M.A./ M.Sc. MATHEMATICS

NOTICE

1. The Ordinances Governing the examination in the Faculties of Arts, Fine Arts, Social Sciences, Science, Commerce, Management, Engineering, Education and Law are contained in separate booklet. The students are advised to refer to the same.

2. Changes in Statutes/ Ordinances/ Rules/ Regulations/ Syllabus and Books may, from time to time, be made by amendment or remaking , and a candidate shall, except in so far as the University determines otherwise comply with any change that applies to years he has not completed at the time of change.

Note : The decision taken by the Academic Council shall be final.

M.A./ M.Sc. MATHEMATICS
SCHEME OF EXAMINATION - 2013

Each Theory Paper 3 Hrs. duration 100 Marks

Dissertation/ Thesis/Survey Report/ Fixed work. if any 100 Marks

1. The number of paper and the maximum marks for each paper practical shall be shown in the syllabus for the subject concerned. It will be necessary for a condidate to pass in the theory part as well as in the practical part (Wherever prescribed) of a subject/ Paper separately.
2. A candidate for a pass at each of the Pervious and the Final Examination shall be required to obtain (i) atleast 36% marks in the aggregate of all the paper prescribed for the examination and (ii) atleast 36% marks in practical (s) wherever prescribed at the examination, provided that if a candidate fails to secure atleast 25% marks in each individual paper work, wherever prescribed. He shall be deemed to have failed at the examination not with standing his having obtained the minimum percentage of marks required in the aggregate for that examination. No division will be awarded at the Previous Examination,. Division shall be awarded at the end of the Final Examination on the combined marks obtained at the Previous and the Final Examination taken together, as noted below :

   First Division 60% of the aggregate marks taken togther of
   Second Division 48% the Previous and the Final Examination.

   All the rest will be declared to have passed the examinations.
3. If a candidate clears any paper(s) practical(s)/ Dissertation prescribed at the Previous and /or Final Examination after a continuous period of three years, then for the purpose of working out his division the minimum pass marks only viz 25% (36% in the case of practical) shall be taken into account in respect of such paper (s) Practical(s) Dissertation are cleared after the expiry of the aforesaid period of three year, provided that in case

   where a candidate require more than 25% marks in order to reach the minimum aggregate as many marks out of those actually secured by him will be taken into account as would enable him to make the deficiency in the requisite minimum aggregate.
4. The Thesis /Dissertation/ Survey Report. Field Work shall be typed & written and submitted in triplicate so as to reach the office of the Registrar atleast 3 weeks before the commencement of the theory examinatiion. Only such candidates shall be permitted to offer dissertation/ Fields work/ Survey report. Thesis (if provided in the scheme of examination) in lieu of a paper as have secured atleast 55% marks in the aggregate of all scheme, irrespective of the number of papers in which a candidate actually appeared at the examination.

N.B.(i) Non-Collegiate candidates are not eligible to offer dissertation as per Provision of O.170-A.

M.A. /M.Sc. (Maths) Examination-2013

There shall be 10 Papers in all out of these five shall be offered in previous and 5 in final. Each paper shall be of l00 marks and of 3 hours duration.

M.A. / M.Sc. (Previous) Examination 2013

SCHEME

Paper	Nomenclature	Duration	Max .Marks
I.	Advanced Algebra	3 Hrs	100
II.	Real and Complex Analysis	3 Hrs	100
III.	Partial Differential Equation and Mechanics	3 Hrs	100
IV.	Differential Equations, Integral Equations and Integral Transform	3 Hrs	100
V.	Discrete Mathematics and Numerical Analysis	3 Hrs	100

M.A./M.Sc. Maths (P.) Exam.-2013
Paper - I -ADVANCED ALGEBRA

Duration : 3 hours Max. Marks – 100

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : 40

Unit-I

Homomorphism theorems on groups, conjugate elements, classes and class equation of a finite group, Sylows Theorem. Cauchy's theorem for finite Abelian group, Normal and Subnormal series. Composition series. Jordan-Holder Theorem. Solvable groups.

Unit-II

Ideals, Principal Ideal rings, Division and Euclidean algorithm for polynomials over a field, Euclidean rings and domains, unique factorization theorems, unique factorization domains.

Finite field extension, Algebraic and Transcendental extensions, Separable and Inseparable extensions, Normal extensions, Perfect field, Galois extensions, Elements of Galois theory.

Unit-III

Linear transformations, Range, Kernel, Rank-nullity theorem, Singular and nonsingular transformations, Vector space of linear transformations.

Linear functional, Dual and bidual of a Vector space, Annihilators, Invariance, Projections, Adjoint of a linear transformations.

Unit-IV

Matrix representation of a linear transformation, Change of Basis. Transition matrix, Similarity, Eigen values and Eigen vectors for a linear transformation, Cayley-Hamilton Theorem,

Minimal polynomial and minimal equation, Canonical forms,

Diagonalization, Reduction to triangular form, Nilpotent transformations. Index of nilpotency. Jordan blocks and Jordan Canonical form.

Unit-V

Bilinear form, its matrix representation and rank, Symmetric and skew symmetric bilinear forms, Quadratic form associated with a bilinear form, Symmetric matrix associated with a quadratic form.

Diagonalization of a quadratic form. Hermitian form and its matrix representation. Positive definite Hermitian form.

Inner product spaces, Cauchy-Schwartz inequality, orthogonal vectors. Orthogonal complements, orthonormal sets and bases, Bessel's inequality for a finite orthonormal set. Gram Schmidt orthogonalisation process.

References :

1. I.N.Herstien	Topics in Linear Algebra (Wiley Eastern)
2. A.R.Vashistha	Algebra (Krishna Publications- Meerut)
3. Sharma & Vashistha	Linear Algebra (Krishna Publication)
4. Shanti Naravan	A Text book of Modern Abstract algebra (Wiley Eastern)
5. Surjeet Singh & Zameeruddin	Modern Algebra(Vikas Pub. House)
6. KHoffemn & R.Kunje	Linear Algebra (Prentice- Hall India Ltd)
7. S. Maclane and G. Birkhoff	Algebra 2nd ed. (Macniillen Co.)
8. S. Lang	Linear Algebra
9 V V Vovevodin	Linear Algebra (MIR Publications)
10.D.S.Chauhan &K.N.Singh	Studies in Algebra (JPH, Jaipur)

Paper II Real and Complex-Analysis

Duration : 3 hours Max. Marks – 100

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : 40

Unit-I

Riemann- Stieltjes integral, properties of Integral and Differentiation. Point wise and uniform convergence of sequence & series of functions. Cauchy criterion, Weirstrass M-test, Abel and Dirchlet test for Uniform Convergence. Uniform Convergence and continuity.

Unit-II

Measurable sets , Lebesgue outer measure and measurability, measurable functions. Borel and Lebesgue measurability. Non measurable sets.

Unit-III

Algebra of Complex numbers. Analytic functions, Sterographic projection of complex numbers, Holomorphic complex valued functions and their inverse, Cauchy-Reimann equations ,Power series.

Unit-IV

conformal mapping. Bilinear transformations.their properties and classification, Special transform $w = z^2$, z =, w = , z = c Sin w, complex integration ,Cauchy Theorem and integral formula,Poisson's integral formula,Tayler's and Laurents series,Morera's Theorem. Lioville's Theorem, Maximum modulus principle, Minimal modulus principle , Schwarz's Lemma.

Unit-V

Classification of Singularities. Branch Points, Reimann Theorem on removable Singularity, open mapping theorem Casoratti-Weirstrass theorem. meromorphic functions, The argument principle. Roche's Theorem, Residues, Cauchy's residue theorem; evaluation of integrals, branches of many valued function with reference to arg z, log z , z^a

References :

1. Malick- Arora	Mathematical Analysis (New Age International Limited)
2. Schuam Series	Complex Variable (TataMcgraw Hill)
3.Churchill & Brown	Complex Analysis (TataMcgraw Hill)
4-.H.L.Royden	Real Analysis (Macmillen Pub. Co.)
5. Walter Rudin	Real and Complex Analysis (TataMcgraw Hill)
6. G N.Purohit	Lebesgue measure & Integration (JPH. Jaipur)

Paper - III - PARTIAL DIFFERENTIAL EQUATIONS & MECHANICS

Duration : 3 hours Max. Marks – 100

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : 40

Unit-I

Examples of PDE. Classification. Canonical forms,
Nonlinear First Order PDE-Complete Integrals, Envelopes,
Method of solving Second order PDE - separation of variable and Cauchy's problem.

Unit-II

Laplace's, Heat Equation and Wave Equation upto three dimension in cartesion coordinates and upto two dimension in polar coordinates, their fundamental solutions by variable separation.

Unit-III

Moment and product of Inertia- principal axes and Momental Ellipsoid, D'Alembert's principle, Motion about a fixed axis, (General equation of motion).

Unit-IV

Generalized Coordinates, Holonomic and Non-holonomic systems. Scleronomic and Rheonomic systems, Generalized potential, Lagrange's equations,
Hamilton's variables, Hamilton canonical equations,

Unit-V

Poisson's Bracket. poisson's identity. Jacobi-Poisson Theorem. Hamilton Jacobi equations, Motivating problems of calculus of variations, Shortest distance, Minimum surface of revolution. Brachistochrone problem. Isoperimetric problem. Geodesic. Fundamental lemma of calculus of variations. Hamilton's Principle, Principle of least action.

References :

1. Erwin Creyszig	:	Engineering Mathematics	New Age India Ltd.
2. M.D. Rai Singhania	:	Advanced Differential Equation	S.Chand Publication
3. Gold Stein	:	Classical Mechanics	Narosa Publication
4. P.P. Gupta	:	Rigid Dynamics	Krishna Prakashan Meerut.
5. M. Ray	:	Dynamics of Rigid Body	Student's and Friend's Agra

Paper IV -DIFFERENTIAL EQUATIONS, INTEGRAL EQUATION & INTEGRAL TRANSFORM

Duration : 3 hours Max. Marks – 100

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : 40

Unit-I

Existence and uniquencss of solution dy/dx = f(x y), Canonical transformation of PDE. Sturm Liouville Boundary Value Problems. Green's function. Cauchy problems and characteristics

Unit-II

Fredholm and Volterra types Linear Integral Equations of the first and second kinds, Solution of Fredholm Integral Equations with separable Kernels

Unit-III

Solution of Integral Equations by successive substitutions and successive approximations.

Unit-IV

Laplace Transform :- Definition, properties, Laplace transform of derivatives. Laplace Transforms for Integrals, Inverse Laplace Transforms, convolution theorem, Application to Ordinary Differential Equations and Integral Equations.

Unit-V

Fourier Transform : - Fourier sine and cosine transform, convolution theorem.

Fourier Transform of Derivatives, Inverse Fourier transform.

References:

1. Erwin Kreyszig	Engineering Mathematics(New Age Intern. Limited)
2. M.D.Raisinghania	Differential Equation (S.Chand Pub!.)
3 M.D.Raisinghania	Integral Transform (S.Chand Pub!.)
4. Shanti Swaroop	Integral Equations (Krishna Publication Meerut)

5. J.L. Bansal and H.S. Dhami Differential equation volume I & II (JPH Jaipur)

Paper - V - DISCRETE MATHEMATICS & NUMERICAL ANALYSIS

Duration : 3 hours Max. Marks – 100

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : 40

Unit-I

Sets and Proposition:- Cardinality. Mathematical Induction. Principle of inclusion and exclusion. Pigeon hole principle.

Graph Theory :- Graphs. planer graph. Eulerian and Hamiltonian Graph. Directed Graphs

Trees :- Binary Tree. Binary Search Tree

Unit-II

Lattices :- Lattice and algebraic structure. duality. distributed and complemented lattice. partially ordered sets.

Boolean Algebra :- Boolean functions and expression, propositional calculus.

Design and Implementalion of digital networks, Application to switching and Logic circuits.

Unit-III

Solutions of Equations :- Bisection. Secant Regulafalsi, N-R Method.Chebshev method, Acceleration of convergence, N-R Method for non linear equation. Roots of a polynomial equation -Bairstaw and Birge-Veta method, Graeffe's root square method . Curve Fitting and Approximation :Least square principle, Chebshev Approximation.

Unit-IV

Linear Equations :- Direct method, Gauss, Gauss-JordaChobesky Partioned, Triangularisation, Iterative method ,

Jacobi, Gauss-Seidal and Relaxation Methods, Matrix inversion and eigen value problem-Power methods, Jacobi method ,complex eigen values,

Unit-V

Numerical Solution of Ordinary Differemial Equation :- Iterative methods Picards, Eulers and improved Eular methods. Runge-Kutta methods. PredictorCorrector methods, Stability analysis , Difference methods for BVP(Boundary Value Problems)

References :

1. Schuam Series Discrete Mathematics (TataMcgraw Hill)
2. Jain-Iyenger-Jain Numerical Analysis ((New Age International Limited)
3. C.L.Liue Elements of Discrete Mathematics (Tata1\1cgraw Hiil)
4. M.k. Gupta Discrete Mathematics (Krishna Prakashan Meerut)
5. Vedamurthy, S.N. Iyanger Numerical Methods (Vikas Publication House)
6 Goyel, Mittal Numerical Analysis (Pragati Prakashan)
7. Gupta Malik Calculus of Finite Difference & Numerical Analysis

M.A. / M.Sc. (Final) Examination -2013
Paper - I- FUNCTIONAL ANALYSIS

3 Hrs. duration Max. Marks – 100

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : 40

Unit - I

Metric spaces and their examples, Diameter of a set and bounded set, Open sphere, interior point of set, Limit point of a set, Closed ball, Convergent and Cauchy sequences,

Unit -II

Complete metric space, Cantor's intersection theorem, Baire category theorem, Continuity in metric spaces Contracting mapping, Fixed point theorem.

Unit - III

Normed Vector spaces, Banach Spaces and their examples, Continuous linear transformations, The Hahn-Banach theorem and its application,

Unit - IV

The open mapping theorem, The closed graph theorem, The uniform boundedness theorem, Inner product spaces, Hilbert space and their examples, Cauchy Schwatz's inequality, Parallelogram Law.

Unit - V

Orthogonal complements, Orthonormal sets, Bessel's inequality, Gram Schmidt orthogonlization process, Riesz representation theorem, The adjoint of an operator, Self adjoint and normal operators projections.

Book Recommended:

G.F. Simmons. Introduction to Topology and Modern Analysis, Mc Graw Hill Book Company Chapters 2, 9 and 10 (1963).

Paper - II -TOPOLOGY

3 Hrs. duration Max. Marks – 100

Note : The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 10

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 50

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : 40

Unit -I

Countable and uncountable sets, Infinite sets and the Axiom of choice. Cardinal numbers and its airthmetic. Schroeder - Bernstein theorem. Cantor's theorem and the continum hypoinsis, Zorn's lemma. Wellordring theorem. Definition and examples of topological spaces. Closed sets. Cosure. Dense sebsets. Neighbourhoods. Interior, exterior and boundary. Accumulation points abd derived sets.

Unit -II

Bases and sub-bases. Subspaces and relative topology. First and second Countable spaces. Lindelof's theorems, Separable spaces, Second Countability and Separability. Separation axioms T_0,T_1,T_2 their Characterizations and basic properties. Urysohn's lemma. Tietze extension theorem.

Unit- III

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. Compactness in metric spaces. Equivalence of compactness, countable, and sequential compactness in metric spaces.

Unit - IV

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

Tychnoff product topology in terms of stantard sub-base and its characterizations. projection maps. Separation axioms and product spaces. Connectedness and product spaces. Compactness and product soaces (Tychonoff's theorem).

Unit - V

Countability and product spaces.Embedding and metrization. Embedding lemma and Tychonoff embedding. The Urysohn metrization theorem. Nets and filters. Topology and convergence of nets. Hausdroffness and nets. Compactness and nets. Filters and their convergence.

References :

1. James R.Munkres, Topology, A First Cource, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.
2. J.Dugundji, Topology, Allyn and Bacon. 1966 (Reprinted in india by Prentice Hall of India pvt Ltd).
3. George F.Simmons, Introduction to Topology and Modern Analysis McGraw Hill Book Company,1983.
4. K.D.Joshi, Introduction to General Topology, Wiley Eastern Ltd.