FOLDER-9

# बिलासपुर विश्वविद्यालय

## बिलासपुर ( छत्तीसगढ़ )

पाठ्यक्रम

समाज विज्ञान - संकाय

नियमन एवं पाठ्यक्रम

एम. ए. / एम. एस. सी. (पूर्व) गणित

**परीक्षा : 2014**

:: प्रकाशक ::

कुलसचिव बिलासपुर विश्वविद्यालय

बिलासपुर ( छत्तीसगढ़ )

the examination shall be paper only.

5. Besides regular students and subject to other compliance with this ordinance, ex-students and non collegiate candidates shall be eligible for admission to the examination as per provision or ordinance No. 6 relating to Examination (General).

   Provided that non- collegiate candidate shall be permitted to offer only such subjects/papers as are taught to the regular students at any of the University teaching Department or College.

6. The Subject of the Examination shall be of the following :

   (i) Mathematics (ii) Physics
   (iii) Chemistry (iv) Zoology
   (v) Botany (vi) Geology

   A candidate who has passed the M.Sc. Examination of the University many subject shall be allowed to present himself for the M.Sc. Examination in any one of more of the optional papers in the subject not taken by him at the said examination and if successful will be given a certificate to that effect.

7. From the session 1986-87 for the Previous Examinatio, candidate must obtain for a pass atleast 36% in each theory and Practical and 36% of the aggregate marks in the Theory paper and Practical separetely in each examination. The above provision of 20% in each paper shall be applicable for Final Examination from the academic session of 1987-88 .

8. No division will be assigned on the result of the Previous Examination the division in which a candidate is placed shall be determined on the basis of aggregate of marks obtained in both. the M. Sc. Previous and M.Sc. Final Examination.

9. Successful candidates who obtain 60% or more of the aggregate marks shall be placed in the first Division, those obtaining less than 60% but not less 48% in the second Division and all other success full candidate obtaining less than 48% in the Third Division.

10. Candidates who have passed the M.Sc Examination of the University in any subject in Third or Second Division and desire to appear at the M.Sc. Examination in the same subject for improving division without attending a regular course of study in a College affiliated to the University or in a Teaching Department of the University be allowed to appear at the aforesaid examination as non-collegiate student on the following conditions.

    (i) There shall be only two Division for such candidates the First division and second Division. The Marks required for obtaining these division shall be the same as prescribed in the ordinance i.e. examinees who are successful in Final of the Examination. and have obtained 60% or more aggregate of the marks in Previous and Final Examination taken together shall be placed in the First Division and Examinees who are successful in Final Examination and have obtained less than 60% but not less than 48% of aggregate marks in previous and Final examination taken together shall be placed in the Second Division.

    (ii) The result of the candidates obtaining less than 48% of the agreegate marks in previous and Final Examination taken together shall not be declared.

    (iii) Candidates shall have the option to appear at both the previous and final examination in one and the same year and for being successfull at the examination, the candidates shall obtain 48% of the aggregate marks.

    Provided that such candidates who opt to appear in previous and final examination separately shall have to obtain minimum aggregate required for the previous examination but he will have to obtain atleast 48% in the aggregate of previous and final examination taken to gather or else his result will be canclled.

    (iv) The syllabus for the examination shall be same as prescribed for the year in which the examination is held.

    (v) Not more than to attempt shall be allowed to such a candidate. Failure of appearance at the examination after per permission has been accorded by the University shall be counted as an attempt.

    Provided however such candidates who to appear at the previous and final examination separately will be allowed only one attempt of the previous examination and two attempts as the final examination.

    (vi) Candidates who wish to avail the opportunity given in fore going Paper will have to apply for permission as required in the Ordinance relating to admission of non - collegiate students to the University examination along with registration fee.

    (vii) In case, a student Improves his division under provision of this para, the fresh Degree will be issued after cancealling his first Degree.



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# M.A./M.SC.MATHEMATICS (PREIVOUS)

w.e.f. Session 2005-06

There shall be four compulsory papers and one optional paper of 100 marks each. Student can choose any one optional paper out of three.

## DETAILS OF SYLLABUS

## COMPULSORY PAPER - I M.A./M.SC.MATHEMATICS (PREVIOUS)

**M.M.401 (a & b) Advanced Abstract Algebra** M.M.100

**Intoduction -** Permutation group, Normal Subgroup, Revisited Normalizer and commutator subgroup, three isomorpsm theorem, Corrospondence theorem, Maximam Normal Subgroup, Automorphism and Inner Automorphism, centre of group.

**Normal Series -** Normal and Subnormal series, Composition series Jordan Holder theorem, Solvable group Nilpotent group.

**Ring and Ideals -** Definitions, Maximum and prime Ideals, Nilpotent and Nil Ideals zorn's Lemma (Statement Only) its application to obtain maximal ideals.

**Modules and vector space -** Definition and examples submodules, quotient modules, Direct, sums, Modules generated by a set R Homomorphism of Modules, isomorphism theorem, exact sequence of modules, short exact sequence, cyclic modules, simple modules , semi simple modules schure's Lemma, free modules Representation of Linear mapping, Rank of Linear mapping, Rank Nullity theorem.

**Field Theory -** Extension field, Algebric and transceddental extension, seperable and inseperable extension, Normal extension perfect field finite field, premitive elements, Algebrically closed field, Aulomorphism of extension, galois extension, fundamental theorem of Galois theory.

**Canonical Form -** Similarity of Linear transformation invarient sub spaces Reduction to triangular form, Nilpotint transformation, Primary decomposition theorem ,Jordon blocks and Jordan Form.

Noeitherian an Artinian modules and rings, Hilberts basis theorem wedderburn theorem.

**Text Books -** (1) P.R. Bhattacharya, S.K. Jain and S.R. Nagpaul. Basic abstract Algebra. IInd Edition Cambridge University press Indian Edition : 1997.

(2) I.N. Herstein, Topics in Algebra Wiley Eastern Ltd New Delhi. 1975.



**Reference Books :** 1. M.Artin Algebra P.H.I.
2. D.S.Malik, J.N.Morderon, M.K.Sen, Fundamentals of Abstract Algebra.

## COMPULSORY PAPER - II - M.A./M.SC. MATHEMATICS (PREVIOUS)

**MM 402 (a & b) Real Analysis & Measure Theory** M.M.100

**Definition and existence of Riemann - stieltjes integral,** Properties of the Integral, Integration and differentiation, the fundamental theorem of Calculus, Integration of vector - valued fuctions Rectifiable curves.

Rearrangements of terms of a series, Riemann's theorem.

Sequences and series of functions, pointwise and uniform convergence. Cauchy criterion for uniform convergence, Weierstrass M-Tests, Abel's and Dirichlet's tests for uniform convergencel uniform convergence and continuity, uniform convergence and Riemann - Stieltjes integration uniform convergence and differentation , Weierstrass approximation theorem, Power series uniqueness theorem for power series, Abel's and Tauber's theorems.

**Functions of several variables,** linear transformations, Derivatives in an open subset of R Chain rule, Partial derivatives, interchange of the order of differentation, Derivatives of high orders, Taylor's theorem, Inverse function theorem, Implicit function theorem, Jacobians, extreme Problems with constraints. Lagrange's multiplier method, Differentation of integrals, Partitions unity, Differential forms, Stoke's theorem. Lebesgue outer measure, measurble set. Borel and lebsgue measurbility Non measurable set, measurable function.

**Reiman and Lebesque Integral,** Integration of non - negative function, the general Integral, Integration of series.

**Theory of Differentiation and integration,** The Four - derivatives function of Bounded variations.

Measure and outer measure, Extension of a measure : Uniquness of extension on completion of measure, measure spaces, integration with respect to a measure.

The $L^p$ Spaces , convex function, Jardon,s Inequality , Holder and Minkowski Inequality completness of $L^p$

**Text Book -**

1. Walter Rudin, Principal of Mathematical Analysis(3rd edition) Mc. Graw Hill, Kogakusha 1976 internation student edition (Chapter Non 6 to 10)

2. G. be Barra, measure theory and integration, Wiley Eastern Limited 1981. (Chapter No.2 to 7).

**Refference Book.**

1. P.K. Jain and V.P. Gupta, Lebesque Measure and Integration New age International (P) Limited Published ,New Delhi 1986.(Reprint 2000)

## COMPULSORY PAPER III - M.A./M.SC. MATHEMATICS

~~4529~~ **(PREVIOUS)** ~~AM-1567~~

**MM 403 (a & b) Topology** ~~AL-6600~~ ~~5549~~ **M.M.: 100**

Definition and examples of topological spaces.Closed sets Closure.Dense subsets.Neighbourhoods interior exterior and boundary. Accumulation points and derived sets. Bases and sub - bases.Subspaces and relative topology. A-1507

Alternate methods of defining a topology in terms of Kuratowski Closure Operator and Neighbourhood Systems.

Continuous Functions and homeomorphism.

First and Second Countable spaces. Lindelof;s theorems. Separable spaces. Second Countability and Separability.

Separation axions $T_0, T_1, T_2, T_{3½}, T_4$: Their Characterizations and basic properties. Uryhohn's lemma Tietze extension theorem.

**Compactness.** Continuous functions and compact sets. Basic properties of compactness. Compactness and finite intersection property. Sequentially and countably compact sets. Local compactness and one point compactification, Stone - vech compactification. Compactness in metri spaces. Equivalence of compactness countable compactness and sequential compactness in metric spaces.

Connected spaces.Connectedness on the real line .Components Locally Connected spaces.

Tychonoff product topology in terms of standard sub - base and its characterizations projection maps. Separation axioms and product spaces. Connectedness and product spaces. Compactness and product spaces (Tychonoff's Theorem.) Countability and product spaces.Embedding and metrization Embedding lemma and Tychonoff embedding .The urysohn metrization Theorem.

**Nets and filters.** Topology and convergence of nets. Hausdorffness and nets .Compactness and nets. Filters and Their convergence. Canonical way of converting nets to filters and vice- verse. Ultra- filters



and Compactness.

**Text Book**

1. James R. Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd. New Delhi.2000.

2. K.D. Joshi, Introduction to General Topology, Wiley Eastern Ltd, 1983.

**Reference Book**

1. B. mendelson, Introduction to Topology Allyn & Bacon, Inc Boston 1962.

2. K.K. jha Advanced General Topology Nav Bharat Prakashan ,Delhi.

## COMPULSORY PAPER IV - M.A./M.SC. MATHEMATICS

A-1508 ~~5550~~ ~~AM-1568~~

**(PREVIOUS)** ~~AL-6601~~

**MM 404 (a & b) Complex Analysis.** ~~4530~~ **MM. 100**

**Complex Integration.** Cauchy -Goursat. Theorem,Cauchy's integral Formula. Higher order derivatives. Morera's Theorem. Cauchy's inequality and Liouvile's theorem.The fundamental theorem of algebra. Taylor's theorem. Maximum modulus principle Schwarz Lemma. Laurent's series.Isolated singulartities.Meromorphic functions. The argument principle.Rouche's theorem Inverse function theorem.

Residues. Cauchy's residue theorem. Evaluation of integrals.

Bilinear transformations. their properties and classifications. Definitions and examples of conformal mappings.

Spaces of analytic functions. Hurwitz's theorem,Montel's theorem Riemann mapping theorem.

**Weierstrass factorisation theorem.** Gamma function and its properties Riemann Zeta function. Riemann's functional equation,Runge's theorem ,Mittag - Leffler's theorem Analytic Continuation.Uniqueness of direct analytic continuation .Uniqueness of analytic continuation along a curve. Power series method of analytic continuation Schwarz Reflection principle Monodromy theorem and its consequences. Harmonic functions on a disk. Harnak's inequality and theorem. Diriclet problem. Green's function.

Canonical products. Jensen's formula. Poission - Jensen Formula.Hadamard's three circles theorem. Order of an entire function.

Exponent of Convergence. Borel's theorem. Hadamard's factorization theorem.

The range of an analytic function. Bloch's theorem. The little Picard theorem. Schottky's theorem. Montel Caratheodory and the Great picard theorem.

**Text Books.**


1. J.B. Conway. Functions of one Complex variable .Springer verlag. International student edition Narosa Publishing House 1980.
2. L.V. Ahlfors, Complex Analysis. McGraw - Hill 1979.
3. Walter Rudin, Real and Complex Analysis, McGraw -Hill Book Co. 1966.
4. E.C. Titchmarsh, The theory of Functions, Oxford University Press London.
5. S. Ponnusamy, Foundations of Complex Analysis Narosa Publishing House 1997.


## OPTIONAL PAPER I - ADVANCED DISCRETE MATHEMATICS

A-1509 ~~8557~~ ~~AM-1569~~

**M.M.405** ~~4531~~ AR-66020 **M.M.100**

**Formal Logic-** Statement and Notation, Conectives - Negation, conjuction Disjunction , Truth Table, Conditional and Bioconditional, statement well formed formula, Toutology, Equivalent formula, Duality Lan functionally complete set of connectives, two state Divices and statement logic, Normal form, Principle conjuctives and Principle Disjunctive Normal forms, The theory of inference for the statement, calculus, Rules of Inference, Automatic theorem proving, the predicate calculus, Quantifiers, Predicate formulas, Free and Bound variables Inference theory of predicate calculus, valid formulas, over finite Univers, valid formulas, involving quantifiers formulas Involving more than one quantifiers.

**Algebric Structure -** Algebric system, semigroup and Moriods , Definition and examples (Including these pertaining to conetenation operation) Homomorphism, of semigroup and monoids, congruence relation and quotient semigroups, subsemigroup and submoriods, Direct product Basic Homomorphism theorem.

**Lattices -** Lattice as partial ordered sets their properties, Laltice as Algebric, system, sublattice, Direct Product and Homomorphism, Complete, Complemented, and Distributive lattice.

**Boolean Algebras -** Boolean Algebra as lattice, varies Boolean Identi-



ies The swicting Algebra, subAlgebra, Direct Products and Homomorphism Join - Irreducible Elements, Atom and Minterm, Boolean form and their Equivalence Minterm Boolean forms, sum of products, and products of sum canoncial forms MiniMization Boolean function, Application of Boolean Algebra, Swiching Theory (Using AND ,OR and NOT Gates)

**Grammer and Language -** Phrase Structure Grammer, Rewriting Rules Derivation, Sentential forms, context - sensetive context, Free and Regular grammers and Language Notation of syntext, Analysis, Polish Notation, Conversion of Infix experience to polish Notation The Revarne polish Notation.

**Introductory Computability Theory -** Finit state machines and their transition Table Diagrams, Equivalence of finite state machines, Reduced Machines.Homorphism, Finite Automata Acceptiors , Non Deterministic Finite Automata and equivalence of its power to that of Deterministic Finite Automata.

**Graph Theory -** Definition of (Undirected) Graphs, Paths, Circuits Cycles & Subgraphs Induced, subgraph, Degree of vertex.Connectivity, Planer Graphs and their propertier .Trees, Euler's formula for connected Planner Graphs.Complete and complete Bipartite graphs, Kurotowikis Theorem (Statement Only) and its use. Spanning trees, Cut sets, Fundamental cut sets and cycles,Minimal Spanning Trees, Matrix. Representation of Graphs. Euler's Theorem on the Existence of Eulerian Paths Directed Graphs, In degree and out degree of a vertex Weighted undirected Graphs.

### Text Books


(i) J.P. Trembley and R. Manohar .diserete Mathimatical struture with Application to Computor science - McGraw Hill Book.co.1997.

(2) C.L. Lie -Elements of Discrete Mathematics - McGraw Hill.Co .

(3) N.Deo, Graph Theory with Application to Engineering & Computer Science prentice hall of India.


**Reference Book-**


1. J.E. Hopcraft and I.D. Willman Introduction to Automate Theory Languages and compution - Nurosa Publishing House.
2. S. Wiitala. Dicrete Mathematics - Aunified Approach McGraw Hill Book Co.
3. Symour Lep chutz - Finite Mathematics (International Edition 1983) Mc.Graw Hill Co New York.

## M.A./M.Sc. Mathematics (Previous)

## OPTIONAL PAPER - II

### MM 405 (a & b) Differential Geometry of Manifolds.MM.:100

Definition and examples of differentialble manifolds. Tangent spaces jacobian map. One parameter group of transformation, Lie. derivatives. Immersions and imbeddings .Distribution exterior algebra. Exterior derivative.

Topological groups. Lie groups and lie algebras, Product of two. Liegroups. One parameter subgroups and exponential maps. Examples of Liegroups. Homomorphism and isomorophism. Lie Transformation Groups. General linear groups. Principal fibra bundle. Linear frame bundle. Associated fibre bundle. Vector bundle. Tangent bundle. Induced bundle. Bundle homomorphisms.

Riemannion manifolds. Riemannian connection Curvature tensors. Sectional curvative Schur's theorem. Geodesics in a Riemannian manifold. Projective curvature tensor. Conformal curvature tensor.

Submanifolds & hypersurfaces. Normals.. Gauss's fomulae Weingarten equations Lines of curvature, Generalized Gauss and Mainardi- Codozzi equations.

Almost complex manifolds. Nijenhuis tensor. contravariant .and covariant almost avalytic vector field F - Connection.

**Recommended Books.**

1. R.S. Mishra: Structures on a differentiable manifolds and their applications.Chandrama Prakashan ,Allahabad 1984.

2. B.B. Sinha. An Introduction to modern Differential Geometry, kalyani, Publishers New Delhi. 1982.

**References:**

1. R.S.Mishra Acourse in tensors with applications to Riemannian Geometry, Pthishola Private Limited, Allahabad 1973.

2. K.Yano and M.Kon. Structure of Manifolds. World Scientific Publishing Company Private Limited.1984.