UNDERGRADUATE COURSES DESCRIPTIONS for the Degree of Bachelor of Science in Mathematics

19101 Calculus I 4 Cr. Study of single variable calculus, numerical sequences, limits, continuity differentiation, extreme function values, the definite integrals, applications of the definite integrals, Inverse functions, logarithmic and exponential functions, inverse trigonometric and hyperbolic functions, techniques of integration, indeterminate forms, improper integrals, Taylor's formulae, infinite series.
Prerequisite: Precalculus

19102 Calculus II 4 Cr. Study of several variable calculus: Euclidean geometry matrices, linear transformation, elementary topology of R^n, limits, derivative as linear operator, directional and partial derivatives, extreme function values, Lagrange multiplier, multivariable and iterated integrals, change of variable theorem, parametric curves and surfaces, line integral, surface integral, vector analysis, green stokes and divergence theorem.
Prerequisite: Calculus I 19101

19104 Foundation of Mathematics 4 Cr. Introduction to logic, concept of sets, relations, functions, Cartesian products, countable sets, cardinal number, Schrowder-Bernstein cantor's theorems. axiom of choice, Zorn's lemma, construction of numbers: natural numbers, integers, rational and real numbers by set theory approach.
Prerequisite: Calculus I 19101

19114 Algebra I 4 Cr. Groups and elementary properties, homomorphisms rings, fields, integral do-mains and their elementary properties P.I. and V.F. domains, finite fields.
Prerequisite: Linear Algebra 19117

19115 Mathematical Analysis I 4 Cr. The real and complex number systems, basic topology, numerical sequences and series, continuity, differentiation.
Prerequisite: Calculus II 19102; Foundation of Mathematics 19104

19116 Mathematical Analysis II 4 Cr. The Riemann-Stieltjes integral, sequences and series of functions, some special-functions.
Prerequisite: Mathematical Analysis I 19115

19117 Linear Algebra I 4 Cr. Vector spaces. Basis, dimensions. Gram-Schmidt process, projections, linear transformations, isomorphism, change of basis. Eigen values and Eigen vectors, Diagonalizations, Jordon canonical forms, Hermition matrices, exponential of a matrix.
Prerequisite: Calculus II 19102

19201 Elementary Differential Equations 3 Cr. Methods of solving especial classes of ordinary differential equation including linear, Bernoulli, separable and exact first order equation, reduction of order, variation of parameter, undetermined coefficients, power series methods, and Laplace transform methods in second order linear equation and autonomous system of linear differential equations. Systems of first order differential equations, exponential matrix.
Prerequisite: Calculus I 19101; Calculus II 19102

19204 Elementary Partial Differential Equations 2 Cr. Fourier series, Fourier transformation and it's applications, introduction and classification of P.D.E. of types hyperbolic, parabolic and elliptic, separation of variables and Fourier transform method for solving homogeneous and nonhomogeneous heat conduction & vibrating string and Dirichlet problems, Sturm Lioville theorems and eigenvalue problems, canonical forms and D'Alembert's solution of wave equations.
Prerequisite: Elementary Differential Equation 19201

19301 Numerical Methods 2 Cr. Error analysis, solving nonlinear equations, solving systems of linear and nonlinear equations, interpolation, numerical differentiation and integrations, solving ordinary differential equations.
Prerequisite: Calculus II 19102; Elementary Differential Equation 19201

19321 Complex Variables 4 Cr. Complex numbers and their geometrical representation, functions, mappings, limits, derivative, Cauchy-Riemann conditions, elementary functions and their mapping, integration, Cauchy's theorem, indefinite integrals, Cauchy's integral formula, Morera's and Liouville theorem, power series, Laurant series, residues theorem, evaluation of certain types of real integrals, conformal mapping.
Prerequisite: Mathematical Analysis I 19115

19333 Numerical Analysis I 4 Cr. Error in arithmetic operations & computational methods, solution of nonlinear equations, interpolation, approximation theory, numerical differentiation, numerical integration, solution of ordinary differential equations.
Prerequisite: Elementary Differential Equation 19201; 18101

19334 Numerical Analysis II 4 Cr. Solution of linear simultaneous equations, gauss elimination, other direct methods iteration methods, solution of nonlinear simultaneous equations, least square approximation, eigenvalues and eigenvectors, solution of partial differential equations, finite elements method and iteration methods.
Prerequisite: Numerical Analysis I 19333; Elementary P.D.E. 19204

19340 Discrete Mathematics 4 Cr. Fundamental principles of counting, relations and functions, languages, finite state machine, principles of inclusion and exclusion, generating functions, recurrence relations, introduction to graph theory.
Prerequisite: Foundation of Mathematics 19104; 18101

19402 Number Theory 4 Cr. Solutions of congruencies, congruencies of higher degree quadratic residues, quadratic reciprocity.
Prerequisite: Foundation of Mathematics 19104

19405 Introductory Algebraic Geometry 4 Cr. Plane conics, cubics and the group law, curves and their genus, the category of affine varieties, Affine varieties and the null stellensatz, functions on varieties, projective and binational geometry, tangent space, tangent cone, singularity, dimension, lines on a cubic surface, an introduction to spectrum of a ring and structure sheaf.
Prerequisite: Algebra I 19114

19431 Algebra II 4 Cr. Action of a group on a set, Sylow theorem UFD property, free modules, modules over PI domains, splitting fields of polynomials, normal extension galois theorem.
Prerequisite: Algebra I 19114

19438 Algebra III 4 Cr. Torsion modules, invariance theorem, applications to Abelian groups and linear transformations (rational and Jordan canonical forms). Real quadratic forms, decomposition of a single linear transformation and similarity, ring of endomorphism of a finitely generated module over a P.I.D.
Prerequisite: Algebra II 19431

19440 Introduction to Ordinary Differential Equations 4 Cr. Linear systems, exponentials of operators, stability. The existence-uniqueness theorem for systems of ordinary differential equations, dependence on initial conditions and parameters, the maximal interval of existence, the flow defined by a differential equations, linearization, stable and unstable manifold theorem, Hartman-Grobman theorem, stability and Liapunov functions, gradient and Hamiltonian systems. The Poincare Bendixson theory in R2, Bendixson criteria.
Prerequisite: Mathematical Analysis I 19115; Linear Algebra 19117; Elementary Differential Equation 19201

19441 Topology I 4 Cr. Topological spaces and continuous functions, connectedness and compactness, countability and separation axioms: the countability axioms, the separation axioms, the Urysohn lemma, the Urysohn metrization theorem, the Tychonoff theorem, the Stone-Cech compactification.
Prerequisite: Mathematical Analysis I 19115

19443 Mathematical Analysis III 4 Cr. The derivative of functions of several variables, the Chain Rule, partial derivatives, the inverse function theorem, the implicit function theorem, the rank theorem, extremum problems with side conditions, Lagrange's theorem: multiple and iterated integrals for functions of several variables, Fubini's theorem, change of variables in multiple intergrals, differential forms and related theorems, simplexes and chains, Stoke's theorem, closed forms, exact forms and their applications in vector analysis.
Prerequisite: Mathematical Analysis II 19116

19506 Foundation of Demography 3 Cr. Introduction, source of data on population, structure of population, factors in population dynamics, population growth and population policy.
Prerequisite: Sampling Methods 19530

19510 Probability & Statistics 3 Cr. Descriptive statistics, counting rules, introducing concepts of probability, conditional probability, Bayes theorem, random variables with emphasis on discrete cases, probability function & distribution function, conditional probability function, standard discrete distributions, sum of two independent random variables.

19511 Statistical Methods 3 Cr. An introduction to data analysis, point estimation, confidence intervals, testing statistical hypotheses, simple linear regression analysis, one-way analysis of variance, two-way analysis of variance, contingency tables.
Prerequisite: Probability I 19513

19513 Probability I 3 Cr. Probability models, axioms, theorems and interpretations related to probability functions, counting techniques, conditional probability, Bayes' formula, independent events, random variables, C.D.F. Discrete case, mathematical expectations, and standard discrete distributions.
Prerequisite: Calculus I 19101; Probability & Statistics 19510

19514 Probability II 3 Cr. Continuous case, P.D.F., standard continuous distributions moments, DeMoivre-Laplace theorem, bivariate case, functions of R.V.'s, conditional distributions, order statistics, M.G.F., L.L.N., and C.L.T.
Prerequisite: Calculus II 19102; Probability I 19513

19518 Mathematical Statistics I 3 Cr. Aspects of estimation, partitions, sufficiency, minimal sufficiency, completeness and bounded completeness, methods of estimation including method of moments & maximum likelihood method, unbiased estimation, minimum variance unbiased estimators, Cramer-Rao inequality, efficiency & consistency, introducing Bayes estimation.
Prerequisite: Statistical Methods 19511; Probability II 19514

19519 Mathematical Statistics II 3 Cr. Aspects of statistical hypothesis testing, simple vs simple tests, most powerful tests, likelihood ratio tests, composite vs. composite tests, uniformly most powerful tests, generalized likelihood ratio test, sequential probability ratio test, categorical data analysis, contingency tables.

Prerequisite: Mathematical Statistics I 19518

19524 Time Series 3Cr. Stationary and weakly stationary processes, trends, seasonal variation, MA and AR processes, alternative representations of AR and MA processes, ARMA processes, Nonstationary time series, Forecasting spectral theory of time series.
Prerequisite: Mathematical Statistics I 19518

19530 Sampling Methods I 3 Cr. Introduction to sampling and census; some basic concepts in sampling; random and non-random sampling; simple random and stratify sampling for mean, proportion's and ratio's and estimating sample size for above characteristics.
Prerequisite: Mathematical Statistics I 19518

19531 Sampling Methods II 3 Cr. Simple random and stratify sampling for ratio's in details, regression estimating; cluster sampling for mean and proportion's, systematic sampling, two stage simple random-sampling.
Prerequisite: Sampling Methods I 19530

19540 Nonparametric Statistics 3 Cr. Aspects of nonparametric, p-th quantile estimation and confidence interval, sign test, McNemar test, Cox and Stewart test, goodness of fit tests, Mann-Whitney test, Kruscal-Wallis test, Spearman's Rho, Kendal's Tau test, Wilcoxon signed ranks test.
Prerequisite: Statistical Methods 19511; Probability II 19514

19544 Statistical Quality Control 3 Cr. Aspects of quality control, history of quality improvement, TQM, seven magnificent rules, control charts for variables, control charts for attributes, acceptance sampling.
Prerequisite: Sampling Methods I 19530; Statistical Methods 19511

19553 Design and Analysis of Experiments I **3** Cr. Aspects of design and analysis of experiments, analysis of variance and comparison of means. Completely randomized design, complete block design, incomplete block designs, latin squares, Greeco latin. Youden square, General Factorial Experiments.
Prerequisite: Regression 19562

19554 Design and Analysis of Experiments II 3 Cr. 2k and 3k factorial experiments, confounding, fractional replications, nested designs, multifactor experiments with randomization restrictions, split plot designs, analysis of covariance.
Prerequisite: Design and Analysis of Experiments I 19553

19562 Regression 3 Cr. Aspects of regression analysis, straight-line regression analysis, sample correlation coefficient and the straight-line regression analysis, ANOVA table for simple linear regression, examination of residuals, multiple regression analysis, ANOVA table for multiple regression analysis, partial & multiple correlation coefficients, interaction in regression analysis, colinearity, polynomial regression, lack-of-fit test, orthogonal polynomials.
Prerequisite: Linear Algebra 19117; Mathematical Statistics I 19518

19570 Multivariate Statistical Methods I 3 Cr. Multivariate distribution theory, sampling from a Multivariate Normal Distribution and maximum likelihood estimation, Wishart distribution, inferences about a mean vector (generalized likelihood ratio test), confidence regions of the mean vector, simultaneous confidence intervals, comparison of several multivariate means, multivariate linear regression models.
Prerequisite: Mathematical Statistics I 19518

19571 Multivariate Statistical Methods II 4 Cr. Principal component analysis, factor analysis, canonical correlation analysis, discrimination and classification, cluster analysis.
Prerequisite: Multivariate Statistical Methods I 19570

19581 Stochastic Processes 3 Cr. Markov Chains, the basic limit theorems, Random Variables, Branching process, Markov Chains with discrete states in continuous time including Poisson and Birth and Death processes, Renewal processes.
Prerequisite: Probability II; Elementary Differential Equations