DANTULURI NARAYANA RAJU COLLEGE (AUTONOMOUS)
(A College with Potential for Excellence)
Bhimavaram, W.G.DIST. A. P.
Department: Mathematics.
Semester: I

For the Academic Year: 2014 – 15.
Paper: M 101 ALGEBRA – I

Group Theory: Definition of a group, Some examples of groups, some preliminary lemmas, Subgroups, A counting principle, Normal subgroups and quotient groups, Homomorphisms, Automorphism, Cayley's theorem, permutation group, Another counting principle, Sylows theorem, Direct products, finite abelian groups,

Ring Theory: Definition and examples of Rings, Some special classes of rings, Homomorphisms, Ideals and quotient rings, more Ideals and quotient rings, The field of quotients of an Integral Domain, Euclidean rings, a particular Euclidean ring, Polynomial rings, Polynomial over the rational field, Polynomial rings over the commutative rings.

Paper: M 102 REAL ANALYSIS – I

Basic Topology, finite, countable and uncountable sets. Metric spaces, compact sets, Connected sets,

Numerical sequences and series, convergent sequences, Sub sequences, Cauchy sequences, upper and lower limits, Some special sequences, series, series of non negative terms, number e, The root and ratio tests, Power series, Summation by parts, absolute convergence, Addition and multiplication of series, rearrangements

Continuity: Limits of function, continuous functions. Continuity and compactness, continuity and connectedness, Discontinuities, Monotone functions, Infinite limits and limits at infinity,

Differentiation: The derivate of a real function, Mean value theorems, The continuity of derivatives, L. Hospitals rule, Derivatives of higher order, Taylor's theorem, Differentiation of vector - valued functions.

Paper: M 103 TOPOLOGY – I

Sets and set inclusion, The Algebra of sets, Functions, Products of sets, Partition and equivalence relations. Countable sets, Uncountable sets, Partially ordered sets and lattices.

Metric spaces, The definition and some examples, Open sets, closed sets. Convergence, completeness, Baire's theorem. Continuous mappings. Spaces of continuous functions, Euclidean and Unitary spaces.

Topological Spaces-The definition and some examples, Elementary concepts, open bases and open subbases, Week topologies, The function algebras C(X, R) and C(X, C).

Compact spaces: product of spaces – Techonoff's theorem and locally compact spaces. Compactness for metric spaces. Ascoli's theorem.

Paper: M 104 DIFFERENTIAL EQUATIONS - 1

Second order linear differential equations: Introduction-general solution of homogeneous equation, Use of a known solution to find another -

Homogeneous equations with constant coefficients, Method of undetermined coefficients, Method of variation of parameters,

Oscillation theory and boundary value problems: Qualitative properties of solutions – strum comparison theorem, Eigen values, Eigen functions and the vibrating strings,

Power series solutions: A review of power series- series solutions of first order equations, Second order linear equations Ordinary points – regular singular points

Systems of first order equations: Linear systems, Homogeneous linear systems with constant coefficients- existence and uniqueness of solutions, Successive approximations ; Picard's theorem, some examples

Paper: M 105 LINEAR ALGEBRA & DISCRETE MATHEMATICS

Elementary canonical forms: Introduction – Characteristic values, vectors. Annihilating polynomials, Invariant Subspaces,

Simultaneous Triangulation - Simultaneous Diagonalization, Direct sum Decompositons, Invariant Direct Sums, The Primary Decomposition theorem,

Definition of lattices, Modular lattices, distributive lattices, Boolean Polynomials:

Basic properties, Boolean Polynomials, Ideals, minimal forms of Boolean polynomials.

Semester: II

For the Academic Year 2014 – 2015

Paper: M 201 ALGEBRA – II

Fields: Extension fields, the transcendence of e. Roots of polynomials Construction with straightedge and compass

Fields: More about roots, The elements of Galois theory, Solvability by radicals, Galois groups over the rationals

Finite field: Wedderburn's theorem on finite division rings

A theorem of Frobenius: Integral quoternions and the four-square theorem

Paper: M 202, REAL ANALYSIS – II

Riemann - Stieltjes integral: Definition and existence of the Riemann Stieltjes integral, Properties of the integral, Integration and differentiation,
The fundamental theorem of calculus – integral of vector valued function, rectifiable curves,

Sequences and series of the function: Discussion on the main problem Uniform convergence, uniform convergence and continuity, Uniform convergence and integration, Uniform convergence and differentiation
Equicontinuous families of function, The Stone – Weierstrass theorem.

Power Series: Functions of several variable: Linear transformation, differentiation, The Contraction principle, The inverse function theorem,

The implicit function theorem, The Rank theorem, Determinates, Derivatives of higher order, Differentiation of integrals

Paper: M 203 TOPOLOGY – II

T_1 spaces and Hausdorff spaces. Completely regular spaces and normal spaces, Urysohn's lemma and the Tietze extension theorem. The Urysohn imbedding theorem, The Stone – cech compactification.

Connected spaces. The components of a space. Totally disconnected spaces. Locally connected spaces.

The Weierstrass approximation theorem. The Stone – Weierstrass theorems. Locally compact Hausdorff spaces, The extended Stone – Weiersatrass theorems.

Neighbourhoods of a point in topological group. Isomorpism and local isomorphisms. Subgroups – Quotient groups, Homomorphisms.

Paper: M 204 COMPLEX ANALYSIS

Elementary properties and examples of analytic functions: Power series Analytic functions: Analytic functions as mappings, Mobius transformations

Complex integration: Riemann- stieltjes integrals, Power series representation of analytic functions, Zeros of an analytic functions, The index of a closed curve,

Cauchy's theorem and integral formula, The homotopic version of cauchy's theorem and simple connectivity , Counting zeros, The open mapping theorem ,

Singularities: Classification of singularities, Residues, The argument principle.

Paper: M 205, GRAPH THEORY & ADVANCED CODING THEORY

Graphs, digraphs, network, multi graph, elementary results, Structure based on connectivity, Characterization theorems on trees, Tree distances, Binary trees,

Eulerian graphs, Hamiltonian graphs, Spanning trees, Fundamental cycles, Minimal spanning trees, Kruskal algorithm, Prims algorithm

Introduction to coding theory: Introduction, Basic assumptions, correcting, detecting codes, Information rate, the effects of error detection and correction, Finding most likely code word transmitted, some basic algebra, weight and distance, Maximum likelyhood decoding, reliability of M.L.D, error detecting codes, error correcting codes

Linear codes: Linear codes, two important subspaces, independence Basis, dimension, matrices, bases for C = <S> and C, generating matrices and encoding. Parity check matrices, equivalent codes, distance of a linear code, cosets, M.L.D for linear codes, reliability of linear codes.

For the Academic Year: 2015 – 16.

Paper: M 101 ALGEBRA – I

Group Theory: Definition of a group, Some examples of groups, some preliminary lemmas, Subgroups, A counting principle, Normal subgroups and quotient groups, Homomorphisms, Automorphism, Cayley's theorem, permutation group, Another counting principle, Sylows theorem, Direct products, finite abelian groups,

Ring Theory: Definition and examples of Rings, Some special classes of rings, Homomorphisms, Ideals and quotient rings, more Ideals and quotient rings, The field of quotients of an Integral Domain, Euclidean rings, a particular Euclidean ring, Polynomial rings, Polynomial over the rational field, Polynomial rings over the commutative rings.

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Basic Topology, finite, countable and uncountable sets. Metric spaces, compact sets, Connected sets,

Numerical sequences and series, convergent sequences, Sub sequences, Cauchy sequences, upper and lower limits, Some special sequences, series, series of non negative terms, number e, The root and ratio tests, Power series, Summation by parts, absolute convergence, Addition and multiplication of series, rearrangements

Continuity: Limits of function, continuous functions. Continuity and compactness, continuity and connectedness, Discontinuities, Monotone functions, Infinite limits and limits at infinity,

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Sets and set inclusion, The Algebra of sets, Functions, Products of sets, Partition and equivalence relations. Countable sets, Uncountable sets, Partially ordered sets and lattices.

Metric spaces, The definition and some examples, Open sets, closed sets. Convergence, completeness, Baire's theorem. Continuous mappings. Spaces of continuous functions, Euclidean and Unitary spaces.

Topological Spaces-The definition and some examples, Elementary concepts, open bases and open subbases, Week topologies, The function algebras C(X, R) and C(X, C).

Compact spaces: product of spaces – Techonoff's theorem and locally compact spaces. Compactness for metric spaces. Ascoli's theorem.

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Oscillation theory and boundary value problems: Qualitative properties of solutions – strum comparison theorem, Eigen values, Eigen functions and the vibrating strings,

Power series solutions: A review of power series- series solutions of first order equations, Second order linear equations Ordinary points – regular singular points

Systems of first order equations: Linear systems, Homogeneous linear systems with constant coefficients- existence and uniqueness of solutions, Successive approximations ; Picard's theorem, some examples

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Elementary canonical forms: Introduction – Characteristic values, vectors. Annihilating polynomials, Invariant Subspaces,

Simultaneous Triangulation - Simultaneous Diagonalization, Direct sum Decompositons, Invariant Direct Sums, The Primary Decomposition theorem,

Definition of lattices, Modular lattices, distributive lattices, Boolean Polynomials:

Basic properties, Boolean Polynomials, Ideals, minimal forms of Boolean polynomials.

For the Academic Year 2015 – 2016

Paper: M 201 ALGEBRA – II

Fields: Extension fields, the transcendence of e. Roots of polynomials Construction with straightedge and compass

Fields: More about roots, The elements of Galois theory, Solvability by radicals, Galois groups over the rationals

Finite field: Wedderburn's theorem on finite division rings

A theorem of Frobenius: Integral quoternions and the four-square theorem

Paper: M 202, REAL ANALYSIS – II

Riemann - Stieltjes integral: Definition and existence of the Riemann Stieltjes integral, Properties of the integral, Integration and differentiation,
The fundamental theorem of calculus – integral of vector valued function, rectifiable curves,

Sequences and series of the function: Discussion on the main problem Uniform convergence, uniform convergence and continuity, Uniform convergence and integration, Uniform convergence and differentiation
Equicontinuous families of function, The Stone – Weierstrass theorem.

Power Series: Functions of several variable: Linear transformation, differentiation, The Contraction principle, The inverse function theorem,

The implicit function theorem, The Rank theorem, Determinates, Derivatives of higher order, Differentiation of integrals

Paper: M 203 TOPOLOGY – II

T_1 spaces and Hausdorff spaces. Completely regular spaces and normal spaces, Urysohn's lemma and the Tietze extension theorem. The Urysohn imbedding theorem, The Stone – cech compactification.

Connected spaces. The components of a space. Totally disconnected spaces. Locally connected spaces.

The Weierstrass approximation theorem. The Stone – Weierstrass theorems. Locally compact Hausdorff spaces, The extended Stone – Weiersatrass theorems.

Neighbourhoods of a point in topological group. Isomorpism and local isomorphisms. Subgroups – Quotient groups, Homomorphisms.

Paper: M 204 COMPLEX ANALYSIS

Elementary properties and examples of analytic functions: Power series Analytic functions: Analytic functions as mappings, Mobius transformations

Complex integration: Riemann- stieltjes integrals, Power series representation of analytic functions, Zeros of an analytic functions, The index of a closed curve,

Cauchy's theorem and integral formula, The homotopic version of cauchy's theorem and simple connectivity , Counting zeros, The open mapping theorem ,

Singularities: Classification of singularities, Residues, The argument principle.

Paper: M 205, GRAPH THEORY & ADVANCED CODING THEORY

Graphs, digraphs, network, multi graph, elementary results, Structure based on connectivity, Characterization theorems on trees, Tree distances, Binary trees,

Eulerian graphs, Hamiltonian graphs, Spanning trees, Fundamental cycles, Minimal spanning trees, Kruskal algorithm, Prims algorithm

Introduction to coding theory: Introduction, Basic assumptions, correcting, detecting codes, Information rate, the effects of error detection and correction, Finding most likely code word transmitted, some basic algebra, weight and distance, Maximum likelyhood decoding, reliability of M.L.D, error detecting codes, error correcting codes

Linear codes: Linear codes, two important subspaces, independence Basis, dimension, matrices, bases for C = <S> and C, generating matrices and encoding. Parity check matrices, equivalent codes, distance of a linear code, cosets, M.L.D for linear codes, reliability of linear codes.

Semester: III

For the Academic Year 2015 – 2016

Paper: M 301 FUNCTIONAL ANALYSIS

Banach spaces: The definition and some examples, Continuous linear transformations, The Hahn – Banach theorem, The natural imbedding of N in N**, The open mapping theorem,

The conjugate of an operator

Hilbert spaces: The definition and some simple properties, Orthogonal complements, Orthonormal sets.

Adjoint, normal, Unitary operators: The conjugate space H*, The adjoint of an operator, Self- adjoint operators, Normal and Unitary operators, Projections

Finite dimensional Spectral theory: Matrices. Determinants and spectrum of an operator, The spectral theorem, A survey of the situation.

Paper: M 302 NUMBER THEORY – I

Arithmetical functions and dirichlet multiplication: Introduction-The mobius function $\mu(n)$ - The euler quotient function $\varphi(n)$, A relation connecting φ and μ - A product formula for $\varphi(n)$ - The dirichlet product of arithmetical functions, Dirichlet inverses and the mobius inversion formula - The mangoldt function $\Lambda(n)$ - multiplicative functions, Multiplicative function and dirichlet multiplication -The inverse of a completely multiplicative function - Liouville's function $\lambda(n)$ - The divisor functions $\sigma_\alpha(n)$, Averages of arithmetical functions: Introduction – The big Oh notation – Asymptotic equality of functions – Euler's summation formula, Some elementary asymptotic formulas – The average order of d(n) – The average order of the divisor function $\sigma_\alpha(n)$ – The average order of $\varphi(n)$, An application to the distribution of lattice points visible from the origin – The average order of $\mu(n)$ and $\Lambda(n)$ – Another identity for the partial sums of a dirichlet product.

The partial sums of a Dirichlet product –Applications to $\mu(n)$ and $\Lambda(n)$. Some elementary theorems on the distribution of prime numbers: Introduction, Chebyshev's function $\Psi(x)$ and $\theta(x)$ – Relations connecting $\theta(x)$ and $\Pi(x)$

Some equivalent forms of the prime number theorem – Inequalities for $\Pi(n)$ and P_n - shapiro's tauberian theorem – applications of shapiro's theorem – An asymptotic formula for the partial sums $\Sigma_{p\leq x}(1/p)$., The partial sums of the mobiusfunctions

Congruences: definitions and basic properties of congruences, Residue classes and complete residue system, Linear congruences – Reduced residue systems and the Euler –Fermat thorem , Polynomial congruences modulo p. Lagranges theorem, Applications of Langranges theorem – simultaneous linear congruences , The Chinese remainder theorem – Applications of the Chinese remainder theorem, The polynomial congruences with prime power moduli ,

Finite abelian groups and their characters : Characters of finite abelian goups, The character group – The orthogonality relations for characters – Dirichlet characters – Sums involving dirichlet characters. The non vanishing of $L(1,\chi)$ for real non principle χ , Dirichlet theorems on primes in arithmetical progressions: Introduction , Dirichlet theorems for primes of the form 4n-1 and 4n+1., The plan of the proof of dirichlet theorem , proof of the lemma 7.4 , proof of the lemma 7.5 , proof of the lemma 7.6. Proof of the lemma 7.7 , proof of the lemma 7.8 , Distribution of primes in arithmetic progressions.

Paper: M 303 LATTICE THEORY - I

Partially ordered sets-diagrams, Special subsets of a poset-length-lower and upper bounds. The minimum and maximum condition-the Jordan Dedekind chain conditions-dimension functions.

Algebras-lattices-the lattice theoretic duality principle-lattices as posets-diagrams of lattices. Semi lattices, ideals-bound elements of lattice-atoms and dual atoms. Complements, relative complements, semi complements.
Irreducible and prime elements of a lattice-the homomorphism of a lattice-axioms systems of lattices.

Complete lattices- complete sub lattices of a complete lattice-conditionally complete lattice- lattices. Compact elements, compactly generated lattices- sub algebra lattice of an algebra. Closure operations- Galois connections, Dedekind cuts. Partially ordered sets as a topological spaces-

Distributive lattices. Infinitely distributive and completely distributive lattices- modular lattices. Characterization of modular and distributive lattices by their sub lattices. Distributive sub lattices of modular lattices- the isomorphism theorem of modular lattices. Covering conditions- meet representations in modular distributive lattices. Some special sub classes of the class of modular lattices- preliminary theorems. Modular lattices of locally finite length- the valuation of lattice. Metric and quasi metric lattice - complemented modular lattices.

Paper M 304 – COMMUTATIVE ALGEBRA –I

Rings and ring homomorphism, ideals, quotient rings, zero divisors, Nilpotent elements, units, prime ideals and Maximal ideals, nil radical and Jacobson radical, operations on ideals, Extensions and contractions.

Modules and module homomorphisms, Sub modules and quotient modules, operations on submodules, direct sum and product, finitely generated modules, exact sequences, Tensor product of modules, Restriction and extension of scalars, Exactness properties of the tensor product, algebras, tensor product of algebras.

Local Properties, Extended and Contracted ideals in rings of fractions.

Primary decompositions.

Paper M 305 COMPLEX ANALYSIS – II

The maximum modulus theorem: The maximum principle – Schwarz's lemma – convex function's and hadamard's three circles theorem – Phragmén - Lindelöf Theorem.

Compactness and Convergence in the Space of Analytic Functions: The space of continuous function C (G, Ω) – Spaces of Analytic functions – spaces of meromorphic functions – The Riemann Mapping Theorem – Weierstrass factorization theorem – Factorization of sine functions.

Runge's Theorem : Runge's Theorem – Simple connectedness – Mittag – Leffler's Theorem, Analytic Continuation and Riemann Surfaces, Schwarz Reflection Principle – Analytic Continuation Along A Path – Monodromy theorem.

Harmonic Functions: Basic properties of Harmonic functions – Harmonic functions on a disk. Jenson's formula, the genus and the order of an entire function Hadamard's factorization theorem.

Semester: IV.

For the Academic Year 2015 – 2016

Paper: M 401 MEASURE AND INTEGRATION

Lebesgue measure: Outer measure, Measurable set and Lebesgue measure, A non - measurable set. Measurable functions, Littlewood's three principles,

The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure. The integral of non-negative function, The general Lebesgue integral, Convergence in measure,

Differentiation and Integration: Differentiation of monotonic functions Functions of bounded variation, differentiation of an integral, Absolute continuity and Convex functions.

The Classical Banach Spaces: The L^P-Spaces, The Minkoswki and Holder inequalities, Convergence and completeness. Approximation in L^P, Bounded linear functional on the L^P spaces.

Paper: M 402 NUMBER THEORY - II

Periodic arithmetical functions and Gauss sums: Functions periodic modulo k- existence of finite Fourier series for periodic arithmetical functions, Ramanujan's sum and generalizations –Multiplicative properties of the sums, $S_k(n)$-Gauss sums associated with dirichlet characters. Dirichlets characters with non-vanishing Gauss sums- Quadratic residues and the quadratic reciprocity law: Quadratic residues, Legendre's symbol and its properties, Evaluation of (-1/p) and (-2/p), Gauss lemma – The quadratic reciprocity law –Applications of the reciprocity law – The Jacobi symbol – Applications Diophantine equations – Gauss sums and the quadratic reciprocity law.

Primitive roots: The exponent of a number mod m, Primitive roots – Primitive roots and reduced residue systems – The non existence of primitive roots mod 2^α for $\alpha \geq 3$. The existence of primitive roots and p for odd primes p – Primitive roots and quadratic residues – The existence of primitive roots mod p^α - The existence of primitive roots mod $2\ p^\alpha$. The non existence of primitive roots in the remaining cases – The number of primitive roots mod m – The index calculus – Primitive roots and Dirichlet characters – real valued dirichlet characters mod p^α . Primitive Dirichlet characters mod p^α -

Dirichlet series and Euler products: The half plane of absolute convergence of a dirichlet series, The function defined by dirichlet series –

Multiplication of Dirchlits series– Euler products – The half-plane of convergence of a dirichlet series. Analytic properties of Dirichlet series – Dirichlet series with non negative coefficients.

Properties of gamma function, Integral representation for the Hurwitz zeta function – A contour integral representation for the Hurwitz zeta function. The analytic continuation of the Hurwitz zeta function. Analytic continuation of $\zeta(s), L(s,\chi)$. Hurwitz's formula for $\zeta(s,a)$. The functional equation for Riemann zeta function.

Paper: M 403 LATTICE THEORY – II

Boolean algrbras, De morgan formulae, Complete Boolean algrbras – Boolean algebras and Boolean rings. The algebra of relations. The lattice of propositions. Valuation of Boolean algebras –

Birkhoffs lattices – Semi modular lattices – Equivalence lattices. Linear dependence – Complemented semimodular lattices.

Ideals and dual ideals. Ideal chains and ideal lattices. Distributive lattices and rings of sets.

Congruence relation of an algebra. Permutable equivalence relations. The schreier refinement theorem in arbitrary algebras. congruence relation of lattices. Minimal congruence relation of some subsets of distributive lattices. The connection between ideals, congruence relations of lattices.

Paper M 404: COMMUTATIVE ALGEBRA – II

Integral Dependence, the going – up theorem – Integrally closed integral domains, the going – down theorem, valuation rings.

Chain conditions.

Noetherian rings – Primary decomposition of Noetherian rings, Artin rings.

Discrete valuation rings, Dedekind domains, Fractional ideals.

Paper: M 405 PARTIAL DIFFERENTIAL EQUATIONS.

First order P.D.E: Curves and surfaces – Genesis of First Order P.D.E., - Classification of Integrals – Linear Equations of first order – pfaffian Differential Equations – Compatible Systems – Charpit's Method Jacobi's Method – Integral Surfaces Through a Given Curve.

Second Order P.D.E.: Genesis of Second Order P.D.E. – Classification of Second Order P.D.E. – One Dimensional Wave equation: Vibrations of an Infinite String – Vibrations of Semi infinite String Vibrations of a String of Finite Length – Riemann's Method – Vibrations of a String of Finite Length.

Laplace's Equation: Boundary value Problems – Maximum and nimum Principles – The Cauchy Problem – The Dirichlet Problem for the Upper Half Plane – The Neumann Problem for the Upper Half Plane – Dirichlet problem for a Circle – The Dirichlet Exterior Problem for a Circle – the Neumann Problem for a Circle – the Dirichlet problem for a Rectangle – Harnack's Theorem Laplace Equation – Green's Function – The Dirichlet Problem for a Half Plane – The Dirichlet problem for a Circle

Heat Conduction Problem: Heat Conduction – Infinite Rod Case – Heat Conduction - Finite Rod Case – Duhamel's Principle – Wave Equation – Heat Conduction Equation – Quasi Linear Equations – Non Linear First Order P.D.E.

For the Academic Year: 2016 – 17.

Paper: M 101 Algebra – I

Automorphisms - Conjugacy and G-sets- Normal series solvable groups- Nilpotent groups.

Structure theorems of groups: Direct product- Finitely generated abelian groups- Invariants of a finite abelian group- Sylow's theorems- Groups of orders p2, pq .

Ideals and homomorphisms- Sum and direct sum of ideals, Maximal and prime ideals- Nilpotent and nil ideals- Zorn's lemma

Unique factorization domains - Principal ideal domains- Euclidean domains- Polynomial rings over UFD- Rings of traction.

Paper: M 102 Real Analysis – I

Basic Topology, finite, countable and uncountable sets. Metric spaces, compact sets, Connected sets,

Numerical sequences and series, convergent sequences, Sub sequences, Cauchy sequences, upper and lower limits, Some special sequences, series, series of non negative terms, number e, The root and ratio tests, Power series, Summation by parts, absolute convergence, Addition and multiplication of series, rearrangements

Continuity: Limits of function, continuous functions. Continuity and compactness, continuity and connectedness, Discontinuities, Monotone functions, Infinite limits and limits at infinity,

Differentiation: The derivate of a real function, Mean value theorems, The continuity of derivatives, L. Hospitals rule, Derivatives of higher order, Taylor's theorem, Differentiation of vector - valued functions.

Paper: M 103 Differential Equations - 1

Second order linear differential equations: Introduction-general solution of homogeneous equation, Use of a known solution to find another -
Homogeneous equations with constant coefficients, Method of undetermined coefficients,Method of variation of parameters,
Oscillation theory and boundary value problems: Qualitative properties of solutions – strum comparison theorem, Eigen values, Eigen functions and the vibrating strings,
Power series solutions: A review of power series- series solutions of first order equations, Second order linear equations Ordinary points – regular singular points

Systems of first order equations: Linear systems, Homogeneous linear systems with constant coefficients- existence and uniqueness of solutions, Successive approximations ; Picard's theorem, some examples.

Paper: M 104 Topology

Sets and set inclusion, The Algebra of sets, Functions, Products of sets, Partition and equivalence relations. Countable sets, Uncountable sets, Partially ordered sets and lattices.

Metric spaces, The definition and some examples, Open sets, closed sets. Convergence, completeness, Baire's theorem. Continuous mappings.

Spaces of continuous functions, Euclidean and Unitary spaces.

Topological Spaces-The definition and some examples, Elementary concepts, open bases and open subbases, Week topologies, The function algebras C(X, R) and C(X, C).

Compact spaces: product of spaces – Techonoff's theorem and locally compact spaces. Compactness for metric spaces. Ascoli's theorem.

Paper: M 105 Discrete Mathematics

Graphs, digraphs, network, multi graph, elementary results, structure based on connectivity, characterization, theorems on trees, tree distances, binary trees.

Eulerian graphs, Hamiltonian graphs, Spanning trees, Fundamental cycles, Minimal spanning trees. Kruskal algorithm, Prims algorithm.

Definitions of lattices, Modular lattices and distributive lattices.

Basic properties, Boolean polynomials, ideals, minimal forms of Boolean polynomials.

For the Academic Year 2016 – 2017

Paper: M 201 Algebra – II

Algebraic extensions of fields: Irreducible polynomials and Eisenstein criterion- Adjunction of roots- Algebraic extensions-Algebraically closed fields.

Normal and separable extensions: Splitting fields- Normal extensions- Multiple roots- Finite fields- Separable extensions.

Galois theory: Automorphism groups and fixed fields- Fundamental theorem of Galois theory- Fundamental theorem of Algebra.

Applications of Galois theory to classical problems: Roots of unity and cyclotomic polynomials- Cyclic extensions- Polynomials solvable by radicals - Ruler and Compass constructions.

Paper: M 202, Real Analysis – II

Riemann - Stieltjes integral: Definition and existence of the Riemann Stieltjes integral, Properties of the integral, Integration and differentiation,
The fundamental theorem of calculus – integral of vector valued function, rectifiable curves,

Sequences and series of the function: Discussion on the main problem Uniform convergence, uniform convergence and continuity, Uniform convergence and integration, Uniform convergence and differentiation
Equicontinuous families of function, The Stone – Weierstrass theorem.

Power Series: Functions of several variable: Linear transformation, differentiation, The Contraction principle, The inverse function theorem,
The implicit function theorem, The Rank theorem, Determinates, Derivatives of higher order, Differentiation of integrals

Paper: M 203 COMPLEX ANALYSIS – I

Elementary properties and examples of analytic functions: Power series Analytic functions: Analytic functions as mappings, Mobius transformations

Complex integration: Riemann- stieltjes integrals, Power series representation of analytic functions, Zeros of an analytic functions, The index of a closed curve,

Cauchy's theorem and integral formula, The homotopic version of cauchy's theorem and simple connectivity , Counting zeros, The open mapping theorem ,

Singularities: Classification of singularities, Residues, The argument principle.

Paper: M 204 LINEAR ALGEBRA

Elementary Canonical Forms: Introduction – Characteristic Values – Annihilating Polynomials –invariant subspaces – Simultaneous Triangulation – Simultaneous Diagonalization.

Direct – sum Decompositions – invariant direct sums – the primary decomposition theorem – cyclic subspaces and Annihilators – cyclic decompositions and the rational form.

The Jordan Form – Computation of Invariant Factors – Semi Simple Operators.

Bilinear Forms : Bilinear Forms – Symmetric Bilinear Forms – Skew Symmetric Bilinear Forms – Group Preserving Bilinear Forms.

Paper: M205 - PROBABILITY THEORY & STATISTICS

Sample Space & Events, Axioms of Probability, Some elementary theorems, Boole's inequality, Conditional probability, Baye's theorem

Discrete & Continuous random variables, Mathematical Expectation, variance, Covariance, Moment Generating Function, Characteristic function, Binomial Distribution, Poisson Distribution, Normal & Uniform Distribution

Population and samples, sampling distribution of the Mean, sampling distribution of the variance and F distributions. Point estimation, Interval estimation, Tests of Hypotheses, Hypotheses concerning one and two means.

Estimation of proportions, Hypotheses concerning one proportion, Hypotheses concerning several proportions, the analysis of r x c tables, Goodness of Fit, Correlation & Regression, The method of least squares, inferences bases on the least – square estimators.

For the Academic Year 2016 – 2017

Paper: M 301 FUNCTIONAL ANALYSIS

Banach spaces: The definition and some examples, Continuous linear transformations, The Hahn – Banach theorem, The natural imbedding of N in N**, The open mapping theorem, The conjugate of an operator

Hilbert spaces: The definition and some simple properties, Orthogonal complements, Orthonormal sets.

Adjoint, normal, Unitary operators: The conjugate space H*, The adjoint of an operator, Self- adjoint operators, Normal and Unitary operators, Projections

Finite dimensional Spectral theory: Matrices. Determinants and spectrum of an operator, The spectral theorem, A survey of the situation.

Paper: M 302 NUMBER THEORY – I

Arithmetical functions and dirichlet multiplication: Introduction-The mobius function $\mu(n)$ - The euler quotient function $\varphi(n)$, A relation connecting φ and μ - A product formula for $\varphi(n)$ - The dirichlet product of arithmetical functions, Dirichlet inverses and the mobius inversion formula - The mangoldt function $\Lambda(n)$ - multiplicative functions, Multiplicative function and dirichlet multiplication -The inverse of a completely multiplicative function - Liouville's function $\lambda(n)$ - The divisor functions $\sigma_\alpha(n)$, Averages of arithmetical functions: Introduction – The big Oh notation – Asymptotic equality of functions – Euler's summation formula, Some elementary asymptotic formulas – The average order of d(n) – The average order of the divisor function $\sigma_\alpha(n)$ – The average order of $\varphi(n)$, An application to the distribution of lattice points visible from the origin – The average order of $\mu(n)$ and $\Lambda(n)$ – Another identity for the partial sums of a dirichlet product.

The partial sums of a Dirichlet product –Applications to $\mu(n)$ and $\Lambda(n)$. Some elementary theorems on the distribution of prime numbers: Introduction, Chebyshev's function $\Psi(x)$ and $\theta(x)$ – Relations connecting $\theta(x)$ and $\Pi(x)$
Some equivalent forms of the prime number theorem – Inequalities for $\Pi(n)$ and P_n - shapiro's tauberian theorem – applications of shapiro's theorem – An asymptotic formula for the partial sums $\Sigma_{p\leq x}(1/p)$., The partial sums of the mobiusfunctions

Congruences: definitions and basic properties of congruences, Residue

classes and complete residue system, Linear congruences – Reduced residue systems and the Euler –Fermat thorem , Polynomial congruences modulo p. Lagranges theorem, Applications of Langranges theorem – simultaneous linear congruences , The Chinese remainder theorem – Applications of the Chinese remainder theorem, The polynomial congruences with prime power moduli ,

Finite abelian groups and their characters : Characters of finite abelian goups, The character group – The orthogonality relations for characters – Dirichlet characters – Sums involving dirichlet characters. The non vanishing of $L(1,\chi)$ for real non principle χ , Dirichlet theorems on primes in arithmetical progressions: Introduction , Dirichlet theorems for primes of the form 4n-1 and 4n+1., The plan of the proof of dirichlet theorem , proof of the lemma 7.4 , proof of the lemma 7.5 , proof of the lemma 7.6. Proof of the lemma 7.7 , proof of the lemma 7.8 , Distribution of primes in arithmetic progressions.

Paper: M 303 LATTICE THEORY - I

Partially ordered sets-diagrams, Special subsets of a poset-length-lower and upper bounds. The minimum and maximum condition-the Jordan Dedekind chain conditions-dimension functions.

Algebras-lattices-the lattice theoretic duality principle-lattices as posets-diagrams of lattices. Semi lattices, ideals-bound elements of lattice-atoms and dual atoms. Complements, relative complements, semi complements.
Irreducible and prime elements of a lattice-the homomorphism of a lattice-axioms systems of lattices.

Complete lattices- complete sub lattices of a complete lattice-conditionally complete lattice- lattices. Compact elements, compactly generated lattices- sub algebra lattice of an algebra. Closure operations- Galois connections, Dedekind cuts. Partially ordered sets as a topological spaces-

Distributive lattices. Infinitely distributive and completely distributive lattices- modular lattices. Characterization of modular and distributive lattices by their sub lattices. Distributive sub lattices of modular lattices- the isomorphism theorem of modular lattices. Covering conditions- meet representations in modular distributive lattices. Some special sub classes of the class of modular lattices- preliminary theorems. Modular lattices of locally finite length- the valuation of lattice. Metric and quasi metric lattice - complemented modular lattices.

Paper M 304 – COMMUTATIVE ALGEBRA –I

Rings and ring homomorphism, ideals, quotient rings, zero divisors, Nilpotent elements, units, prime ideals and Maximal ideals, nil radical and Jacobson radical, operations on ideals, Extensions and contractions.

Modules and module homomorphisms, Sub modules and quotient modules, operations on submodules, direct sum and product, finitely generated modules, exact sequences, Tensor product of modules, Restriction and extension of scalars, Exactness properties of the tensor product, algebras, tensor product of algebras.

Local Properties, Extended and Contracted ideals in rings of fractions.

Primary decompositions.

Paper M 305 COMPLEX ANALYSIS – II

The maximum modulus theorem: The maximum principle – Schwarz's lemma – convex function's and hadamard's three circles theorem – Phragmén - Lindelöf Theorem.

Compactness and Convergence in the Space of Analytic Functions: The space of continuous function C (G, Ω) – Spaces of Analytic functions – spaces of meromorphic functions – The Riemann Mapping Theorem – Weierstrass factorization theorem – Factorization of sine functions.

Runge's Theorem : Runge's Theorem – Simple connectedness – Mittag – Leffler's Theorem, Analytic Continuation and Riemann Surfaces, Schwarz Reflection Principle – Analytic Continuation Along A Path – Monodromy theorem.

Harmonic Functions: Basic properties of Harmonic functions – Harmonic functions on a disk. Jenson's formula, the genus and the order of an entire function Hadamard's factorization theorem.

For the Academic Year 2016 – 2017

Paper: M 401 MEASURE AND INTEGRATION

Lebesgue measure: Outer measure, Measurable set and Lebesgue measure, A non - measurable set. Measurable functions, Littlewood's three principles,

The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure. The integral of non-negative function, The general Lebesgue integral, Convergence in measure,

Differentiation and Integration: Differentiation of monotonic functions Functions of bounded variation, differentiation of an integral, Absolute continuity and Convex functions.

The Classical Banach Spaces: The L^P-Spaces, The Minkoswki and Holder inequalities, Convergence and completeness. Approximation in L^P, Bounded linear functional on the L^P spaces.

Paper: M 402 NUMBER THEORY - II

Periodic arithmetical functions and Gauss sums: Functions periodic modulo k- existence of finite Fourier series for periodic arithmetical functions, Ramanujan's sum and generalizations –Multiplicative properties of the sums, $S_k(n)$-Gauss sums associated with dirichlet characters. Dirichlets characters with non-vanishing Gauss sums- Quadratic residues and the quadratic reciprocity law: Quadratic residues, Legendre's symbol and its properties, Evaluation of (-1/p) and (-2/p), Gauss lemma – The quadratic reciprocity law –Applications of the reciprocity law – The Jacobi symbol – Applications Diophantine equations – Gauss sums and the quadratic reciprocity law.

Primitive roots: The exponent of a number mod m, Primitive roots – Primitive roots and reduced residue systems – The non existence of primitive roots mod 2^α for $\alpha \geq 3$. The existence of primitive roots and p for odd primes p – Primitive roots and quadratic residues – The existence of primitive roots mod p^α - The existence of primitive roots mod $2\ p^\alpha$. The non existence of primitive roots in the remaining cases – The number of primitive roots mod m – The index calculus – Primitive roots and Dirichlet characters – real valued dirichlet characters mod p^α . Primitive Dirichlet characters mod p^α -

Dirichlet series and Euler products: The half plane of absolute convergence of a dirichlet series, The function defined by dirichlet series – Multiplication of Dirchlits series– Euler products – The half-plane of

convergence of a dirichlet series. Analytic properties of Dirichlet series – Dirichlet series with non negative coefficients.

Properties of gamma function, Integral representation for the Hurwitz zeta function – A contour integral representation for the Hurwitz zeta function. The analytic continuation of the Hurwitz zeta function. Analytic continuation of $\zeta(s), L(s,\chi)$. Hurwitz's formula for $\zeta(s,a)$. The functional equation for Riemann zeta function.

Paper: M 403 LATTICE THEORY – II

Boolean algrbras, De morgan formulae, Complete Boolean algrbras – Boolean algebras and Boolean rings. The algebra of relations. The lattice of propositions. Valuation of Boolean algebras –

Birkhoffs lattices – Semi modular lattices – Equivalence lattices.

Linear dependence – Complemented semimodular lattices.

Ideals and dual ideals. Ideal chains and ideal lattices. Distributive lattices and rings of sets.

Congruence relation of an algebra. Permutable equivalence relations. The schreier refinement theorem in arbitrary algebras. congruence relation of lattices. Minimal congruence relation of some subsets of distributive lattices.

The connection between ideals, congruence relations of lattices.

Paper: M 404 COMMUTATIVE ALGEBRA – II

Integral Dependence, the going – up theorem – Integrally closed integral domains, the going – down theorem, valuation rings.

Chain conditions.

Noetherian rings – Primary decomposition of Noetherian rings, Artin rings. Discrete valuation rings, Dedekind domains, Fractional ideals.

Paper: M 405 PARTIAL DIFFERENTIAL EQUATIONS.

First order P.D.E: Curves and surfaces – Genesis of First Order P.D.E., - Classification of Integrals – Linear Equations of first order – pfaffian Differential Equations – Compatible Systems – Charpit's Method Jacobi's Method – Integral Surfaces Through a Given Curve.

Second Order P.D.E.: Genesis of Second Order P.D.E. – Classification of Second Order P.D.E. – One Dimensional Wave equation: Vibrations of an Infinite String – Vibrations of Semi infinite String Vibrations of a String of Finite Length – Riemann's Method – Vibrations of a String of Finite Length.

Laplace's Equation: Boundary value Problems – Maximum and nimum Principles – The Cauchy Problem – The Dirichlet Problem for the Upper Half Plane – The Neumann Problem for the Upper Half Plane – Dirichlet problem for a Circle – The Dirichlet Exterior Problem for a Circle – the Neumann Problem for a Circle – the Dirichlet problem for a Rectangle – Harnack's Theorem Laplace Equation – Green's Function – The Dirichlet Problem for a Half Plane – The Dirichlet problem for a Circle

Heat Conduction Problem: Heat Conduction – Infinite Rod Case – Heat Conduction - Finite Rod Case – Duhamel's Principle – Wave Equation – Heat Conduction Equation – Quasi Linear Equations – Non Linear First Order P.D.E.

For the Academic Year: 2017 – 18.

Class: I MSc Semester: I

Paper: M 101 ALGEBRA – I

Automorphisms - Conjugacy and G-sets- Normal series solvable groups- Nilpotent groups.

Structure theorems of groups: Direct product- Finitely generated abelian groups- Invariants of a finite abelian group- Sylow's theorems- Groups of orders p2, pq .

Ideals and homomorphisms- Sum and direct sum of ideals, Maximal and prime ideals- Nilpotent and nil ideals- Zorn's lemma

Unique factorization domains - Principal ideal domains- Euclidean domains- Polynomial rings over UFD- Rings of traction.

Paper: M 102 REAL ANALYSIS – I

Basic Topology, finite, countable and uncountable sets. Metric spaces, compact sets, Connected sets,

Numerical sequences and series, convergent sequences, Sub sequences, Cauchy sequences, upper and lower limits, Some special sequences, series, series of non negative terms, number e, The root and ratio tests, Power series, Summation by parts, absolute convergence, Addition and multiplication of series, rearrangements

Continuity: Limits of function, continuous functions. Continuity and compactness, continuity and connectedness, Discontinuities, Monotone functions, Infinite limits and limits at infinity,

Differentiation: The derivate of a real function, Mean value theorems, The continuity of derivatives, L. Hospitals rule, Derivatives of higher order, Taylor's theorem, Differentiation of vector - valued functions.

Paper: M 103 DIFFERENTIAL EQUATIONS - 1

Second order linear differential equations: Introduction-general solution of homogeneous equation, Use of a known solution to find another - Homogeneous equations with constant coefficients, Method of undetermined coefficients, Method of variation of parameters,

Oscillation theory and boundary value problems: Qualitative properties of solutions – strum comparison theorem, Eigen values, Eigen functions and the vibrating strings,

Power series solutions: A review of power series- series solutions of first

order equations, Second order linear equations Ordinary points – regular singular points

Systems of first order equations: Linear systems, Homogeneous linear systems with constant coefficients- existence and uniqueness of solutions, Successive approximations ; Picard's theorem, some examples.

Paper: M 104 TOPOLOGY

Sets and set inclusion, The Algebra of sets, Functions, Products of sets, Partition and equivalence relations. Countable sets, Uncountable sets, Partially ordered sets and lattices.

Metric spaces, The definition and some examples, Open sets, closed sets. Convergence, completeness, Baire's theorem. Continuous mappings.

Spaces of continuous functions, Euclidean and Unitary spaces.
Topological Spaces-The definition and some examples, Elementary concepts, open bases and open subbases, Week topologies, The function algebras C(X, R) and C(X, C).

Compact spaces: product of spaces – Techonoff's theorem and locally compact spaces. Compactness for metric spaces. Ascoli's theorem.

Paper: M 105 DISCRETE MATHEMATICS

Graphs, digraphs, network, multi graph, elementary results, structure based on connectivity, characterization, theorems on trees, tree distances, binary trees.

Eulerian graphs, Hamiltonian graphs, Spanning trees, Fundamental cycles, Minimal spanning trees. Kruskal algorithm, Prims algorithm.

Definitions of lattices, Modular lattices and distributive lattices.

Basic properties, Boolean polynomials, ideals, minimal forms of Boolean polynomials.

For the Academic Year 2017 – 2018

Paper: M 201 ALGEBRA – II

Algebraic extensions of fields: Irreducible polynomials and Eisenstein criterion- Adjunction of roots- Algebraic extensions-Algebraically closed fields.

Normal and separable extensions: Splitting fields- Normal extensions- Multiple roots- Finite fields- Separable extensions.

Galois theory: Automorphism groups and fixed fields- Fundamental theorem of Galois theory- Fundamental theorem of Algebra.

Applications of Galois theory to classical problems: Roots of unity and cyclotomic polynomials- Cyclic extensions- Polynomials solvable by radicals - Ruler and Compass constructions.

Paper: M 202, REAL ANALYSIS – II

Riemann - Stieltjes integral: Definition and existence of the Riemann Stieltjes integral, Properties of the integral, Integration and differentiation,
The fundamental theorem of calculus – integral of vector valued function, rectifiable curves,

Sequences and series of the function: Discussion on the main problem Uniform convergence, uniform convergence and continuity, Uniform convergence and integration, Uniform convergence and differentiation
Equicontinuous families of function, The Stone – Weierstrass theorem.

Power Series: Functions of several variable: Linear transformation, differentiation, The Contraction principle, The inverse function theorem,

The implicit function theorem, The Rank theorem, Determinates, Derivatives of higher order, Differentiation of integrals

Paper: M 203 COMPLEX ANALYSIS – I

Elementary properties and examples of analytic functions: Power series Analytic functions: Analytic functions as mappings, Mobius transformations

Complex integration: Riemann- stieltjes integrals, Power series representation of analytic functions, Zeros of an analytic functions, The index of a closed curve,

Cauchy's theorem and integral formula, The homotopic version of cauchy's theorem and simple connectivity , Counting zeros, The open mapping theorem ,

Singularities: Classification of singularities, Residues, The argument principle.

Paper: M 204 LINEAR ALGEBRA

Elementary Canonical Forms: Introduction – Characteristic Values – Annihilating Polynomials –invariant subspaces – Simultaneous Triangulation – Simultaneous Diagonalization.

Direct – sum Decompositions – invariant direct sums – the primary decomposition theorem – cyclic subspaces and Annihilators – cyclic decompositions and the rational form.

The Jordan Form – Computation of Invariant Factors – Semi Simple Operators.

Bilinear Forms : Bilinear Forms – Symmetric Bilinear Forms – Skew Symmetric Bilinear Forms – Group Preserving Bilinear Forms.

Paper: M205 - PROBABILITY THEORY & STATISTICS

Sample Space & Events, Axioms of Probability, Some elementary theorems, Boole's inequality, Conditional probability, Baye's theorem

Discrete & Continuous random variables, Mathematical Expectation, variance, Covariance, Moment Generating Function, Characteristic function, Binomial Distribution, Poisson Distribution, Normal & Uniform Distribution

Population and samples, sampling distribution of the Mean, sampling distribution of the variance and F distributions. Point estimation, Interval estimation, Tests of Hypotheses, Hypotheses concerning one and two means.

Estimation of proportions, Hypotheses concerning one proportion, Hypotheses concerning several proportions, the analysis of r x c tables, Goodness of Fit, Correlation & Regression, The method of least squares, inferences bases on the least – square estimators.

For the Academic Year 2017 – 2018

Paper: M 301 FUNCTIONAL ANALYSIS

Banach spaces: The definition and some examples, Continuous linear transformations, The Hahn – Banach theorem, The natural imbedding of N in N**, The open mapping theorem, The conjugate of an operator

Hilbert spaces: The definition and some simple properties, Orthogonal complements, Orthonormal sets.

The conjugate space H*, The adjoint of an operator, Self- adjoint operators, Normal and Unitary operators, Projections

Finite dimensional Spectral theory: Matrices. Determinants and spectrum of an operator, The spectral theorem, A survey of the situation.

Paper: M 302 LEBESGUE THEORY

Lebesgue measure: Outer measure, Measurable set and Lebesgue measure, Measurable set and Lebesgue measure, A non - measurable set. Measurable functions, Littlewood's three principles.

The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure. The integral of non-negative function, The general Lebesgue integral, Convergence in measure,

Differentiation of monotonic functions, Functions of bounded variation, differentiation of an integral, Absolute continuity

The L^P-Spaces, The Minkoswki and Holder inequalities, Convergence and completeness.

Paper: M 303 ANALYTICAL NUMBER THEORY

Arithmetical functions and dirichlet multiplication: Introduction-The mobius function $\mu(n)$ - The euler quotient function $\varphi(n)$

A relation connecting φ and μ - A product formula for $\varphi(n)$ - The dirichlet product of arithmetical functions, Dirichlet inverses and the mobius inversion formula - The mangoldt function $\Lambda(n)$ - multiplicative functions

Multiplicative function and dirichlet multiplication -The inverse of a completely multiplicative function - Liouville's function $\lambda(n)$ - The divisor functions $\sigma_\alpha(n)$, Genralized convolutions.

Averages of arithmetical functions: Introduction – The big Oh notation – Asymptotic equality of functions – Euler's summation formula

Some elementary asymptotic formulas – The average order of d(n) – The average order of the divisor function $\sigma_\alpha(n)$ – The average order of $\varphi(n)$
An application to the distribution of lattice points visible from the origin – The average order of $\mu(n)$ and $\Lambda(n)$ – Another identity for the partial sums of a dirichlet product. The partial sums of a Dirichlet product –Applications to $\mu(n)$ and $\Lambda(n)$.

Some elementary theorems on the distribution of prime numbers: Introduction, Chebyshev's function $\Psi(x)$ and $\theta(x)$ – Relations connecting $\theta(x)$ and $\Pi(x)$, Some equivalent forms of the prime number theorem – Inequalities for $\Pi(n)$ and P_n - shapiro's tauberian theorem – applications of shapiro's theorem – An asymptotic formula for the partial sums $\Sigma_{p\leq x}(1/p)$.
The partial sums of the mobius functions –

Congruences: definitions and basic properties of congruences
Residue classes and complete residue system, Linear congruences – Reduced residue systems and the Euler –Fermat thorem , Polynomial congruences modulo p. Lagranges theorem, Applications of Langranges theorem – simultaneous linear congruences , The Chinese remainder theorem – Applications of the Chinese remainder theorem, The polynomial congruences with prime power moduli ,

Paper: M 304 PARTIAL DIFFERENTIAL EQUATIONS.

Introduction, Methods of Solution of $\frac{\mathbf{dx}}{\mathbf{P}}=\frac{\mathbf{dy}}{\mathbf{Q}}=\frac{\mathbf{dz}}{\mathbf{R}}$, Orthogonal trajectories of a system of curves on a surface, Pfaffian Differential forms and equations, Solutions of Pfaffian differential equations in three variables
Cauchy's problem for first order partial differential differential equations

Linear Equations of the first order, Integral surfaces, Orthogonal surfaces, Non-linear partial differential equations of the first order, Cauchy's method of characteristics, Compatible system of first order equations, Charpits method, Special types of first order equations, Jacobi's method

Partial Differential equations of the second order, Their orgin,
Linear partial differential equations with constant and variable coefficients,
Solutions of linear hyperbolic equations, Method of equation of variables, Monger'smethod.

Laplace equations, elementary solutions, Families of equipotential surfaces, Boundary value problems, Methods of separation of variables of solving Laplace equations, problems with axial symmetry, Kelvin's inversion

theorem, the wave equation, Elementary solution in one dimensional form, Riemann – Volterra solution of one dimensional wave equation.

Paper: M 305 LATTICE THEORY

Partially ordered sets-diagrams, Special subsets of a poset-length-lower and upper bounds. The minimum and maximum condition-the Jordan Dedekind chain conditions-dimension functions.

Algebras-lattices-the lattice theoretic duality principle-lattices as posets-diagrams of lattices. Semi lattices, ideals-bound elements of lattice-atoms and dual atoms. Complements, relative complements, semi complements.
Irreducible and prime elements of a lattice-the homomorphism of a lattice-axioms systems of lattices.

Complete lattices- complete sub lattices of a complete lattice-conditionally complete lattice- lattices. Compact elements, compactly generated lattices- sub algebra lattice of an algebra. Closure operations- Galois connections, Dedekind cuts. Partially ordered sets as a topological spaces-

Distributive lattices - Infinitely distributive and completely distributive lattices- modular lattices. Characterization of modular and distributive lattices by their sub lattices - Distributive sub lattices of modular lattices - the isomorphism theorem of modular lattices. Covering conditions- meet representations in modular distributive lattices. Some special sub classes of the class of modular lattices- preliminary theorems. Modular lattices of locally finite length- the valuation of lattice. Metric and quasi metric lattice-complemented modular lattices.

For the Academic Year 2017 – 2018

Paper: M 401 MEASURE THEORY

Measure spaces, Measurable functions, Integration, General convergence theorems,

Signed measure, The Raydon – Nikodym theorem, The L^P Spaces

Outer measure and measurability, The Extension theorem, Product measures.

Inner measure, Extension by sets of measure zero, Caratheodory outer measure, Hausdroff measure.

Paper: M 402 – NUMERICAL ANALYSIS

Transcendental and polynomial equations: Introduction, Bisection method, Iteration methods based on first degree equation; Secant method, Regula Falsi method, Newton- Raphson method, Iteration method based on second degree equation; Mullers method, Chebyshev method, Multipoint iterative method, Rate of convergence of secant method, Newton Raphson method,

System of linear algebraic equation: Direct methods, Guass elimination method, Triangularization method, Cholesky method, Partition method, Iteration method: Gauss seidel Iterative method, OR method.

Interpolation and Approximation: Introduction, Lagrange and Newton's divided difference interpolation, Finite difference operators, sterling and Bessel interpolation, Hermite interpolation, piecewise and Spline Interpolation, least square approximation.

Numerical Differentiation: methods based on Interpolation, methods based on Finite difference operators Numerical Integration: methods based on Interpolation, Newton's cotes methods, methods based on Undetermined coefficients, Gauss Legendre Integration method, Numerical methods ODE: Single step methods: Euler's method, Taylor series method, Runge kutta second and forth order methods, Multistep methods: Adam Bash forth method, Adam Moulton methods, Milne-Simpson method.

Paper: M403 - GRAPH THEORY

Basic concepts, Isomorphism, Euclidian and Hamilton Graphs, Trees, Properties of Trees, Spanning Trees, Connectivity and Separability, Network flows.

Planar graphs, Kuratowski's two graphs, Different representations of planar graphs, Detection of Planarity, Geometric and Combinational Duals of a graph, Vector spaces of a Graph.

Matrix representation of graphs, Incidence and circuit matrices of a graph, Fundamental Circuit matrix, Application to a Switching network, Cut set and Path Matrices, Adjacency matrices, Directed Graphs, Trees with directed Edges, Incidence and adjacency matrix of a digraph.

Coloring, Covering and Partitioning, Chromatic number, Chromatic Partitioning, Chromatic polynomial, Matchings, Coverings, The form color problem, Applications of graph theory in Operations Research.

Paper: M 404 - LINEAR PROGRAMMING

Formulation of Linear Programming problems, Graphical solution of Linear Programming problem, General formulation of Linear Programming problems, Standard and Matrix forms of Linear Programming problems, Simplex Method.

Two-phase method, Big-M method, Method to resolve degeneracy in Linear Programming problem, Alternative optimal solutions. Solution of simultaneous equations by simplex Method, Inverse of a Matrix by simplex Method, Concept of Duality in Linear Programming, Comparison of solutions of the Dual and its primal.

Mathematical formulation of Assignment problem, Reduction theorem, Hungarian Assignment Method, Travelling salesman problem, Formulation of Travelling Salesman problem as an Assignment problem, Solution procedure.

Mathematical formulation of Transportation problem, Tabular representation, Methods to find initial basic feasible solution, North West corner rule, Lowest cost entry method, Vogel's approximation methods, Optimality test, Method of finding optimal solution, Degeneracy in transportation problem, Method to resolve degeneracy, Unbalanced transportation problem.

Paper: M 405 DISCRETE DYNAMICAL SYSTEMS.

Phase Portraits, Periodic Points and Stable Sets, Stable Sets continued, Sarkovskii's theorem, Differentiability and its implications (hyperbolic, attractive and repelling periodic points),

Parameterized Families of Functions and Bifurcations, The Logistic Function Part I [Cantor Sets], Symbolic Dynamics and Chaos.

The Logistic Function Part II Topological Conjugacy, The Logistic Function Part III [Period Doubling Cascade], Newton's Method

Numerical solutions of Differential Equations, The Dynamics of Complex functions [Newton's Method in Complex Plane], the Quadratic Family, Mandelbrot Set