Syllabus and Course Scheme
Academic year 2017-18

M.Sc. – MATHEMATICS

Exam.-2018

UNIVERSITY OF KOTA
MBS Marg, Swami Vivekanand Nagar,
Kota - 324 005, Rajasthan, India
Website: uok.ac.in

M.A./ M.Sc. MATHEMATICS EXAM.- 2018

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.

SCHEME OF EXAMINATION - 2018
M.A./ M.Sc. MATHEMATICS

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 candidate 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 withstanding 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 together 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 examination. 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-2018

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 2017

SCHEME

Paper	Nomenclature	Teaching Hr./Week	Duration	Max .Marks
I.	Advanced Algebra	6	3 Hrs	100
II.	Real and Complex Analysis	6	3 Hrs	100
III.	Partial Differential Equation and Mechanics	6	3 Hrs	100
IV.	Special functions, Integral Equations and Integral Transform	6	3 Hrs	100
V.	Discrete Mathematics and Numerical Analysis	6	3 Hrs	100

M.A. / M.Sc. (Final) Examination 2018

Compulsory Papers

VI.	Functional Analysis	6	3 Hrs	100
VII.	Topology	6	3 Hrs	100

Optional Papers (Any Three)

Opt I	Operations Research	6	3 Hrs	100
Opt II	Fluid Dynamics	6	3 Hrs	100
Opt III	Mathematical Statistics	6	3 Hrs	100
Opt IV	Information Theory	6	3 Hrs	100
Opt V	Programming in C with ANSI Features	6	3 Hrs	100
Opt VI	Relativity	6	3 Hrs	100
Opt VII	Astronomy	6	3 Hrs	100
Opt VIII	Mathematical Modelling	6	3 Hrs	100
Opt IX	Hypergeometric Functions & Polynomials	6	3 Hrs	100

M.A./M.Sc. Maths (P.) Exam.-2017

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.

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 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.Convergence of sequence of measurable functions. Lebesgue integral of a bounded function.

Unit-III

Analytic functions, Sterographic projection of complex numbers, Holomorphic complex valued functions and their inverse, Cauchy-Reimann equations ,Power series.
conformal mapping. Bilinear transformations their properties and classification, Special transforms $w = z^2$, $z = \sqrt{w}$, $z = c \sin w$,

Unit-IV

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^n Analytic continuation .

References :

1. Malik- 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

Exaistance and uniqueness of solution of (dy/dx) = f(x,y). 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 Equation, 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, Euler's dynamical equations for the motion of a rigid abuot an axis .

Unit-V

Calculus of variations, Shortest distance, Minimum surface of revolution, Brachistochrone problem, Isoperimetric problem, Geodesic, 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 -SPECIAL FUNCTIONS AND INTEGRAL EQUATIONS

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

The hypergeometric functions : The Gauss' hypergeometric function F (a, c; z) its integral form, continuous function relations, the hypergeometric differential equation, elementary properties, simple and quadratic transformations, Gauss' and Kummar's theorems.

The generalised hypergeometric function F (a_1, ..., a_p, b_1.....b_q ;z), its differential equations, continuous function relations, integral forms, Saalschut's, Whipple's, Dixon's theorems, contour integral representation.

Unit II

Bessel function : its differential equation, pure and differential recurrence relations, generating function, modified Bessel function and its properties.

Confluent hypergeometric function ϕ(a, b; z) : definitions, properties, recurrence relations, Kummar's formulas.

Generating functions: generating functions of the form $G(2xt - t^2)$, sets generated by e^t (xt) and A(t) exp[-xt / (1-t)] and the related theorems.

Unit-III

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

Unit-IV

Solution of Integral Equations by successive substitutions and successive approximations.

Unit-V

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.

References:

1. Erwin Kreyszig Engineering Mathematics(New Age Intern. Limited)
2. M.D.Raisinghania Integral Transform (S.Chand Pub!.)
3. Shanti Swaroop Integral Equations (Krishna Publication Meerut)
4. E. D. Rainville Special functions
5 R K Saxena and D C Gokhroo Special Functions Ramesh Book depot

6. Gupta And Goyal Integral Transforms K P M Meerut
7. Pundir and Pundir Integral Equations and B V P Pragati Prakashan Meerut

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

NOTE : Non programmable Scientific Calculator is allowed.

Unit-I

Sets and Proposition: Cardinality. Mathematical Induction, Principle of inclusion and exclusion, Pigeon hole principle. Logic ,Predicate , Validity of Statements , Quantification , Proof of Implications /Identities, Method of Proofs.

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

Unit-II

Trees : Binary Tree, Binary Search Tree.

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 : Rate of Convergence of Bisection. Secant Regulafalsi, N-R Methods. Chebshev method, 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

Solution of System of linear equations : Direct methods, Gauss, Gauss-Jordan, Cholesky, Partition, Triangularisation method.

Iterative methods: 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 Differential Equations : Iterative methods –improved Euler methods. Runge-Kutta methods. Predictor Corrector methods.

Stability analysis, Difference methods for Boundary Value Problems (BVP).

References :

1. Schuam Series Discrete Mathematics (Tata Mcgraw Hill)
2. Jain-Iyenger-Jain Numerical Analysis (New Age International Limited)