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 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.

Graph Theory:

Unit III : 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.

Number Theory:

Unit IV : Divisiblity Theory In the Integers: Division Algorithim, the Greatest Common Divisor. The Euclidean Algorithm, The Diophantine Equations ax+by = c, Fundamental Theoem of Arithmetic.

References:

1. Kolman, 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.

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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, Mittag-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 special reference to argz, logz and Bilinear transformations, their properties and classifications, definition and examples of conformal mappings. Mobius Transformations.

References :

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

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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 uniqueness of solution with examples.

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

Unit 3 : Ascoli- Arzela theorem, 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.

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

References :

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

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PAPER VIII (MAT CC-08)

Measure Theory

Measure theory:

Unit 1: Lebesgue outer measure, Measurable sets Measuribility, Measurable functions, Borel and Lebesque 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, Lebesgue differentiation Theorems, Differentiation and Integration.

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

Unit 5 : The L^P-spaces, convex functions, Jensen inequality Holder's and Minkowski's Inequalities, completeness of -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

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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 homeomorphism, 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 Topology and Modern Analysis
2. K.K.Jha :– Functional Analysis, Advanced General Topology
3. Futton:- Algebraic Topology First Course

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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 approximation, Pell's equations, Lagrange four sphere theorem.

Reference:

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, Tata McGraw Hill Publishing House, 2006.
4. Higher Arithmetic, H. Davenport, Cambridge University Press, 1999.
5. Introduction to Analytic Number Theory, T.M. Apostal, Narosa Publishing House.

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