

Description of courses offered by the Department of Mathematics

0302131 Principles of Statistics and Probabilities 3 hours.

Identifying the problems to be studied, collecting data, designing a questionnaire, classifying data in statistical tables, representing data in graphs, measures of dispersion (range, variance, standard deviation), probability, discrete probability distributions, Continuous probability distributions, Regression and Correlation .

No Prerequisite

0302101 Calculus (1) 3 hours .

Functions , limits and continuity, the derivative, differentiation formulas , the chain rule, implicit differentiation, logarithmic and exponential functions, inverse functions, analysis of functions and their graphs, applications of the derivative, integration , the fundamental theorem of calculus .

No Prerequisite

0302102 Calculus (2) 3 hours

Applications of the definite integral (Area, volumes, length of a curve), integration by parts, trigonometric integrals , integration by partial fraction, improper integrals , infinite series, sequences, convergence tests, Taylor and Mclaurian series, power series .

Prerequisite (0302101)

0302151 Set theory 3 hours

Sets, relations and functions, denumerable and non denumerable sets, equivalence relations, countable and non countable sets, finite and infinite sets, cardinal numbers, logic and methods of proof, axiom of choice.

Prerequisite (0302102)

0302207 Calculus (3) 3 hours

Polar coordinates, conic sections, rotation of axes, vectors in space, dot product, cross product, projections, lines and planes in 3 dimensions, vector valued functions.

Prerequisite (0302102)

0302202 Advanced Calculus 3 hours

Partial derivatives, functions of two or more variables, double and triple integrals, calculus of vector fields.

Prerequisite (0302201)

0302203 Ordinary Differential Equations (1)

3 hours

First order differential equations and relevant applications, higher order linear differential equations and their applications, series solutions of differential equations, Laplace transform, Cauchy-Euler equations .

Prerequisite (0302102)

0302215 Real Analysis

3 hours

The real numbers \mathbb{R} , the algebraic properties of \mathbb{R} (order, completeness), supremum, Archimedean property, sequences , convergence tests for sequences, monotone sequences, Cauchy criterion, Bolzano-Weierstrass theorem, series, convergence tests of series, limits of functions, Limit theorems, continuous functions, uniform continuous, monotone and inverse functions, Roll's theorem, mean value theorem, L'Hospital's rule, Taylor's theorem .

Prerequisite (0302151)

0302232 Probability Theory

3 hours

Sample space, events, axioms of probability, probability rules, conditional probability and independence, Bay's theorem, random variables , discrete random variables and probability distribution functions, continuous random variables and probability density functions, the distribution function, mathematical expectation, moments mean and variance, moment generating function and Chebyshev's inequality, discrete probability models, Bernoulli and Binomial distributions, geometric, negative binomial, Poisson, and Hyper geometric distributions, continuous probability distributions covered the uniform, exponential, gamma, beta, normal, multivariate distributions; bi variant distributions (discrete and continuous), M.P.d.f.'s and d.f.'s, conditional distributions and independence, covariance and correlation, conditional moments, mean and variance.

Prerequisite (0302230).

0302331 Mathematical Statistics(1)

3 hours

Distribution of functions of random variables, d.f method, transformation method, and moment generation function method. sampling distributions, the mean and the variance, law of large numbers and central limit theorem , the Chi square ,t, and F distributions, order statistics , point estimation, methods of estimation, moments method and maximum likelihood method, unbiasedness, mean square error, efficiency, minimum variance unbiased estimators, consistency and sufficiency definitions, interval estimation, the confidence interval concept and its intervals for the mean and variances of the normal dist, one and two populations, ratios of two variances, testing hypotheses , types of errors, critical regions, power tests, the most powerful tests, Neumann-Pearson lemma, likelihood ratio test, hypotheses testing and some applications. **Prerequisite (0302232)**

0302241 Linear Algebra(1)**3 hours.**

System of linear equations, methods of solving linear equations, matrices, determinants, vectors in 2-space and 3-space, scalar product, dot product, cross product, general vector spaces, subspaces, linear independence, basis and dimension, inner product spaces, orthonormal bases, Gram-Schmidt process, change of basis and linear transformation.

Prerequisite (0302102)**0302242 Abstract Algebra (1)****3 hours**

Binary operations, groups, subgroups, permutation groups, cyclic and factor groups, homeomorphisms, auto morphisms and isomorphism theorems, Lagrange theorem, conservative functions.

Prerequisite (0302151)**0302261 Euclidean and Non-Euclidean Geometry****3 hours .**

Euclidean geometry, postulates, Euclidean parallel postulate, Euclidian geometry, (equivalence, similarity, properties of geometric shapes), Non Euclidian geometry, Saccheri's quadrilateral, neutral geometry, non-Euclidean geometry, Lobachevskian geometry and Riemann's geometry, the logical consistency of the non-Euclidean geometry, the conversion rule, polar properties in elliptic geometry.

Prerequisite (0302202)**0302381 Operations Research (1)****3 Hours**

History of operations research, mathematical and linear programming. The objective function and constraints in linear programming, the canonical and the standard forms, graphical solution of two-variable linear programs, the simplex method, big-M technique, dual problem, special cases in solving linear programming, primal - dual simplex method, sensitivity analysis concerning constraints and objectives, changes in the coefficients of the objective function, changes in the right-hand side of the constraints, addition of new constraint, transportation problem, assignment problem, networks and integer programming.

Prerequisite (0302241)**0302303 Ordinary Differential Equations (2)****3 Hours**

Systems of linear differential equations, two - dimensional autonomous systems, existence and uniqueness theory, boundary value problems, periodic functions, nonlinear differential equations, stability.

Prerequisite :(0302203)

0302301 Partial Differential Equations**3 Hours.**

An introduction to partial differential equations and their classifications and solutions, Fourier's integrals, the heat equation, the wave equation and the potential equation (Laplace equation).

Prerequisite (0302203)**0302311 Mathematical Analysis (1)****3Hours**

Riemann integral and its properties, the fundamental theorem of calculus, bounded functions, Riemann-Stieltj's integrals, fundamental theorems for Riemann-Stieltj's integrals, Topology of \mathbb{R} , Differentiation and integration on \mathbb{R}^n , partial derivatives, directional derivatives, chain rule, extreme values, change of variables.

Prerequisite (0302212)**0302312 Complex Analysis (1)****3 Hours**

Complex numbers, algebraic properties, powers and roots, analytic function, continuity, derivatives, Cauchy-Riemann equations, elementary functions, mapping by elementary functions, complex integral, Cauchy-Goursat theorem, Cauchy-integral formula, Liouville's theorem, series, Taylor series, Laurent series, residues, calculation of residues, poles, and applications.

Prerequisite (0302202)**0302221 Numerical Analysis (1)****3 hours.**

Finding numerical solutions specially for problems which have no exact solutions, computer calculations, computing errors, numerical solutions for equations with one variable, approximations by polynomials, numerical solution for system of linear equations, numerical matrix algebra, numerical differentiation and integration.

Prerequisite: (0302102)**0302441 Abstract Algebra (2)****3 hours**

Review of abstract algebra (1), fields, rings, Euclidian rings, divisible groups, principle rings and ideals, maximal and irreducible ideals, finite fields, extension of fields, algebraic extensions.

Prerequisite: (0302342)**0302362 Topology (1)****3 Hours**

Topological spaces and subspaces, interior, exterior, boundary, cluster and isolated points for sets, bases, sub-bases, finite product and general products of topological spaces, continuous functions, isomorphism, axiom of choice, separated spaces, countable spaces, normal and regular spaces, metric spaces. T_i - Space ($i= 0, 1, 2$).

Prerequisite: (0302212)

0302471 Mathematical Methods**3 Hours**

Beta and gamma functions, Laplace transforms, Fourier transforms, special functions, applications.

Prerequisite: (0302301)

0302421 Numerical Analysis(2)**3 Hours**

Initial and boundary value problems for ordinary differential equations, approximation theory, approximation functions by polynomials, approximation of Eigen values and eigenvectors, approximation functions by rational functions, numerical approximations for partial differential equations.

Prerequisite: (0302221)

0302371 Principles of Applied Mathematics**3 Hours**

Vector analysis, the position vector, velocity and acceleration in rectangular, polar, cylindrical and spherical coordinates. Newton's laws of motion, kinetic and potential energy, the impulse, variation of gravity with height. Simple harmonic motion, damped motion, conservative forces, harmonic motion in two and three dimensions. Central forces, the laws of area and motion in a central field, orbits in an inverse-square field, the force of gravitation between two bodies, Lagrangian mechanics, generalized coordinates, Lagrange's equation and applications, Hamilton's theory, calculus of variation, extreme values for integrals, applications.

Prerequisite :(0302203)

0302133 Statistical Methods**3 Hours**

A review of hypotheses testing, applications on Z and t tests, independence and goodness of fit test. One-way analysis of variance, completely randomized design, ANOVA table, assumptions and hypotheses, estimation of parameters, random model, Two-way ANOVA; assumptions, hypotheses, parameter estimation and random and mixed models, correlation and regression, simple linear regression; assumptions, hypotheses and model selection procedures: forward, backward, and stepwise methods.

Prerequisite :()

0302337 Experimental Designs**3 Hours**

Randomized block designs, latin squares, designs of factorial experiments, two factorial designs 2^n and 3^n , confounding designs and nested designs.

Prerequisite :(0302232)

0302332 Time Series**3 Hours**

A definition of time series provided with examples and applications, stationary and non-stationary series, trend and seasonality, probability modeling of time series, auto-covariance and autocorrelation functions, auto-regressive and moving average models, ARMA and ARIMA models, auto correlations and their use in model selection procedures, an introduction to spectral analysis.

Prerequisite :(0302232)**0302333 Sampling Theory****3 Hours**

Sampling distributions, the covariance, and correlation, estimation theory and the properties of good estimator, types of samples and sampling error, methods of data collection and designing a questionnaire, simple random sample, how to draw the sample, estimation of population mean, total and proportion, random sample, totals and proportion, systematic sample, cluster sampling: one stage cluster sample and two-stage cluster sample, ratio and regression estimation and comparing the methods involved .

Prerequisite:(0302232)**0302341 Linear Algebra (2)****3 Hours**

Linear transformations, transformation to diagonal matrices, similar matrices, similarity of diagonal and normal matrices, applications to differential equations, quadratic forms, matrices of complex numbers, independent and normal vectors, vector spaces, basis for vector spaces, Eigen values and eigenvectors.

Prerequisite:(0302241)**0302343 Number Theory****3 Hours**

Divisibility, Euclidian's algorithm, the fundamental theorem, arithmetical functions, Euler's function , Fermat numbers, linear Diophantine equations, linear congruence, the Chinese remainder theorem, system of linear congruence, Wilson's theorem, Fermat's theorem, the order of an integer modulo n, primes and factorization and primitive roots of primes.

Prerequisite:(0302151)**0302481 Operations Research(2)****3 Hours**

Queuing theory, queuing systems, the birth and-death process with regard to its significance and elements, queuing models and applications on queuing theory, making decisions, the evaluation of travel time, inventory theory and components of inventory models, the simulation formulating and implementing a simulation model. Monte Carlo techniques, Markovian decision processes, linear programming, optimal policies and nonlinear programming .

Prerequisite :(0302381)

0302462 Graph Theory**3 Hours**

An introduction to graph theory, walks and paths, operations on graphs, blocks, trees, connectivity, Euler and Hamiltonian graphs and line graphs.

Prerequisite :(0302342)

0302411 Complex Analysis(2)**3 Hours**

Conformal mappings, residue theorem, complex integrals, Ruchee theorem, conformal mappings, conservative functions and its applications, Schwarts Cristofel mappings, analytic continuation, Riemann surfaces and applications.

Prerequisite: (0302312)

0302412 Functional Analysis**3 Hours**

Metric spaces, linear spaces, normed spaces, L_p-spaces, Banach spaces, linear operators, Hilbert spaces, inner product spaces, orthogonal complements and direct sums, orthonormal sets, sequences, Hilbert adjoint operators, metric, linear, nor med spaces.

Prerequisite :(0302311)

0302431 Mathematical Statistics (2)**3 Hours**

Point estimation, risk function, exponential families, sufficient and complete classes, Pitman estimates, properties of maximum likelihood estimate and confidence sets, different tests as hypothesis testing, general probability, ratio test, uniformly most powerful test and sequential tests.

Prerequisite :(0302331)

0302461 Topology (2)**3 Hours**

T-spaces ($I=3$, $3\frac{1}{2}$, 4, 5), axioms of count ability, compact spaces, connected spaces, sequences, product spaces, Lindelof spaces, function spaces and metric spaces..

Prerequisite :(0302362)

0302442 Special Topics in Abstract Algebra**3 Hours**

As decided by the department.

0302413 Special Topics in Analysis**3 Hours**

As decided by the department.

0302401 Special Topics in Differential Equations**3 Hours**

As decided by the department.