Proposed CBCS Syllabus
of
MATHEMATICS
at P.G. Level
(To be effective from 2018-19)

Jai Prakash University
Chapra

Proposed Syllabus of M.A., M.Sc. (Mathematics) Semester I

Paper I (MAT CC-01)

Abstract Algebra

Abstract Algebra

Prerequisites : Introduction to Group, Elementary Properies of Group, Finite Group.

And subgroup, Cyclic Group, Permutation Group, Properties of Permutations. Rings, integral Domains. Characteristic of rings.

Unit 1 : Homomorphism : Group actions. Sylow theorems, Normal and subnormal series composition series of a group. Jordan - Holder Theorem. Solvable groups, commutator subgroup of a group, Nilpotent groups.

Unit 2 : Ring homomorphism, Isomorphism, quotient rings, ideals. Kernel of ring homomorphism, principal ideal ring and domain, prime and maximal ideal. Euclidean domain.

Unit 3 : Extension fields, algebraic and transcendental extension, splitting field of Polynomial, separable and inseparable extension, normal, extension.

Unit 4 : Cycle Modules, sims le Modules, semi-simple Modules, Schur's Lemma, Free Modules,

Unit 5 : Solution of equations by radicals, insolvability of equations of degree 5 by radicals.

References :

1. L. N. Herstein :- Topics in Algebra.
2. M. Artin :- Algebra
3. L. S. Luther & L.B.S. Passi :- Algebra Vols I & II Narosa Publication House
4. D.S. Dummit and R.M. Foote :- Abstract Algebra
5. N.S. Gopalakrishnan :- University Algebra

Paper II (MAT CC-02)

Real Analysis

Real Analysis

Unit 1 : Sequences and series of functions, pointwise and uniform covergence. Cauchy critrion for uniform covergence. Weierstrass - M test. Abel's and Dirichlet's test for uniform convergence.

Unit 2 : Uniform convergence and differentiation. Weierstrass approximation theorem Power series. Able's and Tauber's theorem.

Unit 3 : Definition and examples of Riemann-Stieltje's integral Property of integral. Integration and differentiation, the fundamental theorem of Calculus.

Unit 4 : Functions of several variables. Linear transformation, Derivatives in an open subset of Rn chain rule, partial derivatives, interchange of order of differentiation. Derivative of higher orders, Taylor's theorem.

Unit 5 : Inverse function theorem, Implicit function theorem, Jacobians, Extremum Problems with constraints. Lagrange's multiplier methods.

References :

1. W. Rudin :- Principles of Mathematical Analysis
2. T.M. Apostal :- Mathematical Analysis
3. I.P. Natanson :- Theory of function of Real Variable
4. H.I., Royden :- Real Analysis

Paper III (MAT CC-03)
Linear Algebra

Linear Algebra

Unit 1 : Finite dimensional vector spaces : Linear transformations and their matrix representations, rank : systems of linear equations, eigen values and eigen vectors, minimal polynomial. Cayley-Hamilton Theorem, diagonalization

Unit 2 : Hermition, Skew Hermitian and unitary matrices ; Finite dimensional inner product spaces. Gram-Schmidt orthonormalization process, self adjoint operators.

Unit 3 : Similarity of linear transformations. Invariant subspaces, reduction to triangular forms. Nilpotent transformations. Index of Nilpotency, invariants of a Nilpotent transformations, primary decomposition theorem. Joardan blocks and Jordan forms rational canonical form.

Unit 4 : Bilinear form, algebra of bilinear form Matrix of bilinear forms, degenerate and Non-degenerate bilinear forms. Alternating bilinear forms.

Unite 5 : Symmetric and Skew-symmetric bilinear forms. Ouadratic form, law of Inertia. Sylvester's theorem. Hermitian forms definite forms.

References :

1. K.B. Datta :- Matrix and Linear Algebra
2. S. Lipschutz :- Linear Algebra, Schaum's outline series
3. Hoffman and Kunze :- Linear Algebra

Paper IV (MAT CC-04)
Discrete Mathematics

Discrete Mathematics :

Unit 1 : Definition of graphs, paths, circuits and subgraphs, induced subgraphs, degree of a vertex, connectivity, planar graphs and their properties. Trees and simple applications of graphs.

Lattice Theory

Unit 2 : Lattices as partially ordered sets and their properties, lattices as algebraic system. Sub lattices, direct products and Homomorphisms of Lattices some special lattices eg Complete lattices, complemented lattices and distributive lattices.

Boolean Algebra

Unit 3 : Boolean algebra as a complemented distributive lattice, Boolean rings, identification of Boolean algebra and Boolean rings, sub-algebra and generators.

Unit 4 : Boolean homomorphism and ring homomorphism, ideals in a Boolean algebra and Dual ideals, Fundamental theorem of homomorphism and Stone's representation theorem for Boolean algebras and Boolean rings, simple application to eletrieal network.

Combinatories

Unite 5 : Permutation and combinations, partitions, pigeonhole principle, inclusion-exclusion principle, generating functions, recurrence relations.

References :

1. K. H. Rosen :- Discrete Mathematics and its applications.
2. S. Lipschutz and M. Lipson :- Discrate Mathematics
3. Cl. L. Liu :- Elements of Discrete Mathematics
4. E. Mendelson :- Boolean Algebra and Switching Circuits
5. Kolman, Bushi and Ross :- Discrete Mathematical Structure

Syllabus of M.A/M.Sc (Mathematics)
Semester II
Paper V (MAT CC-05)
General Advanced Mathematics

Set Theory :

Unit I : Elementary set theory, Finite, countable and uncountable sets, Real number system as a complete ordered field. Archimedean property, supremum, infimum.

Fuzzy Set Theory :

Unit II : Fuzzy Sets Versus Crisp sets, Basic definition, types, properties and representations of Fuzzy sets. Convex Fuzzy sets. Basics operation on Fuzzy set. a- Cuts. Decompositions theorem. Complements, t-norm and t-conorm. Extension principles and Simple applications of Fuzzy sets.

Graph Theory :

Unit III : Matching and Maximum Matching, Hall's Matching Courlitia Minimax theorems.

Number Theory :

Unit IV : Divisiblity Theory in the Integers : Division Algorithim, the Greatest Common Divisor. The Fuclidean Algorithm. The Diophantine Equations ax+by=c. Fundamental Theorem of Arithmatic.

References :

1. Koman, Bushi and ross :- Discrete Mathematical Structure.
2. Pundir And Pundir :- Fuzzy Sets & their Application.
3. G.J. Klir & B. Yuan :- Fuzzy sets.
4. Graph theory : F. Harare, Addison Wesley.
5. A. Baker, A concise introduction to the Theory of Numbers.

Paper VI (MAT CC-06)
Complex Analysis

Complex Analysis :

Unit 1 : Algebra of complex numbers, the complex plane, polynomials. power series, transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions. Cauchy-Riemann equations.

Unit 2 : Contour integral. Cauchy's theorem. Cauchy's integral formula. Liouville's theorem.

Unit 3 : Taylor's theorem, Maximum modulus Principle. Schwarz's Lemma, Laurent Series, Isolated singularities. Meromorphic function. Mittage-Leffler's theorem The argument principle, Rouche's theorem, fundamental theorem of algebra, Power series.

Unit 4 : Residues, Cauchy's residue theorem, Evaluation of integral, Branches of any valued functions with speciel reference to arg z, log z and Bilinear transformations, their propertics and classifications, definition and examples of conformal mappings. Mobius Transformation.

References :

1. J. B. Conway :- Functions of one Complex Variables,
2. L.V. Ahlfors :- Complex Analysis

Paper VII (MAT CC-07)
Differential and Integral Equation

Differential and Integral Equations

Unit 1 : Initial Value problem and the equivalent integral equation, n order equation in d dimension as a first order system. Concepts of local existence, existence and uniquencess of solution with examples,

Unit 2 : Integral Equations and their classifications. Eigen values and eigen functions. Freedholm Integral equations of Second Kind. Iterative Scheme and method of successive approximations.

Unit 3 : Ascoli - Arzela theorem (only statement), a theorem on convergence of solutions of a family of Initial value problems. Picard-Lindelof theorem. Peano's existance theorem Corollaries. Kamke's convergence theorem only statement.

Unit 4 : Gronwall's inequality, maximal and minimal soulution, Differential inequalities. Uniquencess theorem. Nagumo's and Osgood's criteria, successive approximations.

References :

1. P. Hartman :- Ordinary Differential Equation
2. S.G. Mikhlin :- Linear Integral Equations.
3. R.P. Kanwal :- Linear Integral Equations. Theory and Techniques.

Paper VIII (MAT CC-08)
Measure Theory

Measure theory :

Unit 1 : Lebesgue outer measure, Measurable sets, Measuribility, Measurable functions, Borel and Lebsegue measurability. non-measurable sets.

Unit 2 : Integration of non-negative functions, the general integral, Integration of series, Riemann and Lebesgue integrals.

Unit 3 : The Four Derivatives, function of bounded variation, Labesgue differentiation Theorems, Differentiation and Integration.

Unit 4 : Measure and outer measure, extension of measures, uniqueness of extension. Completion of measure, measurable spaces. Integration with respect to a measure.

Unit 5 : The LP - spaces, convex functions, Jensent inequality Holder's and Minkowski's Inequalities, completeness of LP- spaces, convergence in measure, Almost uniform Convergence.

References :

1. G.de Barra :- Measure Theory and Integration
2. P.K. Jain and V.P. Gupta :- Lebesque Measure and Integration
3. I.K. Rana :- An Introduction to Measure and Integration
4. P.R. Halmos - Measure Theory

Paper IX (MAT CC-09)

Topology

Unit 1 : Definition and examples of topological spaces, closed sets, dense subsets, Neighbourhood, interior, exterior, boundary and accumulation points. Derived Sets, Bases and subbases. Subspaces and Relative topology.

Unit 2 : Continuous functions and homomorphism, characterisation of continuity in terms of open sets, closed sets and closure. First and second countable topological spaces Lindelof's theorem, separable Spaces, second countability and separability.

Unit 3 : Separation axioms T_0, T_1 and T_2 spaces and their basic properties, compactness, Continuous function and compact sets, basic properties of compactness and Finite intersection property.

Unit 4 : Connectedness, continuous function and connected sets characterization of Connectedness in terms of a discrete two point space, connectedness on real line.

Unit 5 : Regular and Normal spaces T_3 and T_4 spaces, characterisations and basic properties, Urysohn's lemma and Tietze extension Theorems.

References :

1. G.F. Simmons :- Introduction to Tepology and Modern Analysis
2. K.K. Jha :- Functional Analysis, Advanced General Topology
3. Futton :- Algebraic Topology First Course

Syllabus of M.A/M.Sc (Mathematics)
Semester III
Paper X (MAT CC-10)
Functional Analysis

Functional Analysis

Unit 1 : Normed linear spaces, Banach spaces and examples, Quotient space of normed linear Spaces and its completeness, equivalent norms, Riesz Lemma, Basic properties of finite dimensional normed linear spaces and compactness.

Unite 2 : Weak convergence and bounded linear transformation, normed linear spaces of bounded linear transformations, dual spaces with examples, uniform boundness theorem and some of its consequences.

Unit 3 : Open mapping theorem and closed graph theorem, Hahn-Banach Theorem on real linear spaces, complex linear spaces and normed linear spaces, Reflexive spaces.

Unit 4 : Inner product spaces. Riesz lemma on Hilbert space, orthonormals sets and Parseval's identity, structure of Hilbert spaces, Projection theorem, Riesz Representation Theorem.

Unit 5 : Adjoint of an operator on a Hilbert space, Reflexivity of Hilbert spaces. Self-adjoint Operators. positive operator. Projection, Normal and unitary operators.

References :

1. G.F. Simmons :- Introduction to Topology and Modern Analysis
2. K.K. Jha : Functional Advanced General Topology

Paper XI (MAT CC-11)

Fluid Dynamics

Fluid Mechanics :

Unit 1 : Lagrangian and Eulerian methods. Equation of Continuity, Boundary Surfaces, Stream lines, Path lines and Streak lines, velocity potential, irrotational and rotational motions. vortex lines.

Unit 2 : Lagrange's and Euler's equations of motion. Bernoulli's theorem, equation of motion by flux method, equation referred to moving axis, implusive actions.

Unit 3 : Irrotational Motion in two dimension, stream function, complex velocity potential. sources, sinks, doublets and their images, conformal mapping, Milne - Thomson circle theorem.

Unit 4 : Two dimensional irrotational motion produced by motion of a circular, coaxial and elliptic cylinders in an infinite mass of liquid, kinetic energy of a liquid. Theorem of Blasius, motion of a sphere through a liquid at rest at infinity, liquid streaming past a fixed sphere, Equation of motion of a sphere, Stoke's stream function

Unit 5 : Vortex motion and its elementary properties, Kelvin's proof of permanence, Motion due to circular and rectilinear vertices.

References :

1. F. Chorlton :- A text Book of Fluid Dynamics.
2. M.D. Raisinghania :- Fluid Dynamics

Paper XII (MAT CC-12)

Classical Mechanics (Rigid Dynamics)

Unit 1 : Generalised Co-ordinates. Holonomic and Non Holonomic systems, Lagrange's equations of motion, energy equations for conservative fields.

Unit 2 : Hamilton's canonical equations. Rouths equations. Hamilton Principle, Principle of Least Action.

Unit 3 : Small Oscillations, normal Co-ordinates, normal mode of vibration.

Unit 4 : Contact transformation. Lagrange brackets and Poisson brackets, the most general infinitesimal contact transformation, Hamilton - Jacobi equation.

Unit 5 : Motivating problem of Calculus of variation. Euler - Lagrange equation, shortest distance, minimum surfaces of revolution, Brachistochrone problem.

References :

1. A.S. Ramsey : Dynamics Part II
2. S.L. Loney : Dynamics of particle and rigid bodies.

Paper XIII (MAT CC-13)
Optimization Techniques

Linear Programming

Unit 1 : Simplex method for unrestricted variable. Two phase method, Dual simplex method, Parametric Linear programming, Upper Bound teechnique, Interior point algorithm. Linear Goal programming.

Unit 2 : Integer programing. Branch and bound technique. Gomory's algorithm.

Non-Linear programming :

Unit 3 : One and multi-variable unconstrained optimization. Kuhn - Tucker condition for constrained optimization. Wolfe's and Beale's methods.

Unit 4 : Game theory. Two person - Zero sum games with mixed strategies, Graphical solution by expressing as a linear programming problem.

Unit 5 : Inventory theory, Different costs of inventory model, Deterministic Economic lot size model, EOQ with uniform demand and several productions of unequal length / production runs of equal length EOQ models - Shortages not allowed. shortages allowed.

References :

1. H.A. Taha :- Operations Research - An Introduction
2. Kanti Swarup, P.K. Gupta and Man Mohan : Operations Research
3. P. K. Gupta and D.S. Hira :- Operations Research

Paper XIV (MAT CC-14)

Differential Geometry

Unit 1 : Curves in spaces, parameters other than arc lengths, tangent, principal normal, binormal and three fundamental planes, Curvature and torsion of space curves, Serret-Frenet formulae, Fundamental theorem on spaces curves. Helices, spherical indicatrix, Involutes and Evolutes, Bertrand curves.

Unit 2 : Representation of surfaces, Curves on surfaces in R^3 spaces, tangent plane and Normal, Envelope, characteristic and edge of regression, developable surface of revolution, directions on a surface.

Unit 3 : Parametric curves, angle between them, first order and second order magnitudes, principal directions and lines of curvature. Normal Curvature, Euler's theorem and Meunier's theorem. Theorem of Beltrami and Enneper. Gauss Characteristic equation, Mainardi - Codazzi equations.

Unit 4 : Conjugate directions. Isometric lines, asymptotic lines and Geodesics - their equations and properties, curvatrure and torsion, their structures on surfaces of revolution, Bonnet's theorem, Clairaut's theorem and and Dupin's indicatrix.

References :

1. C.E. Weatherburn :- Differential Geometry In Three Dimension
2. J.A. Thorpe :- Elementary Topics in Differential Geometry
3. A. Gray : Differential Geometry of three dimensions. Cambridge University Press

List of Elective Paper
(MAT EC-01 & MAT EC-02)

1. Fuzzy sets and their applicaiton
2. Mathematical Methods
3. Operational Research
4. Theory of Relativity
5. Galois Theory.
6. Advanced Topology
7. Banach Algebras
8. Commutative Algebra
9. Programming in C
10. Number Theory

1. Fuzzy set and their applications

Fuzzy Set Theory :

Unit 1 : Fuzzy Sets Versus Crisp sets. Basic definitions, types, properties and representations of Fuzzy sets. Convex Fuzzy sets. Basics operation on Fuzzy set, α-Cuts, Decompositions theorem, Complements. t-norm and t-conorms. Extension principles and Simple applications of Fuzzy sets.

Unit 2 : Fuzzy logics An overview of classical logic, Multivalued logics. Fuzzy propositions. fuzzy quantifiers. Linguistic variable and hedges, inference from conditional fuzzy propositions the compositional rule of inference.

Unit 3 : Approximate Reasoning An overview of fuzzy expert system. Fuzzy implication and their selection Multiconditional approximate reasoning the role of fuzzy relation equation.

Unit 4 : An introduction to Fuzzy control Fuzzy controllers. Fuzzy rule base Fuzzy inference engine Fuzzification. Defuzzification and the various defuzzification method (The centre of maxima and the mean of maxima methods).

Unit 5 : Decision making in Fuzzy Environment - Individual decision making, Multiperson decision making. Multicriteria decision making, Multistage decision making, Fuzzy ranking methods. Fuzzy linear programming.

References :

1. G.J. Klir and b. Yuan :- Fuzzy sets and Fuzzy Logics.
2. H.J. Zimmermann, Fuzzy set theory and its Applications.
3. G.J. Klir and T.A. Folger :- Fuzzy Sets. Uncertainty and Information.
4. Punder and Pundir :- Fuzzy sets and their applications.

2. Mathematical Methods

Unit 1 : Orthogonalisation. Bessel's Inequality. Mean error minimization, completeness relation. Weierstrass approximation theorem, polynomials of Legendre, Hermite and Bessel. generating function. orthogonality. recurrence relation and Rodrigue's formula

Unit 2 : Partial Differential Equation and properties, concept of well posed problems. Reduction of P.D.E. in two independent variables to the canonical forms, classification in to elliptic, hyperbolic and parabolic equations, Laplace's equations in cartesian. cylindrical and spherical co-ordinates. Equipotential surfaces, Interior and exterior Dirichlet problem, the Maximum-Minimum property, solutions and Uniqueness, Dirichlet's problem for a circle, fundamental properties of Harmonic function.

Unit 3 : Wave equation in one dimension and two dimension, vibrations of struck and plucked string with fixed ends, homogeneous rectangular and circular membranes, eigen vibrations. D' Alembert's solution of one dimensional wave equation. One dimensional Diffusion equation & solution of initial value problem by integral transofrm.

Unit 4 : Tensors - Transformations of Co-ordinates, contravariant and convariant vectors Symmetric and skew-symmetric tensors, addition and multiplication of tensors, Contraction and composition of tensors, Quotient law.

Unit 5 : Reciprocal symmetric tensors of the second order, Christoffle's symbols, covariant derivative of a contravariant vector, Co-variant derivative of a covariant vector, covariant derivative of tensors. curl of a vector, Divergence of a covariant vector, Laplacian of a scalar in invariant.

References :

1. I. N. Sneddon : - Elements of Partial Differential Equations
2. R. Courant and D. Hilbert :- Methods of Mathematical Physics Vol I & Vol II
3. C.E. Weatherburn :- Riemannian Geometry and Tensor calculus
4. Smirnov and Tychonoff :- Partial Differential Equations.

3. Operations Research

Unit 1 : Queuing Theory - Poisson probability law. Distribution of inter-arrival time. Distribution of time between successive arrivals, Differential difference equation of M/M/1 : ∞ / FIFO, M / M /1 : N / FIFO, M / M / C : ∞ / FIFO, M /M/C : N/FIFO.

Unit 2 : Information Theory : Description of communication system, Mathematical difinition of information. Axiomatic approach to information, Measures of uncertainty, Entropy in two dimensions - property, conditional entropy.

Unit 3 : Channel capacity, Efficiency and redundancy, Encoding, Fano-encoding procedure, Necessary and sufficient condition. average length of encoded message.

Unit 4 : Replacement Model - introduction concepts of present value, replacement of items whose maintenance cost increase with time and value of money also changes, Replacement of items that fail completely, individual and group replacement policy.

Unit 5 : Sequencing - N jobs and 2 machines, N jobs and 3 machines, N jobs M machines.

References :

1. H.A. Taha :- Operations Research - An Introduction
2. Kanti Swarup. P.K. Gupta and Man Mohan : Operations Research
3. P.K. Gupta and D.S. Hira :- Operations Research.

4. Theory of Relativity

Unit 1 : Contravariant and Covariant Tenors, Riemannian Metric, Christoffel's symbols, Cavariant derivatives, Riemannian Christoffel curvature tensor, covariant curvature tensor and its symmetry properities, Bianchi identities

Unit 2 : General theory of Relativity - principle of equivalent and general covariance. Einstein field equations and its Newtonian approximation. Schwarz schild external solution and its isotropic form Birkhoff theorem, (only statement)

Unit 3 : Planetory orbits and analogous of Kepler's laws in general relativity. Advance of perihelion of planet, Bending of light rays in a gravitational field. Gravitational shift of spectral lines, Einstein theory.

Unit 4 : Energy Momentum of tensor of a perfect fluid, Schwarz - Schild internal soulution, Energy Momentum tensor of a electromagnetic field. Einstein Maxwell equation.

Unit 5 : Cosmology - Einstein modified field equation with cosmological term static cosmological models of Einstein and De-Sitter, their derivation properties and comparison with the actual universe.

References :

1. C.E. Weatherburn :- An Introduction to Riemannian Geometry and the tensor calculus.
2. A.D. Eddington :- The Mathematical theory of Relativity.
3. Goyal and Gupta :- Theory of Relativity
4. R. Adler, M. Bazin, M. Schiffer :- Introduction to General Relativity.
5. J.J. Synge :- Special theory of Relativity & General theory of Relativity.

5. Galois Theory

Unit 1 : Rings, examples of ring, ideals, prime and maximal ideals. Integral domains. Euclidean Domains, Principal Ideal Domains and Unique Factorizations Domains. Polynomial rings over UFD's.

Unit 2 : Fields, Characteristic and prime subfields, field extension, finite, algebraic and finitely generated field extensions, algebraic closures.

Unit 3 : Splitting fields, normals extension, Multiple roots, Finite fields. separable Extension.

Unit 4 : Galois goups, Fundamental Theorem of Galois Theory, Solvability by radicals, Galois theoem on solvability. Cyclic and abelian extensions. Classical ruler and Compass constructions.

References :

1. D.S. Dummit and R.M. Foote, Abstract Algebra
2. Joseph Rotman, Galois Theory
3. N. Jacobson, Basic Algebra 1, 2nd ed, Hindustan Publising Co 1984
4. S.L. ang. Algebra I, III Edition, Addison Wesley, 2005

6. Advanced Topology

Unit 1 : Countably compact spaces, sequentially compact spaces, totally bounded metric spaces.

Unit 2 : Lebesgue's covering lemma. spaces of continuous functions, Arzela-Ascoli Theorem. Weierstrass's approximation thorem.

Unit 3 : Stone Weierstrass's theorem, metrizable spaces and meztrization theorems, uniform spaces, topology of uniform spaces.

Unit 4 : Uniform continuity, uniform metrizable topological spaces, metrizable uniform spaces.

Unit 5 : Some properties of completely regular spaces, the Stone-Chech compactification.

References :

1. S. Willard : General Topology, Addison - Wesley 1970
2. S.W. Davis : Topology, TMH 2006
3. K.K. Jha : Advanced General Topology, Nav Bharat Prakashan, Patna
4. G.F. Simmous : An introduction to Topology and Modern analysis

7. Banach Algebras

Unit 1 : Elementary Properties and Examples of Banach Algebras, Ideal quotients, the spectrum of an element. dependence of spectrum on algebra. Abelian Banach Algebras.

Unit 2 : Elementary propeties of C* - Algebras and examples. Abelian Algebras and functinal calculus. prositive elements.,

Unit 3 : Ideals and quotients, representations of C*- Algebras and the Gelfand-Naimark construction.

Unit 4 : Spectral measures and representations of Abelian C*-Algebras. Special theorem.

Unit 5 : Topologies on B(H), the double commutant rem and Abelian Von Neumann Algebras.

References :

1. J.B. Conway : A course in Functional Analysis. springer 1990
2. R.V. Kadison and J.r. Ringrose : Fundamentals of the theory of opera tor Albebras AMS 1997
3. G. Murphy : C*- Algebras and Operator theory, Academic Press 1990

8. Commutative Algebra

Unit 1 : Ring and ring homomorphisms, ideals, quotient rings. Zero divisors. Nilpotent elements units, prime ideals and maximal ideals. Nit Radical nad Jacobson Radical. Operations on ideals, extension and contraction.

Unit 2 : Modules and module homomorphisms, sub-modules, quotient modules. Operation on sub-modules. Direct sum and products. Finitely generated modules, exact sequences.

Unit 3 : Tensor product of modules, restriction and extension of scalars. exactness properties of tensor product, Algebras. Tensor product of algebras.

Unit 4 : Local properties, extended and contracted ideals in ring of fraction. primary decomposition, integral dependence, the going-up theorem, integrally closed integral domains, the going-down theorem. chain conditions.

Unit 5 : Primary decompositions in Noetherian ring. Artin rings, discrete valuation rings. Dedekind domains, Fractional ideals.

References :

1. M.F. Atiyah and I.G. Macdonald : Introduction of Commutative Algebra - Addison Wesley
2. H. Matsumura : Commutative ring theory. Camb. Univ. Press
3. N.S. Gopala Krishnan - Commutative algebra
4. S. Lang : Algebra, springer
5. D.P. Patil, Patil, Storch : Introduction to Algebraic Geometry and Commutative Algebra, Anshan Publishers.

9. Programming in C

Theory

1. Introduction to programming language. C language and its features.
2. Unde standing of Structure of Programme in C.
3. Basic data types. Library in C.
4. Operators and expression in C.
5. Functions used for input and output in C.
6. Conditional branching in C. use of If-then.
7. Looping in C. use of for loop. while loop. do-while loop, nested loops.
8. Algorithm and Flow Charts.

Practical

1. Some simple programmes use in C.
2. Leap year.
3. Generate first n-primes
4. roots of quadratic equations.
5. Convert a number to any given base.
6. Generate first n-perfect numbers.
7. Sine and Cosine by Taylors series.
8. Addition and multiplication of matrices
9. Transpose of a matrix
10. Inverse of matrix.

References :

1. Y. Kanitkar : Lets C.
2. Robert lafore : C programming.
3. E. Balaguruswami : Programming in ANSI C.

Paper X (MAT CC-10)

Number Theory

Number Theory :

Unit 1 : Divisibility, G.C.D. and L.C.M., Primes, Fermat numbers, congruences and residues, theorems of Euler, Fermat and Wilson, solutions of congruences, linear congruences, Chinese remainder theorem.

Unit 2 : Arithmetical functions $\varphi(n)$, $\mu(n)$ and $d(n)$ and $\sigma(n)$ Moebius inversion formula, congruences of higher degree, congruences of prime power modulli and prime modulus, power residue.

Unit 3 : Quadratic residue, Legendre symbols, lemma of Guass and reciprocity law. Jacobi symbols, Farey series, rational approximation, Hurwitz theorem, irrational numbers, irrationality of e and π, Representation of the real numbers by decimals.

Unit 4 : Finite continued fractions, simple continued fractions, infinite simple continued fractions, periodic continued fractions, approximation by convergence, best possible appoximation, Pell's equations. Lagrange four sphere theorem.

References :

1. Theory of Numbers, G. H. Hardy and E M Wright, Oxford Science Publications, 2003.
2. Introduction to the Theory of Numbers, I Niven and H S Zuckerman, John Wiley & Sons,

   1960.
3. Elementary Number Theory, D. M. Burton, Thata McGraw Hill Publishing House, 2006.
4. Higher Arithmetic, H. Devenport, Cambridge University Press, 1999.
5. Introducton to Analytic Number Theory, T.M. Apostal, Narosa Publishing House.