Department of Mathematics

Pt .C.L.S. GOVERNMENT COLLEGE,KARNAL

UNDERGRADUTE COURSES

Sr. No.	Course Name	Class	Paper code	Semester	Duration
1	Algebra	B.A./B.SC	BM-111	1st	Six Months
2	Calculus	B.A./B.SC	BM-112	1st	Six Months
3	Solid Geometry	B.A./B.SC	BM-113	1st	Six Months
4	Number Theory &Trigonometry	B.A./B.SC	BM-121	2nd	Six Months
5	Ordinary Differential Equations	B.A./B.SC	BM-122	2nd	Six Months
6	Vector Calculus	B.A./B.SC	BM-123	2nd	Six Months
7	Advance Calculus	B.A./B.SC	BM-231	3rd	Six Months
8	Partial Differential Equations	B.A./B.SC	BM-232	3rd	Six Months
9	Statics	B.A./B.SC	BM-233	3rd	Six Months
10	Sequences and Series	B.A./B.SC	BM-241	4th	Six Months
11	Special Functions &Integral Transforms	B.A./B.SC	BM-242	4th	Six Months
12	Programming in C & Numerical Methods	B.A./B.SC	BM-243	4th	Six Months
13	Real Analysis	B.A./B.SC	BM-351	5th	Six Months
14	Groups & Rings	B.A./B.SC	BM-352	5th	Six Months
15	Numerical Analysis	B.A./B.SC	BM-353	5th	Six Months
16	Real & Complex Analysis	B.A./B.SC	BM-361	6th	Six Months
17	Linear Algebra	B.A./B.SC	BM-362	6th	Six Months
16	Dynamics	B.A./B.SC	BM-363	6th	Six Months
17	Elements of Mathematical Foundation-I	B.C.A.	BCA-113	1st	Six Months
18	Elements of Mathematical Foundation-II	B.C.A.	BCA-123	2nd	Six Months
19	Computer Oriented Numerical Methods	B.C.A.	BCA-236	3rd	Six Months
20	Computer Oriented Statistical Methods	B.C.A.	BCA-245	4th	Six Months
21	Mathematical Foundation for IT-I	B.SC.-IT	BSIT-102	1st	Six Months
22	Mathematical Foundation for IT-II	B.SC.-IT	BSIT-202	2nd	Six Months
23	Business Mathematics -I	B.COM	BC-105	1st	Six Months
24	Business Mathematics -II	B.COM	BC-205	2nd	Six Months

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POSTGRADUTE COURSES

Sr. NO.	Course Name	Class	Paper Code	Semester	Duration
1	Advanced Abstract Algebra – I	M.SC.	MM-401	1st	Six Months
2	Real Analysis – I	M.SC.	MM-402	1st	Six Months
3	Topology	M.SC.	MM-403	1st	Six Months
4	Complex Analysis – I	M.SC.	MM-404	1st	Six Months
5	Differential Equations – I	M.SC.	MM-405	1st	Six Months
6	Practical-I	M.SC.	MM-406	1st	Six Months
7	Advanced Abstract Algebra – II	M.SC.	MM-407	2nd	Six Months
8	Real Analysis – II	M.SC.	MM-408	2nd	Six Months
9	Computer Programming (Theory)	M.SC.	MM-409	2nd	Six Months
10	Complex Analysis – II	M.SC.	MM-410	2nd	Six Months
11	Differential Equations – II	M.SC.	MM-411	2nd	Six Months
12	Practical-II	M.SC.	MM-412	2nd	Six Months
13	Functional Analysis	M.SC.	MM-501	3rd	Six Months
14	Analytical Mechanics and Calculus of Variations	M.SC.	MM-502	3rd	Six Months
15	Elasticity	M.SC.	MM-503(i)	3rd	Six Months
16	Number Theory	M.SC.	MM-503(iv)	3rd	Six Months
17	Fluid Mechanics – I	M.SC.	MM-504(i)	3rd	Six Months
18	Algebraic Coding Theory	M.SC.	MM-504(i)	3rd	Six Months
19	Integral Equations	M.SC.	MM-505(i)	3rd	Six Months
20	Practical-III	M.SC.	MM-506	3rd	Six Months
21	General Measure and Integration Theory	M.SC.	MM-507	4th	Six Months
22	Partial Differential Equations	M.SC.	MM-508	4th	Six Months
23	Mechanics of Solids	M.SC.	MM-509(i)	4th	Six Months
24	Algebraic Number Theory	M.SC.	MM-509(iii)	4th	Six Months
25	Fluid Mechanics-II	M.SC.	MM-510(i)	4th	Six Months
26	Boundary Value Problems	M.SC.	MM-510(ii)	4th	Six Months
27	Mathematical Aspects of Seismology	M.SC.	MM-511(i)	4th	Six Months
28	Practical-IV	M.SC.	MM-512	4th	Six Months

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Program Specific Outcome (PSO)
B.A./B.Sc. /B.C.A./B.SC.(I.T.)/B.COM (Mathematics)

- Scientific temper will be developed in Students.
- Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the science stream.
- Students will become employable; they will be eligible for career opportunities in Industry, or will be able to opt for entrepreneurship.
- Students will possess basic subject knowledge required for higher studies, professional and applied courses like Management Studies, Law etc.
- Students will be aware of and able to develop solution oriented approach towards various Social and Environmental issues.
- Acquire good knowledge and understanding in advanced areas of mathematics and statistics, chosen by the student from the given courses.
- Understand, formulate and use quantitative models arising in social science, business and other contexts.

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Program Specific Outcome (PSO)
M.A./M.SC (Mathematics)

- Think in a critical manner.
- Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.
- Formulate and develop mathematical arguments in a logical manner
- A student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences.
- Student is equipped with mathematical modeling ability, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
- Student should be able to apply their skills and knowledge that is translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.

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COURSE OUTCOMES (U.G.)

Course: BM-111 : Algebra

Students will able to

- To learn basic matrix algebra and method to find solutions to system of linear equations. Also to learn eigenvalues and eigenvectors of matrix.
- Describe the relation between roots and coefficients
- Find the sum of the power of the roots of an equation using Newton's Method.
- Transform the equation through roots multiplied by a given number, increase the roots, decrease the roots, removal of terms
- Solve the reciprocal equations.
- Analyse the location and describe the nature of the roots of an equation.

Course: BM-112 : Calculus

Students will able to

- Study functions and several variables.
- Study the notion of Continuity and Differentiability of multivariate functions.
- Find Maxima and minima of function of two variables.
- Explain subtangent and subnormal.
- Find angle of intersection of two curves.
- Find circle, radius and centre of curvature.

Course: BM-113 : Solid Geometry

Students will able to

- To learn analytical geometry of 3 dimensions which include study of conics, planes, lines, sphere.
- Understand General Equation of second degree, tracing of conics.
- Find equation of cone with given base, equation of cylinder and its properties .
- Get an idea of central conicoid, parabola, plane section of conicoids.

Course: BM-121 : Number Theory & Trigonometry

Students will able to

- Illustrate the Division and Euclidean Algorithm
- Describe the properties of prime numbers

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- Show that every positive integer can be expressed as product of prime power in unique way
- Write a formula for the number of positive integers less than n that are relatively prime to n
- Define congruences and describe the properties of congruences Solve the system of linear congruences
- State Chinese Remainder Theorem, Fermat's and Wilson's theorem
- Understand the proof of De movers Theorem and its application.

Course: BM-122 :Ordinary Differential Equations

Students will able to

- Knowledge of Exact Differential Equations
- Linear differential equation, Clairauts equation and singular solution.
- Understand to solve linear differential equation of second order, method of variation of parameter.
- Find a solution of differential equations of the first order and of a degree higher than the first by using methods of solvable for p, x and y

Course: BM-123 : Vector Calculus

Students will able to

- Get knowledge of scalar and vector product of three and four vectors.
- Understand gradient, divergence, curl and vector identities.
- Evaluate integrals by using Green's Theorem, Stokes theorem, Gauss's Theorem.

Course: BM-231 : Advance Calculus

Students will able to

- Understand partial differentiation, Jacobians, Envelopes and evaluates.
- Get knowledge of Maxima and Minima.
- Get Knowledge of curve in space and differential geometry.

Course: BM-232 : Partial Differential Equations

Students will able to

- Learn to form a partial differential equations.
- Find the solution of First order partial differential equations for some standard types.
- Learn methods to solve linear and Non-linear Partial Differential Equations.

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Course: BM-233 : Statics

Students will able to

- Define Resultant, Component of a Force, Coplanar forces, like and unlike parallel forces, Moment of a force and Couple with examples.
- Prove the Parallelogram of Forces, Triangle of Forces, Converse of the Triangle of Forces, Polygon of Forces, Lami's Theorem, Varignon's theorem of moments.
- Find the resultant of coplanar couples, equilibrium of couples and the equation to the line of action of the resultant.
- Discuss Friction, Forces of Friction, Cone of Friction, Angle of Friction and Laws of friction.
- Define catenary and obtain the equation to the common catenary.

Course: BM-241 :Sequence and Series

Students will able to

- Define different types of sequence.
- Prove properties of convergent and divergent sequence.
- Verify the given sequence in convergent and divergent by using behaviour of Monotonic sequence. Prove Cauchy's first limit theorem, Cesaro's theorem, Cauchy's Second limit theorem.
- Explain subsequences and upper and lower limits of a sequence.
- Give examples for convergence, divergence and oscillating series.
- Discuss the behaviour of the geometric series.

Course: BM-242 :Special functions and Transforms

Students will able to

- Solve second order differential problems by power series method.
- Learn about Bessel equation and legendre equations.
- Solve problems related to Laplace Transformation.
- Find Fourier series expansions for given functions.
- Analysis properties of Fourier transforms convolution and parseval'sidentity .
- Find Cosine and Sine series expansions for given functions.
- Know about Hermite polynomials generating function orthogonally expansion of polynomials.

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Course: BM-243 :Programming in C & Numerical Methods

Students will able to

- Know classification of program language , concept of structure programming , problems solving by computer .
- Understand C language and structure of C Program , defining variable and constant .
- Get knowledge of maintenance of input output operator , Jumping and Lopping
- Explain single and double dimensional arrays, use defined function.

Course: BM-351: Real Analysis

Students will able to

- Knowledge of Reimann integration and improper integration.
- Equip students with basic mathematical tools such as open & close sets, continuity, connectedness, compactness which can be used to study general topology.
- Enhance abstract thinking and visualization of students.
- Generalize the notion of distance, convergent sequence and continuity of functions.
- Increase problem solving ability by solving examples and counter-examples of various concepts involved.

Course: BM-352: Groups & Rings

Students will able to

- Learn fundamental properties and mathematical tools such as closure, identity, inverse and generators.
- Study algebraic structure 'Groups' in detail which is useful in study of Rings.
- Enhance abstract thinking of students.
- Learn to compare two different algebraic structures and study transfer of properties inbetween these structures through homomorphism and isomorphism.
- Study the algebraic structure Ring in detail through various examples.
- Learn the construction of field of quotients of an integral domain.
- Study the Rings of polynomials and its factorization over a field.

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Course: BM-353: Numerical Analysis

Students will able to

- Define Basic concepts of operators Δ,E, ∇
- Find the difference of polynomial
- Solve problems using Newton forward formula and Newton backward formula.
- Derive Gauss's formula and Stirling formula using Newton forward formula and Newton backward formula.
- Find maxima and minima for differential difference equation
- Derive Simpson's 1/3 ,3/8 rules using trapezoidal rule
- Understand approximations, solution of equations and Interpolation .

Course: BM-361: Real & Complex Analysis

Students will able to

- Learn evaluation of double and triple integration and its application to area and volume.
- Understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations.
- Determine whether a given function is analytic.
- Define Bilinear transformation, cross ratio, fixed point.

Course: BM-362: Linear Algebra

Students will able to

- Define Vector Space, Quotient space Direct sum, linear span and linear independence, basis and inner product.
- Discuss the linear transformations, rank, nullity.
- Find the characteristic equation, eigen values and eigen vectors of a matrix.
- Prove Cayley- Hamilton theorem, Schwartz inequality, Gram-schmidt orthogonalisation process.
- Solve the system of simultaneous linear equations.

Course: BM-363: Dynamics

Students will able to

- Define Projectile, impulse, impact and laws of impact,prove that the path of a projectile is a parabola.
- Find the direct and oblique impact of smooth elastic spheres.
- Define Simple Hormonic Motion and find its Geometrical representation.

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- Find the Composition of Simple Hormonic Motion and the differential equation of a central orbit.
- Find the law of force if the orbit is given and vice versa.

Course: BCA-113: Elements of Mathematical Foundation -I

Students would have to

- Understand Set, subsets and operation on sets , power set of a set , partially ordered sets.
- Knowledge about continuity of a function of a single variable, Continuous function and classification of discontinuities.
- Know about higher order derivatives and Formation of differential equations, ordinary differential equations of first degree and the first order.
- Find solution of exact differential equations, Linear differential equations of higher order with constant coefficients application of differential equations to geometry.

Course: BCA-123: Elements of Mathematical Foundation -II

Students would have to

- Learn fundamental properties and mathematical tools such as closure, identity, inverse and generators.
- Study algebraic structure 'Groups' in detail which is useful in study of Rings.
- Enhance abstract thinking of students.
- Learn to compare two different algebraic structures and study transfer of properties in between these structures through homomorphism and isomorphism.
- Knowledge of Propositions and logical operators, truth tables and propositions generated by a set.
- Know about Matrices and their rank to use to find solution of system of linear equations.
- Find Characterstic equations of a square matrix, Cayley Hamilton theorem, eigen value and eigen vectors diagonalization of a square matrix.

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Course: BCA-236: Computer Oriented Numerical Methods

Students would have to

- Learn to apply the various numerical techniques for solving real life problems.
- Solve the problems which cannot be solved by usual formulae and methods can be solved approximately by using numerical techniques.
- Find the solution of ordinary differential equation of first by Euler, Taylor and Runge-Kutta methods.
- Derive Simpson's 1/3 ,3/8 rules using trapezoidal rule
- Understand approximations, solution of equations and Interpolation .

Course: BCA-245: Computer Oriented Statistical Methods

Students will able to

- Define probability density function, probability distribution
- Derive mathematical expectation, binomial, poisson, normal distribution
- Solve the problems of large samples and small samples
- Discuss the moment generating functions, chi-square distribution
- Compute the analysis of variance, one way and two way classifications

Course: BSIT-102: Mathematical Foundation For IT-I

Students will able to

- Learn about Matrix and their Rank, eigen vectors , characteristics equation , diagonalization.
- Ordinary differential equations of the first order and degree, exact equation.
- Combination of sets , finite and infinite sets, Countable and uncountable sets, mathematical induction, Equivalence relation and partitions.

Course: BSIT-202: Mathematical Foundation For IT-II

Students will able to

- Apply various Iterative method to find real root of equations.
- Guass elimination method ,Guass-jorden method.
- Taylor series method, RungaKutta method, Guassseidalmethod ,Euler method , Modified Euler method for finding solution of Ordinary differential equations.
- Understood Interpolation formula, approximation of functions by Taylor series and Chebyshev polynomial

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Course: BC-105: Business Mathematics -I

Students will able to

- Learn about Logarithms, anti-logarithms, Arithmetic and geometric progressions
- Idea of simple derivative of different functions and applications.
- Definition of a matrix, type of matrices, algebra of matrices
- Solution of a system of linear equation having unique solution and involving not more than three variables
- Compound interest and annuities.

Course: BC-205: Business Mathematics -II

Students will able to

- Understand about Permutations and combinations, Binomial theorem and its applications
- Graphical solution of linear inequalities in 2 variables.
- Formulation of equations, graphical method of solution
- Data interpretation, classification and tabulation histogram, limitations of diagrams and graphs.

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COURSE OUTCOMES (P.G.)

Course: MM-401 : Advanced Abstract Algebra -I

Students would have

- Knowledge of conjugency relation normalizer, sylow`s theorem.
- An understanding of normal and subnormal series, Jordan Holder theorem .
- An idea of solvable group and its properties, commutator subgroup , Nilpotent group and its properties .
- Develop the knowledge of extension field , finite extension ,algebraic and transcendental field.
- Knowledge of derivative of polynomial separable and separable extension ,Perfect field and finite field.

Course: MM-402 : Real Analysis -I

Students would be able to

- Understand Riemann Stieltjes integral and its properties, Fundamentals theorem of calculus.
- Know integration of vector-valued function, Riemann's theorem.
- Develop the knowledge of sequence and series of functions, Riemann-stieltjes integration, Power series.
- Develop the knowledge of Pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weirstrass M-test, Abel's test and Dirichlet's test for uniform convergence
- Know about function of several variables, linear transformations, Taylors theorem, Inverse function theorem.
- Explain implicit function theorem , Jacobions, Differentiation of integrals, Differentiation of integrals.

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Course: MM-403 : Topology

Students would be able to

- Define topological spaces, basis for a topology, standard topology, closed set ,limit point and interior of a set.
- Know about continuous functions, Homeomorphism , Topological imbedding comparison of the product Topology and the box topology.
- Understand the metric Topology, The sequence lemma and uniform limit theorem .
- Analysis connected spaces, separation , cartesion product of connected spaces, path connectedness .
- Development an understanding of compact spaces, finite product of compactness the Lemma, first countable and second countable spaces.
- Analysis about the definition and examples of filters on a set, Collection of all filters on a set as a p.o. set,finer filter, methods of generating filters/finer filters,
- Know about Ultra filter (u.f.) and its characterizations, Ultra Filter Principle (UFP) i.e. Every filter is contained in an ultra filter. Image of filter under a function.

Course: MM-404 : Complex Analysis-I

Students would be able to

- Get an idea of Power series, its convergence, radius of convergence , Path in a region, smooth path, p.w. smooth path, contour, simply connected region, multiply connected region,
- Gain knowledge of complex integration, Cauchy integral formula, Higher order derivative.
- Understand Moreras theorem, Liouville,s theorem, Taylors theorem,
- Know about the maximum modulus principle, Schartz lemma, Isolated singularities, Inverse function theorem.
- Develop an understanding of residues, Cauchy residue theorem, Evaluation of integrals.

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Course: MM-405 : Differential Equations-I

Students would have

- Understand Initial value problem and equivalent integral equation, ε-approximate solution, equi-continuous set of functions.
- Derive Ascoli- Arzela theorem, Cauchy –Peano existence theorem, Picard-Lindelof theorem, Gronwall's inequality.

- Know about Linear differential systems: Definitions and notations. Linear homogeneous systems; Fundamental matrix, Adjoint systems, reduction to smaller homogeneous systems.

- Understood about Higher order equations, Linear differential equation (LDE) of order n. Wronskian theory. Reduction of order, Non-homogeneous LDE.

Course: MM-406 : Practical-I

Students would have

- Use problem-solving techniques based on papers MM-401 to MM-405 will be taught.

- Implementation of the various programs in ANSI C.

Course: MM-407 : Advanced Abstract Algebra -II

Students would be able

- Explain the elements of Commutators and higher commutators. Commutators identities. Commutator subgroups, Derived group, Jordan blocks and Jordan canonical forms.
- Understand modules ,sub modules and direct sum of submodules,Finitely generated modules.
- Define simple modules ,semi-simple modules, free modules ,Rank of a modules.
- Explain Noetherian and Artinin modules ,Noetherian and Artinin ring .Hilbert basis theorem.
- Understand fundamentals structure theorem of finitely generated modules over a principal ideal domain.

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Course: MM-408 : Real Analysis –II

Students would be able to

- Understand Lebesgue outer measure, Measurable sets, Regularity, Measurable functions, Non- measurable sets.
- Define integration of Non-negative function, Integration of series, Lebesgue Integration .
- Get an Idea of the four derivative, Function of Bounded variation , differentiation and integration .
- Know about LP spaces, convex function , Ten series inequality, Holder and Murkowski inequalities .
- Understand about dual spaces. Convergence in measure, uniform, convergence and almost uniform convergence
- Understand the Lp spaces, Minkowski and Holder inequalities, completeness of Lp spaces, Bounded linear functionals on the Lp spaces, Riesz representation theorem.

Course: MM-409 : Computer Programming (Theory)

Students would be able to

- Understand Numerical constants and variables; arithmetic expressions; input/output; conditional flow, looping.
- Get an idea Logical expressions and control flow; functions; subroutines; arrays.
- Know about Format specifications; strings; array arguments, derived data types.
- Gain knowledge of Processing files; pointers; modules; FORTRAN 90 features; FORTRAN 95 features.

Course: MM-410 : Complex Analysis-II

Students would be able to

- Get knowledge of Reimann-zeta function, Riemann's functional equation, Runge's theorem, Mittag-Leffler's theorem.
- Prove Hurwitz's theorem, Montel's theorem, Riemann mapping theorem, infinite products, Weierstrass factorization theorem.

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- Develop an understanding of Order of an entire function, Exponent of convergence, Borel theorem, Hadamard's factorization theorem.

- Know about Monodromy theorem and its consequences. Harmonic function as a disk, Poisson's Kernel. Harnack's inequality, Harnack's theorem,

Course: MM-411 : Differential Equations-II

Students would be able to

- Get knowledge of Linear second order equations, self adjoint equation of second order, Riccati's equation, Pruffer transformation,Oscillatory and non-oscillatory equations. Abel's formula.

- Define Sturm theory, Autonomous systems, Types of critical points, paths of linear systems.

- Develop an understanding about Critical points and paths of non-linear systems, Liapunov function. Limit cycles and periodic solutions, Poincare-Benedixson theorem.

- Understand the theory of Second order boundary value problems(BVP), Sturm-Liouville BVP, Orthogonality of function, Applications of boundary value problems.

- Use of Implicit function theorem and Fixed point theorems for periodic solutions of linear and non-linear equations.

Course: MM-412: Practical-II

Students would have

- Use problem-solving techniques based on papers MM-407 to MM-411 will be taught.

- Implementation of the various programs in FORTRAN -90.

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Course: MM-501: Functional Analysis

Students would be able to

- Get knowledge of convergence, Completeness, Limit and limitpoint, Uniformly continuous mapping.
- Understand spaces of continuous functions, Minkowski and Holders inequlities, Normed linear spaces.
- Define Banach space, Continuous linear transformations, Conjugate of normed linear space in its second conjugate space.
- Explain the natural embedding of normed linear space in its second conjugate space,
- Understand inner product spaces ,Hilbert space, orthonormal sets, total(complete) orthonormal sets and sequences, Riesz representation theorem.
- Develop an understanding of Hilbert adjoint operator, Bessel's inequality, Parseval's identity, positive and projection operators.

Course: MM-502: Analytic Mechanics and Calculus of variation

Students would have

- Understand Motivating problems of calculus of variations, Minimum surface of revolution, Brachistochrone problem, Isoperimetric problem, Geodesic.
- Know about Generalized coordinates. Holonomic and Non-Holonomic systems. Scleronomic and Rheonomic systems.
- Analyze Hamilton's variables, Don kin's theorem, Hamilton canonical equations, Routh's equations, Cyclic coordinates Poisson's Bracket.
- Develop an understanding about Canonical transformations, free canonical transformations, Hamilton-Jacobi equation, Jacobi theorem.

Course: MM-503(i) : Elasticity

Students would be able to

- Understand Tensor Algebra, Tensor invariants, Deviatoric tensors, Eigenvalues

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and eigen-vectors of a tensor, Tensor Analysis.

- Know about Analysis of Strain, Principal strains and invariance, General infinitesimal deformation, Analysis of Stress.
- Get a knowledge of Stress quadric of Cauchy, Maximum normal and shear stresses. Mohr's circles, Equations of Elasticity.
- Gain Knowledge of Elasticity moduli for Isotropic media, Strain energy function and its connection with Hooke's Law,Clapeyrom's theorem. Saint-Venant's principle.

Course: MM-503(iv) : Number Theory

Students would have

- Analyze the equation ax+by = c, simultaneous linear equations, Pythagorean triangles.
- Develop an understanding of Elliptic curves, Factorization using elliptic curves, curves of genus greater then 1. Farey sequences, rational approximations, Hurwitz theorem.
- Know about Euclidean algorithm, infinite continued fractions, irrational numbers, approximations to irrational numbers, Best possible approximations.
- Understand Partitions, Ferrers Graphs, Formal power series, generating functions and Euler's identity, Euler's formula.

Course: MM-504(i) : Fluid Mechnics-I

Students would be able to

- Get knowledge of Kinematics of fluid in motion, Lagrangian and Eulerian methods, Stream lines, path lines and streak liens, vorticity and circulation
- Understand Equation of Motion ,Lagrange's and Euler's equations of Motion, Bernculli's theorem, Kelvins circulation theorem,
- Develop an understanding about Stress components in a real fluid, Relations between rectangular components of stress, Navier- Stoke's equations of motion.
- Know about the Hagen-Poiseuille flow, steady flow between two coaxial cylinders, flow between two concentric rotating cylinders.

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Course: MM-504(iii) : Algebraic Coding Theory

Students would be able to

- Know about Block Codes, Minimum distance of a code, Decoding principle of maximum likelihood, Binary error detecting and error correcting codes, Group codes.

- Get Knowledge of Primitive polynomials over finite fields, Automorphism group of $GF(q_n)$, Normal basis of $GF(q_n)$.

- Derive Equivalent codes and permutation matrices, Relation between generator and parity-check matrix of a linear codes over a finite field, Dual code of a linear code, Self dual codes.

- Understand Hadamard matrices, Idempotent generator of a cyclic code, Hamming and BCH codes as cyclic codes,the Gilbert-varsha-move and Plotkin bounds.

Course: MM-505(i) : Integral Equations

Students would be able to

- Get knowledge about Special kinds of Kernel Convolution Integral, Fredholm alternative,
- Fredholm theorem, an approximate method.

- Know about Application of iterative scheme to Volterra integral equations of the second kind, Classical Fredholm's theory.

- Understand definite Kernels and Mercer's theorem, Solution of a symmetric Integral Equation, Rayleigh-Ritz method for finding the first eigen value.

- Develop an understanding of Cauchy-type singular integral equation, Riemann-Hilbert problem, The Hilbert-Kernel, solution of the Hilbert-Type singular Intergal equation.

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Course: MM-506 : Practical –III

Students would have

- Use problem-solving techniques based on papers MM-501 to MM-505 will be taught.
- Implementation of the various programs in FORTRAN -90/95.

Course: MM-507: General Measure and Integration Theory

Students would able to

- Get knowledge of Measures, outer measures, extension of measures, uniqueness of extension, the LUB of an increasingly directed family of measures.
- Define Measure spaces, almost everywhere convergence, almost uniform convergence, Egoroff's theorem, Riesz-Weyl theorem.
- Explain Product Measures , the product of any two measure spaces, Fubini's theorem, Signed Measures, a preliminary Radon-Nikodym theorem, Hahn decomposition, Jordan decomposition.
- Develop an understanding of integration over locally compact spaces, Baire sets, Baire function, Baire-sandwich theorem, Baire measure, Borel sets, Riesz-Markoff's theorem.

Course: MM-508: Partial Differential Equations

Students would have

- Analyze transport equations homogeneous and non-homogeneous, Radial solution of Laplace's Equation, Poisson's equation and its solution Liouville's theorem, Harnack's inequality.
- Develop an understanding of Green's function and its derivation, Energy methods, Drichlet's principle, Heat Equations
- Know about Wave equation, D'Alemberts formula and its applications, reflection method, Euler- Poisson-Darboux equation, Kirchhoff's and Poisson's formulas

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- Understand Conservative Laws ,Representation of Solutions- Separation of variables, Fourier Transform, Laplace Transform, Converting non linear into linear PDE, Cole-Hop Transform, Potential functions, Hodograph and Legendre transforms.

Course: MM-509 (i) : Mechanics of Solids

Students would be able to

- Understand plane stress, Generalized plane stress, General solution of biharmonic equation, Stresses and displacements in terms of complex potentials.
- Know about Propagation of waves in an isotropic elastic solid medium. Waves of dilatation and distortion. Elastic surface waves : Rayleigh waves and Love waves, Extension of beams.
- Get a knowledge of Torsion ,Torsion of cylindrical bars; Torsional rigidity, Torsion and stress functions.
- Gain Knowledge of minimum potential energy, Theorems of minimum complementary energy, Reciprocal theorem of Betti and Rayleigh.

Course: MM-509(iii) : Algebraic Number Theory

Students would be able to

- Get knowledge about Algebraic numbers and algebraic integers, Transcendental Numbers, Liouville's Theorem for real Algebraic numbers, Cyclotomic Polynomials.
- Know about Dedekind domains. Fractional ideals of K. G.C.D. and L.C.M. of ideals in O_k. Chinese Remainder theorem.
- Understand Hurwitz Lemma and Hurwitz constant, Equivalent fractional ideals, Ideal class group, Diophantine equations, Minkowski's bound.
- Develop an understanding of Quadratic reciprocity Legendre Symbol. Gauss sums. Law of quadratic reciprocity, Quadratic fields, Primes in special progression.

Course: MM-510(i) : Fluid Mechnics-II

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- Get knowledge of ttwo-dimensional inviscid incompressible flows, Stream function, irrotational motion in two dimensions, Complex velocity potential, Sources, sinks, doublets and their images, Thomson circle theorem.

- Understand Kinetic energy of liquid contained in rotating elliptic cylinder, circulation about elliptic cylinder, Theorem of Blasius, Theorem of Kutta and Joukowski.

- Develop an understanding about Alembert's paradox, impulsive motion, initial motion of liquid contained in the intervening space between two concentric spheres, Vortex motion and its elementary properties.

- Know about Dynamical similarity, Buckingham pi- theorem , Reynolds number, Prandtl's boundary layer, boundary layer equations in two dimensions, Blasius solution Boundary layer thickness.

Course: MM-510 (ii) : Boundary Value Problems

Students would be able to

- Understand Green's function approach to reduce boundary value problems of a self-adjoint-differential equation with homogeneous boundary conditions to integral equation forms.

- Know about applications to partial differential equations, The Newtonian, single-layer and double layer potentials, Interior and Exterior Dirichlet problems and Neumann problems.

- Get a knowledge of mixed Boundary Value Problems,Two-part Boundary Value problems, Three-part-Boundary Value Problems, Generalized Three-part Boundary Value problems.

- Gain Knowledge of Low-Reynolds-Number Hydrodynamics: Steady stokes Flow, Boundary effects on Stokes flow, Longitudnal oscillations of solids in stokes Flow, Steady Rotary Stokes Flow, Rotary Oscillations in Stokes Flow.

Course: MM-511(i) : Mathematical Aspects of Seismology

Students would be able to

- Know about general form of progressive waves, Harmonic waves, Plane waves, the wave equation,Principle of superposition,Equation of telegraphy.

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- Get Knowledge of reduction of equation of motion to wave equations, P and S waves and their characteristics, Reflection at critical angles, Reflection and reflection of plane P,SV and SH waves at an interface.

- Derive two and three dimensional Lamb's problems in an isotropic elastic solid, A normal force acts on the surface of a semi-infinite elastic solid.
- Understand spherical waves. Expansion of a spherical wave into plane waves, Sommerfield's integral. Kirchoff's solution of the wave equation, Poissons's formula, Helmholtz's formula.

Course: MM-512 : Practical –IV

Students would have

- Use problem-solving techniques like MATLAB based on papers MM-507 to MM-511will be taught.

- Computer programs based on some numerical methods.

Head of Department

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