-time process, that is the Poisson process. Lastly, apply these stochastic processes to some real world problems.

2024113-3	Biomathematics	3	3	0	2022201-4

This course gives a concept of the mathematical biology and an introduction to mathematical modelling and data analysis for biological and biomedical systems. Examples include: The formation of animal coat patterns, the spread of diseases through the community, the interaction between pathogens and the immune system of the body, the growth of tumours, nerve cell signaling, population dynamics, pharmacokinetics and bacterial growth. The emphasis in this course is on the development of the governing model equations and on computer simulations of the model equations rather than on mathematical methods for solving the model equations. Differential equations of epidemics.

2024115-3	Functional Analysis	3	3	0	2023202-4

This course will cover the principles and methods of Functional analysis and its applications in metric spaces with example, Complete metric spaces, Separable metric space, Compact sets, Normed & Banach spaces, Convergence, Bounded linear functional and operators, Dual spaces, Reflexive spaces, Adjoint operator, Inner product space and Hilbert spaces with example, Projection theorem, Orthonormal sets and sequences, Total orthonormal sets, Riesz representation theorem, Self ad joint, Unitary and Normal operators, Hilbert - Adjoint operator, The Hahn Banach Extension theorem, Uniform boundedness theorem (The Banach Steinhaus theorem), Open mapping theorem and Closed graph theorem.

2024205-3	Financial Mathematics	3	3	0	2023101-3

This is an introductory course in mathematical finance. The course covers the following topics: Interdiction, Future value, Present value, Annuities, Net present value, Payback rule, the internal rate of return, Bound valuations, Expected Return, Variance, Portfolio (Portfolio Weights- Portfolio Return- Variance- Portfolio optimization), Insurance cost and fair premiums, Expected cost claims, Timing of incomes claims, Administrative costs and profit loading.

2024201-3	Research Project	3	2	1	-

The course is based on an individual research work including literature studies according to the study plan. An individual study plan will be commonly written by the supervisor and the student which serves as a project description. At the end of the practical work, the students will write a research report. A research article will be written and evaluated by staff members in concern. A poster based on the research results will be designed, presented and discussed. The article could be included on the list of regional conferences on the level of Saudi Universities.

2024202-3	Mathematical Modelling	3	3	0	2022204-3 & 2022201-4

This course provides and introduction to mathematical modelling, Study modelling change with difference equations, approximating change with difference equations, dynamical systems, systems of difference equations, difference operators. Study mathematical models, proportionality, geometric similarity, graphical fitting, analytic fitting, least-squares fitting, choosing models, polynomial models, smoothing, cubic splines. Simulation modelling, modelling using graph theory, modelling with differential equation (Population growth, Drug dosage, graphical solutions, numerical approximations, separation of variables, linear equations), some additional applications of mathematics modeling: Biological applications, social, chemistry and behavioral sciences applications, physics and engineering applications.

2024203-2	Scientific Computations	2	1	2	2022204-3 & 2022201-4

The course is an application of a software package (including, Matlap, Maple, Mathematica). Use software packages to Know basic mathematical algorithms, implement it for a variety of mathematical applications, execute the mathematical operations, execute vectors and matrices operations, make 2-dimensions and 3-dimensions graphs and implement different numerical methods algorithms, Solving nonlinear equations using a software package and Solving ordinary differential equation using a software package.

2024204-3	Differential Geometry	3	3	0	2022103-3& 2022202-4

This course covers basic theory on curves, and surfaces in the Euclidean three space. Topics include: Regular curves, Frenet formulas, local theory of curves, global properties of curves such as isoperimetric inequality, regular surfaces, 1st and 2nd fundamental form, Gaussian curvature and mean curvature, Gauss map, special surfaces such as ruled surfaces, surfaces of revolution, minimal surfaces, intrinsic geometry: geodesic, and Gauss-Bonnet Theorem.

2024210-3	Discrete Mathematics	3	3	0	2022106-3& 2022204-3

This course provides the knowledge for the students to recognize basic counting principles, inclusion-exclusion principles and pigeonhole principle, realize basic concepts of the mathematical proofs, construct the ordinary generating functions and the exponential generating functions, classify homogenous and nonhomogeneous recurrence relations, summarize basic concepts in graph theory like graph connectivity, Eulerian graphs, Hamiltonian graphs, develop solutions of real life problem like Salesman, shortest path and scheduling and recognize construction of trees and its applications.

2024211-3	Quantum Mechanics	3	3	0	2023103-4

This course provides a historical development of quantum mechanics, understanding the physical phenomena at a microscopic level. The difference between classical and quantum mechanics. Schrödinger equation, the statistical interpretation, probability, normalization, coordinate, momentum, the uncertainty principle. Stationary states, infinite square well. Harmonic oscillator, free particle, delta-function potential, finite square well. Hilbert Space, observables. Eigen-function and eigen-values of a hermitian operator. Generalized statistical interpretation, Dirac notation. Quantum mechanics in three dimensions, Schrödinger equation in spherical coordinates. Hydrogen atom, angular momentum, spin. Eigen-vectors and eigenvalues of Boson and Farmion operators. The wave equation of two level atom.

2024212-3	Advanced Biostatistics	3	3	0	2023101-3

This course provides an introduction to data analysis, simple and multiple linear regression analysis, model building strategies in regression analysis to adjust for confounding and dealing with effect modification, logistic regression analysis for binary outcome data, analysis of time to event data including life table, Kaplan-Meier survival plot, log rank test and Cox proportional Hazards model. The learning method will include formal lectures on the topics, hands-on problem solving tutorials, computer laboratory sessions to demonstrate the use of R, Python, SPSS software and presentation on the use of the methods in clinical and public health research.