M.G.S. UNIVERSITY,

BIKANER

SYLLABUS

SCHEME OF EXAMINATION AND COURSES OF STUDY

FACULTY OF ARTS / SCIENCE

M.A. / M.SC. MATHEMATICS

M.A./M.Sc. PREVIOUS EXAMINATION – 2021
M.A./M.Sc. FINAL EXAMINATION - 2022

The Ordiances 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 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 changes that applies to years he has not completed at the time of change.

3. In each paper, 9 questions will be set, 3 questions from each section. Candidates have to answer five questions in all taking at least one question from each section.

4. The syllabus is given in both the languages i.e. Hindi & English, if there is any discrepency, English version will be authentic.

5. The list of text books/ Recommended books/Reference Books as approved by the various B.O.S. are printed along with the English version only.

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

SCHEME OF EXAMINATION

Each theory paper   3 Hrs. duration   100 Marks

Dissertation/Thesis/Survey Report/Field 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 candidate to pass in the theory part as well as in the practical part (Whenever 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) whenever prescribed the examination, provided that if a candidate fails to 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 the examination. No division will be awarded at the Pervious Examination, Division hsall be awarded at the end of the Final Examination combined marks obtained at the Pervious and the Final Examination taken together, as noted below :

   First Division   60%   of the aggregate marks taken together

   Second Division   40%   of the Pervious and the final Examination.

   All the rest shall be declared to have passed the examination.

3. If a candidate clears any paper (s) Practical(s)/Dissertation Prescribed at the Pervious 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) Particle(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 typs & written and submitted in triplicate so as to reach the office of the Register atleast 3 weeks before the commencement of the theory examinations. 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 and I and II semester examination taken in the case of semester scheme, irrespective of the number of paper 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 170-A.

M.A./M.SC. EXAMINATION

MATHEMATICS

SCHEME OF EXAMINATION

There shall be 10 papers in all. Out of these Five shall be offered in previous and Five in final. Each paper shall be of 100 marks and of 3 hours duration.

M. A. / M. Sc. (Previous) Examination, 2021

Papers	Nomenclature	Duration	Max.Marks
I	Advanced Abstract Algebra	3 Hrs.	100
II	Analysis	3 Hrs.	100
III	Mathematical Methods	3 Hrs.	100
IV	Differential and Integral Equations	3 Hrs.	100
V	Numerical Methods	3 Hrs.	100

Paper - I (ADVANCED ABSTRACT ALGEBRA)

Duration : 3 Hrs.   Max. Marks : 100

Note : The paper consists of three sections

Section A : This section contain 10 questions of 02 Mark each (02 question from each unit) all questions are compulsory

Section B : This section contain 05 questions of 04 Mark each (01 question from each unit) all questions are compulsory

Section C : This section contain 05 questions of 20 Mark each (01 question from each unit) attempt any 03 questions

Unit I

Homomorphism theorems on groups, conjugate elements. Classes and class equation of a finite group, Sylows Theorem, P-sylow subgroup, structure theorem for finite abelian groups. Field theory-Extension fields, Algebraic and transcendental extensions, Separable and inseparable extensions

Unit II

Normal and subnormal series, Composition series, Jordan-Holder Theorem, Solvable group, Nilpotent groups. Normal extensions, Perfect fields, Finite fields. Primitive elements, Algebraically closed fields. Automorphisms of extensions. Galois extensions, Fundamental theorem of Galois theory.

Unit III

Vector space of a linear transformation, Matrix representation of a linear transformation, Change of Basis, Similarity, eigen value and eigen vectors for a linear operator, Caley-Hamilton, theorem, diagonalization, minimal

Polynomial and equation. Polynomials over rational fields. The Einstien criterion, Polynormial rings over commutative ring, unique factorization domain, Chain condition and rings.

Unit IV

Linear functionals, Dual and bidual of a vector space and their properties, Annhilators, Invariance, projections and its properties, Adjoints of a linear transformation and its properties. Solution of polynomial equations by radicals, insolvability of the general equation of degree 5 by radicals.

Unit V

Bilinear quadratic and hermition forms, Inner product spaces, Cauchy-Swarchz inequality, orthogonal vectors, orthogonal complements, ortho-normal sets and bases. Bessel's inequality for finite dimensional spaces, Gram-Schmidt orthogonalisation process.

REFERENCES :

1. Maclane and Birkoff : Algebra, Macmillan & Co.

2. Hofman and Kunz. : Linear Algebra, Prentice Hall of India.

3. I.N. Herstein : Topics in Algebra, Wiley Eastern India Ltd.

4. I.S. Luthar and B.S. Passi, : Algebra Vol-I Groups, Vol-II Rings, Narosa Publishing House

5. Gokhroo et.al. : Advanced Abstract Algebra, Navkar Publications, Ajmer

6. Gokhroo et.al : Advanced Linear Algebra, Navkar Publications, Ajmer

7. Purohit, Pareek, Sharma, : Linear Algebra, Jaipur Publishing House

8. Bhattacharya, P.B. etc. : Basic Abstract Algebra (II ed.) Camb. Univ. Press India, 1997

9. P.M. Cohn : Algebra vol I,II & III, John Wiley & Sons, 1982-89, 91

10. D.S. Malik, J.N. Mordeson : Fundamental of Abstract Algebra
    & M. K. Sen   MecGraw Hill International Edition, 1997

11. Vivek Sahai & Vikas Bist : Algebra, Narosa Publishing, 1999

12. Gopal Krishanan, N.S. (II ed.) : University Algebra New Age International Publication

13. Gopal Krishanan, N.S. : University Algebra through 600 problems New Age International Publication

14. B.S. Vatssa : Modern Algebra, 1999 New Age International Publication, (1999)

Duration: 3 Hrs.   Max. Marks : 100

Note : The paper consists of three sections

Section A : This section contain 10 questions of 02 Mark each (02 question from each unit) all questions are compulsory

Section B : This section contain 05 questions of 04 Mark each (01 question from each unit) all questions are compulsory

Section C : This section contain 05 questions of 20 Mark each (01 question from each unit) attempt any 03 questions

Unit I

Countable and non countable sets, lebesgue measure of sets of real numbers. Measurable functions, structure of measurable functions, weierstras's theorem on the approximation of continuous functions by polynomials.

Unit II

Lebesgue integral of measurable functions, lebesgue theorem on the passage to the limit under the integral sign. Summable functions, the space of square summable functions, function of finite variation, stieltjes integral, the indefinite lebesgue integral.

Unit III

Algebra of Complex numbers, Analytic functions, Cauchy-Reimann equations, Cauchy Theorem and integral formula, Power series, Taylor's and Laurents series, Morera's Theorem, Lioville's Theorem, Fundamental Theorem of Algebra, exp, sine, Cosine functions, Maximum modulus principal, Swartz Lemma.

Unit IV

Classification of Singularities, Branch points, Reimann Theorem on removable Singularity, open mapping theorem, casoratti-weirstrass theorem, meromorphic functions. The argument Principle, Roche's Theorem

Unit V

Residues, cauchy's residue theorem, Evaluation of Integrals, Branches of many value function with reference to argz, logz and Z^a, ã definition and examples of Contour mapping. Analytic continuation.

REFERENCES :

1. T.M. Apostal   :   Mathematical Analysis, Narosa Publishing House, New Delhi   (1985)

2. Gabriel Klambauer   :   Mathematical Analysis, Mared Dekker Inc., New York (1975)

3. G-de Barra   :   Measure Theory and Integration, Wiley Eastern Ltd. 1981

4. P.K. Jain and V.P. Gupta : Lebesgue Measure and Integration, New Age

                                International Pub. Ltd., New Delhi (Reprint 2000)

5. Indra Kumar Rana   :   An Introduction to Measure and Integration, Narosa Publishing House, New Delhi (1997)

6. G.N. Purohit : Advanced Analysis, Jaipur Publishing House, Jaipur

7. G.N. Purohit : Lebesgue Measure and Integration,

   Jaipur Publishing House, Jaipur

8. T.S. Nahar : Advanced Analysis, Navkar Publications, Ajmer

9. T.S. Nahar : Measure Theory, Navkar Publications, Ajmer

10. S. Ponnusamy : Foundation of Complex Analysis,

    Narosa Publishing House, New Delhi (1997)

11. Shanti Narain : Complex Analysis, S.Chand & Co., New Delhi

12. L.V. Ahlfords : Complex Analysis, McGraw Hill Co., 1979

13. Purohit and Goel : Complex Analysis, Jaipur Publishing House, Jaipur.

14. K.P. Gupta : Complex Analysis,

    Krishana Prakashan Mandir, Meerut.

15. B. Choudhary : Complex Analysis, Wiley Eastern Ltd. New Delhi.

16. Gokhroo et.al : Complex Analysis, Navkar Publications, Ajmer

17. S.K. Sharma etc. : Complex Analytic Functions Theory and Applications New Age International Publishers.

18. M.R.Speigel : Real variables (Lebesgue Measure and Integration) McGrawHill Co.

Duration: 3 Hrs.   Max. Marks: 100

Note : The paper consists of three sections

Section A : This section contain 10 questions of 02 Mark each (02 question from each unit) all questions are compulsory

Section B : This section contain 05 questions of 04 Mark each (01 question from each unit) all questions are compulsory

Section C : This section contain 05 questions of 20 Mark each (01 question from each unit) attempt any 03 questions

Unit-I (Special Functions)

Hyper Geometric and Confluence, Hyper geometric Functions. Hermite and Laguerre Polynomial, their generating functions and general integral properties.

Unit-II (Special Functions)

Legendres polynomial . Associated Legendre's functions. Bessel's functions. Recurrence relations. Orthogonal properties.

Unit-III (Tensors)

Transformation of Coordinates, Covarient, Contravarient and mixed tensors. Invariants. Addition, subtraction and multiplication of tensors. Contractions of tensors Quotient Law of tensors. Fundamental Tensors, Length of Curve, Associated tensors.Christoffel symbols, Covariant Differentiation of tensors, Laws of covariant differentiation

Unit-IV(Tensors)

Geodisics, Null Geodesics, Geodesics Coordinates Parallelism, Covarient derivatives, Reimann-christroffel tensor, curvature tensor, Ricci tensor, Bianchi identity, Reimaan curvature, Flat space, space of constant curvature.

Unit-V (Integral Transform)

Laplace Transform: Definition and properties, Rules of manipulation: Laplace Transform of derivatives, Inverse Transform, Complex in version formula, Convolution theorem , Use of Laplace Transform to solve differential equation with constant coefficient, Variable coefficients, Simultanens equations and simple Partial differential equation.

REFERENCES :

1.   Rainville E.D.   :   Special Functions Chapter :1,6,8,11 & 12

2.   Sneddon I.N.   :   The use of Integral Transform , Mc-Graw Hill Co., 1966

3.   Speigal M.R.   :   Theory and Problem of Laplace Transform , McGraw Hill Co.

4.   Slater L.J   :   Confluent Hypergeometric Functions, Cambridge University Press,1966

5.   L.J. Slater   :   Generalized Hypergeometric Functions, Cambridge University Press, 1966

6.   Gokhroo et.al   :   Special Functions, Navkar Publications, Ajmer

7.	Gokhroo et.al	:	Transform Calculus, Navkar Publications, Ajmer
8.	Berry Spain	:	Tensor Calculus
9.	Bansal J.L.	:	Tensor Calculus, Jaipur Publication House, Jaipur.
10.	Raj Bali	:	Tensor Calculus, Navkar Publications, Ajmer

Paper - IV (Differential and Integral Equations)

Duration – 3 Hrs.   **Max Marks 100**

Note : The paper consists of three sections

Section A : This section contain 10 questions of 02 Mark each (02 question from each unit) all questions are compulsory

Section B : This section contain 05 questions of 04 Mark each (01 question from each unit) all questions are compulsory

Section C : This section contain 05 questions of 20 Mark each (01 question from each unit) attempt any 03 questions

Unit-I (Differential Equations)

Existence and uniqueness of solution of $dy/dx = f(x,y)$, Cannonical forms and reduction to canonical forms. Classification of second order PDE, Separation of variable for Heat Equation, Wave equations and Laplace Equation.

Unit-II (Differential Equations)

Linear Boundary value problem, (Eigen values eigen functions, normalized eigen functions eigen function expansion, Rayleigh quotient), Strum Liouville Boundary value problem, Cauchy problem and characteristics, Green's function.

Unit-III (Calulus of Variation)

Linear functionals, Minimal functional theorem, General Variations of a function, Euler-Lagranges equation, Variational method for Boundary value problems in ordinary and partial differential equations.

Unit-IV (Integral Equations)

Linear integral equations of first and second kind of Fredholm and Volterra types, Homogeneous Fredholm integral equations, Fredholm integral equations with separable kernels, solution by successive substitutions and successive approximations

Unit-V (Integral Equations)

Volterra integral equations and their solutions solutions by successive substitutions and successive approximations, Classical Fredholm theory, The Fredholm alternative Helbert Schimdt theory of Symmetric Kernels.

REFERENCES :

1.	Lovitle W.V.	:	Integral Equation, Dover Publications
2.	Kanwal R.P.	:	Linear Integral Equation Theory and Techneques, Academic Press, New York
3.	Gokhroo et.al	:	Differential Equation and Calculus of variation, Navkar Publications, Ajmer

4. Gokhroo et.al   :   Integral Equation, Navkar Publications, Ajmer

5. Fred A. Hinchey   :   Introduction to Applicable Mathematics Part-II, Wiley Eastern Ltd.

6. S.G. Mikhlin   :   Linear Integral Equation 1960 (Translated from Russian) Hindustan Book agency

7. A.N. Sneddon   :   Mixed Boundary Value Problem in Potential Theory, North Halland, 1966

8. Goyal et.al.   :   Integral Equation, jaipur publishing house jaipur

PAPER - V (Numerical Methods)

Duration: 3 Hrs.   Max. Marks: 100

Note : The paper consists of three sections

Section A : This section contain 10 questions of 02 Mark each (02 question from each unit) all questions
            are compulsory

Section B : This section contain 05 questions of 04 Mark each (01 question from each unit) all questions
            are compulsory

Section C : This section contain 05 questions of 20 Mark each (01 question from each unit) attempt any 03
            questions

Note : scientific calculators (non programming) are allowed

Unit-I

Iterative methods : Simple iteration, theory of iteration, acceleration of conversion, methods for multiple and complex roots, Newton Raphson method for simultaneous equations, convergence of iteration process in the case of several unknowns.

Unit-II

Solution of polynomial equations, polynomial evaluation, real and complex roots, synthetic division, the Birge-Vieta, Baristow and Graffe's root squaring methods, system of simultaneous equation (Linear) –direct methods –Methods of determination. Gauss elimination, Gauss Jordan, Cholesky, Partition methods of successive, approximate –conjugate Gracient, Gauss and Jacobi iteration, Gauss seidal iteration & Relaxation methods.

Unit-III

Eigen value problem, basic properties of eigen values and eigen vectors, power methods for finding all eigen pairs of a matrix, complex eigen values.

Curve fitting and function approximation, least square error criterion, linear regression, polynomial fitting and other curve fitting, approximation of functions by Taylor series and Chebyshev polynomials.

Unit-IV

Numerical solution of ordinary differential equations, Taylor series methods, Euler's and modified Euler's method, Runge-Kutta method upto fourth order, multi step method (Predictor –Corrector Strategies), stability analysis –single and multi step methods.

Unit-V

Difference methods for Boundary value problems, ordinary differential equations, boundary value problems, shooting methods, finite difference methods, difference scheme for non linear boundary value problems of the type.

Books recommended :

1- Jain, Iyengar & Jain : Numerical Analysis
2- Jain M.K. : Numerical Solution of differential equations.