M.Sc. – MATHEMATICS
Exam.-2020

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

M.A./ M.Sc. MATHEMATICS EXAM.

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
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

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 2020

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 2021

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	Programming in C with ANSI Features	6	3 Hrs	100
Opt V	Relativity	6	3 Hrs	100
Opt VI	Mathematical Modelling	6	3 Hrs	100
Opt VII	Hypergeometric Functions & Polynomials	6	3 Hrs	100

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

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 $w = z2$, $z = \square\square w$, $z = c \sin w$,

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 , zn 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 (a1, ..., ap, b1.....bq ;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 (a, b; z) : definitions, properties, recurrence relations, Kummar's formulas.

Generating functions: generating functions of the form G(2xt - t2), sets generated by et(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)
3. C.L.Liue	Elements of Discrete Mathematics (Tata McGraw Hill)
4. Chauhan, Vyas & Soni	Studies in Numerical Analysis (Jaipur Publishing House)
5. M.k. Gupta	Discrete Mathematics (Krishna Prakashan Meerut)
6. Vedamurthy, S.N. Iyanger	Numerical Methods (Vikas Publication House)
7 Goyel, Mittal	Numerical Analysis (Pragati Prakashan)
8. Gupta Malik	Calculus of Finite Difference & Numerical Analysis

M.A. / M.Sc. (Final) Examination -2020
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 linear 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:

1. G.F. Simmons. Introduction to Topology and Modern Analysis, Mc Graw Hill Book Company Chapters 2, 9 and 10 (1963).
2. Ervin Kreyszig. Functional Analysis
3. J. N. Sharma. Functional Analysis (Krishna Prakashan)

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

Definition and examples of topological spaces, closed sets, closure, dense sets, Neighbourhoods, interior, exterior, Boundary and accumulation points, derived sets

Local Bases, Bases and Sub bases, Subspaces and relative topology, First and Second Countable spaces, Lindelof's theorem

Unit-II

Continuous function, continuity, sequentially continuous, open and closed mapping, bicontinuous mapping, homeomorphism, topological property, topology induced by mapping

Separation axiom, T_0, T_1, T_2, spaces, normal space, hausdorff spaces, regular spaces, T_3, T_4, spaces, completely regular spaces, Tyconoff space, completely normal

Unit-III

Compactness, compact sets, basic property of compactness, compactness and finite intersection property, Sequentially and countablly, compact sets, local compactness, Heine-Borel theorem

Compactness in metric space, Equivalence of compactness, Countable and sequential compactness in metric space

Unit-IV

Connected space, connectedness on the real line, locally connected space, separated space, continuity and connectedness, components

Product Topology, projection map, product invariant properties, general product space, Tychonoff topology, Separation axioms and product spaces, Connnectedness and product space, compactness and product space, Tychonoff theorem

Unit-V

Binary relation, directed sets, residual subsets, cofinal subset, net sequence, convergence of a net, cluster point, subnet, isotone map, ultranet , Hausdorffness and nets, compactness and nets

Filters, standard filters, neighbourhood filters, comparison of filters, intersection of filters, filters generated by collection of sets, filters generated by family of sets, filter base, base of filters , ultra filter, convergence of filters

References :

1. James R.Munkres, Topology, A First Cource,Prentice Hall of India Pvt. Ltd. New Delhi, 2000.
2. George F.Simmons, Introduction to Topology and Modern Analysis McGraw Hill Book Company,1983.
3. K.D. Joshi, Introduction to General Topology, Wiley Eastern Ltd.

M.A. / M.Sc. (Final)- Optional Papers
Opt. Paper - I- OPERATIONS RESEARCH

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

Linear Programming : Theory of simplex method, Two Phase Simplex method. Duality, Dual Simplex methods. Sensitivity analysis.

Unit - II

Game Theory : Two person Zero sum game, Games with mixed Strategies, Solution of Linear programming. Integer Programming,

Unit - III

Network Analysis : Shortest Path Problem, PERT and CPM
Dynamic Programming : Deterministic models

Unit - IV

Inventory problems and their analytical structures. Simple deterministic problems. Squencing Nonlinear Programming : One and multivariable unconstrained Optimization, K.T. Canditions for Constrained Optimization.

Unit - V

Quadratic programming, Queuing System : Steady state solution of queuing model : M/M/1, M/M/1 with limited waiting space, M /M/C, M/M/C with limited waiting space.

References :-

1.Kanti Swaroop: Operations Research, S.Chand Publications
2.S.D.Sharma: Operations Research

Opt. Paper - II -FLUID DYNAMICS

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

Kinematics-Lagrangian methods. Equation of Continuity. Boundary surfaces. Stream lines, Path lines and streak lines, Velocity potential, Irrotational and rotational motion. Vortex Lines.

Equations of Motion-Lagrange's and Euler's equations of motion, Bernouli's theorem, Equation of motion by flux method.

Unit - II

Equations referred to moving axes. Impulse reactions. Stream function, Irrotational motion in two-dimensions. Complex velocity potential. Sources, Sinks, Doublets and their images. Conformal mapping. Milne-Thomson circle theorem.

Unit - III

Two-dimensional Irrotational motion product by motion of circular, co-axial and elliptic clyinders in an infinite mass of liquid, Kinetic energy of liquid, Theorem of Blasius, Motion of a sphere through a liquid at rest at infinity. Liquid streaming past a fixed sphere. Equation of motion of a sphere, Stoke's stream function.

Vortex motion and its elementary properties, Kelvin's proof of permanence, Motions due to circular and rectilinear vortices.

Unit - IV

Fluid Properties : General properties of Newtonian and Non-newtonian and plastic fluids Stress components in realfluid, Relations between rectangle components of stress. Connection between stresses and gradients of velocity, Navier-stoke equations of motion.

Unit - V

Plane Poiseuille and Couette flows between two paralled plates. Theory of Lubrication. Flow through tubes of uniform cross section in form of circle, annulus and equilateral triangle under constant pressure gradient, Unsteady flow over a flat plate.

Reynolds number, Prandit's boundary layer. Boundary layer equations in two dimensions. Blasius solution, Boundary layer thickness. Displacement thickness. Karman Integral Conditions. Separation of boundary layer flow.

References :

1. W.H.Besaint and A.S.Ramsey. Freatiseon Hydromechanics, Part II, CBS Publishers, Delhi 1988.
2. G.K. Batchelor and Introduction to Fluid Mechanics, Foundation, Books, New Delhi 1991.
3. F.Chortion, Textbook of fluid Dynamics, C.B.S, Publishers, Delhi 1985.
4. A.J.Chorin and A.Marsden, A Mathemetical Introdution to Fuild Dynamics, Springer-Vertag, New Yark 1993.
5. L.D.Landau and E.M. Lipschitz, Fluid mechanics, Pergamon Press, Londan, 1985.

Opt. Paper - III -MATHEMATICAL STATISTICS

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

Probability inequalities (Tchebyshef, Markov, Jenson), Convergence in distribution, weak law of large numbers and central limit theorem for independent, indentically distributed random variable with finite variance, marginal and conditional distribution in multivariate case, Covariance matrix and Correlation Coefficient (Product moment- Partial and multiple), Regression.

Unit - II

Probability Distributions :- Bernouli, Binomial, Multinomial Hypergeometic, Geometric, Poission Distribution, Probability Distributions : Uniform, Exponential, Cauchy, Gamma, Beta and Normal distribution.

Unit - III

Sampling Distribution:- t, F, Chi-Square distribution as sampling distribution, Standard errors and large Sampling distribution. Distribution of order statistics.

Theory of Statistics:- Methods of estimation, maximum liklihood method, method of moments, minimum chi square method, least square method.

Unit - IV

Unbiasedness, efficiency, Consistency, Cramer Rao inequality. Statistical Method : Test of mean and variance in normal distribution, one Population and two Population cases, related confidence intervals, Tests of Product Moment.

Partial and multiple Correlation Coefficients of Karl Pearson. Regression and Regression analysis.

Unit - V

Analysis of discrete data : Chi-square test of goodness of fit, Contingency table Analysis of variance:- one way and two way classification, large sample tests through normal approximation, Non-Parametric tests, Sign test, Median test, rank correlation and test of independence

References :

1. Fundamentals of Statistics: Gupta, Kapoor, S.Chand Publications
2. Mathematical Statistics: Kapoor, Saxena, S.Chand Publications

Opt. Paper - IV -PROGRAMMING IN C WITH ANSI FEATURES

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

An overview of programming.Programming language, Classification.
C Essentials-Program Development, Functions, Anatomy of a Function, Variables and Constants, Expressions.Assignment Statements. Formatting Source Files.Continuation Character. The preprocessor.

Unit - II

Scalar Data Types-Declarations, Different Types of Integers. Different kinds of Integer Constants. Floating-Point Types. Initialization. Mixing Types. Explicit Conversions-Casts. Enumeration Type. The Void Data Type. Typedefs. Finding the Address of an object. Pointers.
Control Flow-Conditional Branching. The Switch Statement. Looping. Nested Loops. The break and continue Statements. The goto statement. Infinite Loop.

Unit - III

Operators and Expressions-Precedence and Associativity, Unary Plus and Minus operators. Binary Arithmetic Operators. Arithmetic Assignment Operators. Increment and Decrement Operators. Comma Operators. Relational Operators. Logical Operators. Bit - Manipulation Operators. Bitwise Assignment Operators. Cast Operator. Size of Operators. Conditional Operator. Memory Operator.

Unit - IV

Arrays and Pointers-Declaring an Array. Arrays and Memory Initializing Arrays Encreption and Decryption. Pointer Arithmetic. Passing pointers as Fuction Arguments, Accessing Array. Elements through Pointers. Passing Arrays a Function Arguments. Sorting Algorithms. Strings. Multimensional Arrays. Arrays of Pointers. Pointers to Pointers. Storage Classes-Fixed vs. Automatic Duration. Scope. Global variables. The register Specific. ANSI rules for the syntex and Semantics of the storage-class keywords. Dynamic Memory Allocation

Unit - V

Structure and Union-Structures. Linked Lists, Union.Declarations. Functions-Passing Arguments. Declarations and Calis, Pointers to Functions. Recursion. The Main Function. Complex Declarations
The C Preprocessor-Macro Substitution. Compilation. Include Facility line Control.
Input and Output-Streams, Buffering. The <stdio.h> Header file. Error Handling. Opening and Closing a file. Reading and writing Data. Selecting an I/O Method, Unbuffered. I/O Random Access. The standard library for Input / Output.

References :

1. Peter A.Darnell and Phillp E.Margolis. C: A. Software Engineering Approach, Aarosa Publishing House (Singapur International Student Edition) 1993.
2. Samiel P. Harkison and Gly L. Steele Jr. C: A Reference manuai 2nd Edition Prentice house 1984
3. Brain n. Kernighan & Dennis M. Ritchie. The C Programme Language, 2nd Edition ANSI 1989

Opt. Paper - V - RELATIVITY

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

Equation of geodesics for the given metric, Riemann Christoffel tensors and its significance, Michelson- Morley experiment, Lorentz-Fitzgerald contraction hypothesis, Postualtes of special theory of Relativity, Lorentz transformation.

Unit - II

Mass-Energy formula, Minkowski's 4 dimensional continuum, Space like and time like intervals. Hamiltonian principle, Energy - Momentum tensor and its expression for perfect fluid, principle of Covariance, Principle of equivalence.

Unit - III

Condition for flat space time, Einstein's law of gravitation for empty space and material world, Schwartz child exterior and interior solution for gravitational field.

Unit - IV

Planetary orbit, three crucial tests, Advances of perihelion, Gravitational deflection of light, Shift in spectral lines, Wayl hypothesis, Displacement of the Fraunhoffer lines.

Unit - V

Einstein and De-sitter models, their comparison with the actual universe, Red shift in the spectral line on distant galaxies, Hubble constant, Birkhoits theorem.

References :

1. Tolman R.C. : Relativity, Thermodynamics and Cosmology, Oxford University Press.
2. Synge J.L. : Relativity the Special and General North Holland Publishing Company, Amsterdam.
3. Eddention A.S. : The Mathematical Theory of Relativity, Cambridge.

Opt. Paper - VI -MATHEMATICAL MODELLING

Duration – 3 Hrs. 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

Techniques, classification and simple illustrations. Mathematical Modelling through ordinary differential equation of first order.

Unit - II

Mathematical Modelling through systems of ordinary differential equation of first order. Mathematical Modelling through ordinary differential equation of second order.

Unit - III

Mathematical Modelling through difference equation. Mathematical Modelling through partial differential equations.

Unit - IV

Mathematical Modelling through graphs. Mathematical Modelling through functional Integral, Delay-differential.

Unit - V

Mathematical Modelling through calculus of variations and dynamic programming.
Mathematical Modelling through mathematical programming, maximum principle and maximum entropy principle.

References

1. Mathematical Modelling : J. N. Kapur New Age Int. Pub.
2. Mathematical Modelling : Dr. Maurya Navkar pub. Ajmer

Optional Paper - VI - HYPERGEOMETRIC FUNCTIONS & POLYNOMIALS

Duration – 3 Hrs. 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 (a1, ..., ap, b1.....bq ;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 (a, b; z) :** definitions, properties, recurrence relations, Kummar's formulas. **Generating functions:** generating functions of the form G(2xt - t2), sets generated by et(xt) and A(t) exp[-xt / (1-t)] and the related theorems.

Unit- III

Orthogonal polynomials : condition for orthogonality, zeros and expansion of polynomials, recurrence relation, the christoffel - Darboux formula, Bessel's inequality.

Legendre polynomials : generating functions, differential equations, Rodrigues formula, more generating functions, orthogonality, expansions of x^n, and analytical functions.

Unit- IV

Hermite polynomials : definition, recurrence relations, Rodrigues formula, integral representation, orthogonality, expansion of polynomials, more generating functions.

Laguerre polynomials : definitions, recurrence relations, Rodrigues formula, orthogonality, expansion of polynomials and special properties, other generating functions.

Unit - V

Jacobi polynomials : definitions, Bateman's generating function, orthogonality, pure, differential and mixed recurrence relations, Brafman's generating function, expansion in series of polynomials **Ultraspherical and Gegebauer polynomials :** definition, generating function and related properties.

Suggested Books :

1. Special functions by E.D. Rainville, Chelsea publishing company, Bronex, New York
2. Special functions by Y.L.Luke, Academic press, New York, London
3. Special functions by M.A. Pathan, P.K. Benarji, V.B.L. Chourasia and MC. Goyal, Ramesh Book Depot, Jaipur
4. Special functions by R.K. Saxena and D.C. Gokharoo, Jaipur Publishing House, m Jaipur