Paper- I : BM-301 : Analysis

Max Marks: 30
Time : 3 Hours

Section-I (3 Questions)

Riemann integral, Integrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorems of integral calculus.

Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests. Frullani's integral. Integral as a function of a parameter. Continuity, derivability and integrability of an integral of a function of a parameter.

Section-II (2 Questions)

Series of arbitrary terms. Convergence, divergence and Oscillation. Abel's and Dirichelt's tests. Multiplication of series. Double series.

Fourier series Fourier expansion of piece-wise monotonic functions.

Partial derivatives and differentiability of real-valued functions of two variables. Schwarz's and Youg's theorem. Implicit function theorem.

Section-III (2 Questions)

Stereographic projection of complex numbers.

Continuity and differentiability of Complex functions, Analytic functions.

Cauchy-Riemann equations. Harmonic functions. Elementary functions. Mapping by elementary functions.

Mobius transformations. Fixed Points Cross ratio. Inverse Points and critical mappings.

Section-IV (3 Questions)

Definition and examples of metric Spaces. Neighbourhoods. Limit points. Interior points. Open and closed sets. Closure and interior. Boundary points Subspace of a metric space. Cauchy sequences. Completencess. Cantor's intersection theorem. Contraction principle. Construction of real numbers as the completion of the incomplete metric space of rationsls. Real numbers as a complete ordered field. Dense subsets. baire category theorem. Separable, second countable and first countable spaces. Continuous functions. Extension theorem. Uniform continuity. Isometry and homeomorphism. Equivalent metrics. Compactness. Sequential compatness. Totally bounded spaces. Finite intersection property. Continuous functions and compact sets. Connectedness components. Continuous functions and connected sets.

Note: The examiner is required to set ten questions in all, selecting questions section-wise as indicated in the syllabus. The candidate is required to attempt five questions, selecting at least one questions form each section.

Books Recommended:

1. T.M.Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi,1985
2. R.R.Godberg, Real Analysis, Oxford & IBH Publishing Co., New Delhi, 1970
3. S. Lang : Undergraduate Analysis, Springer- Verlag, New York, 1983
4. D.Somasundaram and B. Choudhary : A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997
5. Shanti Narayan : Theory of Functions of a Complex Variable, S. Chand & Co. New Delhi
6. R.V.Churchill & J.W.Brown : Complex variables and Application, 8^{th} Edition, McGraw-Hill, New York,1990.
7. Shanti Narayan : Theory of Functions of a Complex Variable, S. Chand & Co.New Delhi.
8. E.T.Copsoni, Metric Spaces, Cambridge University Press, 1968
9. G.F.Simmons : Introduction to topology and Modern Analysis, McGraw-Hill,1963

Paper-II BM-302 : Abstract Algebra

Max Marks : 30
Time : 3 Hours

Section-I (3 Questions)

Grous- Automorphisms, inner- automorphism. Automorphism groups and their computations. Conjugacy relation Normaliser. Counting principle and the class equation of a finite group. Center for Group Prime-order Abelianizing of a group and its universal property. Sylow's theorems. p- Sylow subgroup. Sturcture theorem for finite Abelian groups.

Section-II (2 Questions)

Ring theory- Ring homeomorphism. Ideals and Quotient Rings.Field of Quotients of an Integral Domain. Edclidean Rings. Polynomial Rings Polynomials over the Rational Field. The Eienstein Criterion. Polynomial Rings over Commulative Rings. Unique factorization domain R unique factorisation domain implies so is R [X_1, X_2,…..X_n]

Section-III (3 Questions)

Definition and example of vector spaces. Subspaces. Sum and direct sum of subspaces. Linear span. Linear dependence, independence and their basic properties Basic. Finite dimensional vector spaces. Existence theorem for bases. Invariance of the number of elements of a basic set. Dimension. Existence of complementary Subspaces of a subspaces of a finite dimension. Existence of complementary Subspace of a subspace of a finite dimensional vector space. Dimensional of sums of subspace. Quotient space and its dimension. Linear transformations and their representation as matrices. The Algebra of linear transformations. The rank nullity theorem. Change of basis,. Dual space, Bidual space and natural isomorphism. Adjoint of a linear transformation. Eigenvalues.and eigenvectors of a linear transformation. Diagonalisation. Annihilator or a Subspace Bilinear, Quadratic and Hermitian forms.

Section-IV (2 Questions)

Inner product spaces- Cauchy- Schwarz inequality. Orthogonal vectors. Orthogonal Complements. Orthonormal sets and bases. Bessel's inequality for finite dimensional spaces. Gram-Schmidt Orthogonalization process.

Modules. Submodules. Quotient modules. Homeomorphism and Isomorphism theorems.

Note : The examiner is requested to set ten questions in all, selecting questions section- wise as indicated in the syllabus. The candidate is required to attempt five questions selecting at least one question from each section.

Books Recommended :

1. I.N. Herstem : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1975
2. N. Jacobsen : Basic Algebra, Vols. I & II, W.H. Freeman, 1980 (also published by Hindustan Publishing Company)
3. P.B. Bhattacharya, S.K. Jain and S.R.Nagpal : Basic Abstract Algebra (2^{nd} edition)
4. K.Hoffiman and R.Kunze, Linear Algebra, 2^{nd} Edition
5. S.K.Jain, A. Gunawardena & P.B. Bhattacharya : Basic Linear Algebra with MATLAB.
6. Vivek Sahai and Vikas Bist : Algebra, Narosa Publishing House.
7. I.S.Luther and I.B.S.Passi : Algebra, Vol. I, Groups Vol. II – Rings, Narosa Publishing House.

Paper III : BM-303 : Programming in C and Numerical Analysis

(Theory & Practical)

(Non Programmable Scientific Calculator is allowed in this paper)

Max. Marks : 30
Time : 3 Hours

Section-I (3 Questions)

Programmer's model of a computer. Algorithms. Flow Charts. Data Types Anithmetic and Input /Output instructions. Decisions control structures. Decision statement Logical and conditional operators. Loop Case control structure. Functions Recursions Prepocessors. Array Puppeting of strings. Structures. Pointers. File formatting.

Section-II (3 Questions)

Solution of Equations : Bisection, Secent, Regular Falsil Newton's Method. Roots of Polynomials.

Interpolation : Language and Hermite Interpolation, Divided Differences. Difference Schemes, Interpolation Formulas using Differences.

Numerical Differentiation.

Numerical Quadrature : Newton-Cote's Formulas, Gauss Quadrature formulas. Chebychev's Formulas.

Linear Equations : Direct Methods for solving systems of Linear Equations Gauss Elimination, LU Decomposition, Cholesky Decomposition), iterative methods. Jacobi Guass- Seidel, Reizxation Methods).

Algebra Eigenvalue problem : Jacobi's Method, Given's Method. Heuseholder's Method, Power Method, QR Method Lanczos' Method.

Section-III (2 Questions)

Ordinary Differential Equations : Euler Method , Single-step Mehods, Runge-Kutta's Method, Multi-Step Methods, Milne- Simpson method, Methods based on Numerical Intergration, Methods based on Numerical Differentiation, Boundary value Problems Eigenvalue problems.

Approximation : Different types of Approximation, Least Square Polynomial Approximation, Polynomial Approximation using Orthogonal Polynimials, Approximation with Trigonometric Functions. Exponential Functions, Chebychev polynomials Rational Functions.

Section-IV (2 Questions)

Random number generation congruential, statistical tests of pseudorandom numbers.

Random variate generation, inverse transform method, Composition method, acceptance- rejection method, generation of exponential, normal variates, binomial and poisson variates.

Monte Carlo integration, hit or miss Monte Carlo integration, Konte Carlo integration for improper integrals, error analysis for Monte Carlo integration.

Note : The examiner is required to set ten questions in all, selecting questions section wise as indicated in the syllabus. The candidate is required to attempt five questions selecting at least one questions form each section.

Practicals :

Practicals in C is based on Numerical Analysis as in Section-II and III above.

Books Recommended :

1. B.W.Kernighan and D.M.Rithcie, The C programming Language , 2^{ND} Edition.
2. V. Rajaraman, Programming in C, prentice Hall of India, 1994
3. Byron S. Gottfried, Theory and problems of Programming with C, Tata McGraw Hill Publishing Co., Ltd, 1998
4. C.E. Froberg, Introduction to Numerical Analysis (2^{nd} Edition)
5. Melvin J.Maron, Numerical Analysis : A Practical Approach, Macmillan Publishing Co, Inc, New York.
6. M.K. Jain, S.R.K. Lyengar, R.K.Jain, Numerical Methods-Problems and Solutions, New Age International (P) Ltd,1996
7. M.K. Jain, S.R.K.Lyengar, R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
8. R.Y.Rubistein : Simulation and the Monte Carlo Methods, John Wiley, 1981