PROGRAMME GUIDE

DISTANCE EDUCATION PROGRAMMES

MASTER OF SCIENCE (M. Sc.) – MATHS

- **Scheme of Examination**
- **Detailed Syllabus**
- **Counseling and Study Structure**
- **Study Modules & Books Information**
- **Date Schedule & Instructions for Submitting Assignments**

DR. C.V. RAMAN UNIVERSITY

INSTITUTE OF OPEN AND DISTANCE EDUCATION (IODE)

KARGI ROAD, KOTA, BILASPUR, CHATTISGARH

PHONE : 07753-253737, 8827920016, 8827920019 FAX : 07753-253728

E-mail: iode@cvru.ac.in Website: www.cvru.ac.in

MASTER OF SCIENCE (M.SC.) – MATHAMATICS

Duration:24 Months (2 Years) Eligibility : Graduation with Maths Subject

Scheme of Examination

Course Code	Name of the Course	Credit	Total Marks	Theory		Practical Marks		Assignments	
				Max	Min	Max	Min	Max	Min
First Semester									
1MSCM1	Advanced Abstract Algebra-I	4	100	70	25	-	-	30	11
1MSCM2	Real Analysis-I	4	100	70	25	-	-	30	11
1MSCM3	Topology-I	4	100	70	25	-	-	30	11
1MSCM4	Complex Analysis-I	4	100	70	25	-	-	30	11
Total aggregate required to pass		**16**	**400**	**280**	**112**	**-**	**-**	**120**	**48**
Second Semester									
2MSCM1	Advanced Abstract Algebra-II	4	100	70	25	-	-	30	11
2MSCM2	Real Analysis-II	4	100	70	25	-	-	30	11
2MSCM3	Topology-II	4	100	70	25	-	-	30	11
2MSCM4	Complex Analysis-II	4	100	70	25	-	-	30	11
Total aggregate required to pass		**16**	**400**	**280**	**112**	**-**	**-**	**120**	**48**
Third Semester									
3MSCM1	Functional Analysis-I	4	100	70	25	-	-	30	11
3MSCM2	Integral Transform-I	4	100	70	25	-	-	30	11
3MSCM3	Special Functions-I	4	100	70	25	-	-	30	11
3MSCM4	Elective-I	4	100	70	25	-	-	30	11
Total aggregate required to pass		**16**	**400**	**280**	**112**	**-**	**-**	**120**	**48**
Fourth Semester									
4MSCM1	Functional Analysis-II	4	100	70	25	-	-	30	11
4MSCM2	Integral Transform-II	4	100	70	25	-	-	30	11
4MSCM3	Special Functions-II	4	100	70	25	-	-	30	11
4MSCM4	Elective-II	4	100	70	25	-	-	30	11
Total aggregate required to pass		**16**	**400**	**280**	**112**	**-**	**-**	**120**	**48**

ELECTIVE PAPERS IIIRD & IVTH SEMESTER

Optional Papers for 3MSCM4 / 4MSCM4	
A	Advance Differential Equation
B	Advance Discrete Mathematics
C	Operations Research
D	Graph Theory
E	Mathematics Modeling
F	Fundamental of Computers
G	Advance Numerical Analysis
H	Partial Differential Equations

Evaluation Scheme

1. 36% in each theory papers, practical, project-work dissertation & Assignments.
2. Aggregate marks to pass will be 40% including the theory papers, practical, project-work dissertation & Assignments.

DETAILED SYLLABUS

SEMESTER-I

1MSCM1-ADVANCED ABSTRACT ALGEBRA-I

Unit-1

Normal and subnormal series of group, composition series of group, Jordan- holder theorm.

Unit-2

Solvable and Nilpotent groups,

Unit-3

Field & subfield definition & Examples, Extension fields, Algebraic extensions , Separable and Irseparable extensions Normal extension, Perfect fields

Unit-4

Class equation of finite group, Cauchy's theorem for finite groups, Sylow Theorem, Wilson's Theorem, Lagrange's Theorem.

Unit-5

Polynomial Ring R[x] over a Ring R in an indeterminate X, Primitive polynomial .The ring of Gaussian integers as an Euclidean domain, fermat's Theorem, Unique Factorization domain.

1MSCM2- REAL ANALYSIS-I

Unit-1

Sequences & subsequences, Convergent sequence, divergent sequence and some theorems, Real Valued function & Theorems, Cesaros's Theorem, Nested Interval theorem, Limit superior and Limit Inferior.

Unit-2

Series of Non-negative terms, comparison test, cauchy's condensation test, comparison of ratios, Logarithmic test, D'morgan and bertrand's test.

Unit-3

General Principal of convergence, pringsheims Method, Merten's Theorem, Abel's Theorem, Euler's constant Theorem.

Unit-4

Neighbourhoods, open set and closed set & properties, Bolzano-weierstranss Theorem, Baire category theorem for R, covering Theorem.

Unit-5

Limit and continuity Theorems on continuity, Bolzano's theorem on continuity, continuity of inverse function, Geometrical meaning of a derivative, chain Rule of Derivative, Darboux Theorem and cauchy's mean value Theorems.

1MSCM3-TOPOLOGY-I

Unit-1

Definition and examples of topological space, Opensets, Closed sets , Closure , Dense subsets.

Unit-2

Neighborhoods , Interiors ,exteriors and boundry .Accumulation point and derived sets ,bases and sub-bases,subspaces and relative topology .

Unit-3

Continuous Maps, Continuous Maps into R, open and closed maps, Homeomorphism, Finite product spaces, projection maps.

Unit-4

Connected space and disconnected spaces, separated sets, component, locally connected space, Path connectedness, separation axioms : T0, T1 and T2 Spaces.

Unit-5

Introduction of compactness, compact subspace, Finite intersection property, Bolzano-weierstrass property, countable, sequential and local compactness.

1MSCM4-COMPLEX ANALYSIS-I

Unit-I

Complex Number, Analytic Functions, Cauchy – Riemann Equations, Harmonic Functions, Conjugate functions.

Unit-II

Conformal mappings, Bi-linear transformations, Geometrical interpretations of the transformations $\omega = z+\alpha$, $\omega = \beta z$, $\omega = \gamma z$. Bi-linear transformation of a circle.

Unit-III

Complex integration, complex integrals as sum of two real line integrals, Cauchy's Theorem, Extension of cauchy's Theorem to multi – connected region Cauchy.

Unit-IV

Cauchy integral formula, Extension of cauchy's integral formula to multiconnected regions, Liouville's Theorem, Morea's theorem.

Unit-V

Taylor's Theorem, Laurent's Theorem with examples.

SEMESTER-II

2MSCM1-ADVANCED ABSTRACT ALGEBRA-II

Unit-1

Introduction to modules- Examples, sub modules, quotient modules. Module homomorphism, isomorphism.

Unit-2

Finite generate modules, Fundamental structure theorem for finitely generated moduls over a principal ideal domain its application of finitely generated abelian group. cyclic modules.

Unit-3

Simple modues, semisimple modules, free modules ,Schurs lemma. Neotherian & artinian modules and ring

Unit-4

Schroeder- Bernstion Theorem, Hillebert basic Theorem, Wedderburn - Artin Theorem,

Unit-5

Uniform modules, primary modules, Noether - Laskar Theorem. Fundamental structure theorem of module over a principle ideal domain and its application to finitely generated abelian groups.

2MSCM2-REAL ANALYSIS-II

Unit-1

Defination of Riemann-Stieltses Integral & theorems, The Rs-Integral as limit of sums, Some classes of Rs-Integrable function, Algebra of Rs-Integrable function, The Interval of integration, The Rs-Integrability of composite function.

Unit-2

Relation between R- Integral & Rs-Integral, Integration of vector valued function, some more Theorems on integration.

Unit-3

Continuity of function of two variables, Partial Derivatives, Differentiability of two variables, Differentiability of composite function.

Unit-4

Differentiation, Differentiation of vector-valued function, Differentiation in Rn, The implicit function Theorem.

Unit-5

Definition of Jacobians', Case of function of function, Jacobian of implicit functions, Necessary and Sufficient condition for a Jacobian to Vanish Identically.

2MSCM3-TOPOLOGY-II

Unit-1

Separation Axioms: Regular and T3 spaces, normal and T4 spaces, Urysohn's Lemma, Tietze's, Extension theorem, completely regular and Tychonoff spaces, completely normal and T5 spaces.

Unit-2

Countablility Axioms: First and second axioms of countablility, Lindelof spaces , Separable spaces , Coutably compact spaces, Limit point compact spaces.

Unit-3

Convergence in Topology: Sequences and subsequences, convergence in topology, sequential compactness, local compactness, one point compactification, Stone-Cech compactification.

Unit-4

Metric Spaces and Metrizability: Separation and countability axioms in metric spaces, convergence in metric spaces, complete metric spaces.

Unit-5

Product Spaces: Arbitrary product spaces, product invariance of certain separation and countability axioms, Tychonoff's Theorem, product invariance of connectedness.

2MSCM4-COMPLEX ANALYSIS-II

Unit-1

Fundamental theorem of integral calculus for complex functions, uniqueness theorem, The zero of an analytic function, Singularities of an analytic function.

Unit-2

Residues, Cauchy's residue theorem, Evaluation of real definite integrals by contour integration, Integration round the unit circle.

Unit-3

Evaluation of the integral . Evaluation of the integrals of the form , , m>0, where P(x),Q(x) are polynomials,deg Q(x) > deg P(x) Q(x)=0 has no real roots.

Unit-4

Fixed points or Invariant points of a Bilinear transformation, Normal form of a Bilinear transformation, Elliptic, Hyperbolic and parabolic transformations, some special Bilinear transformations.

Unit-5

Analytic, Holomorphic and Regular function, Polar form of Cauchy-Riemann Equations, Derivative of w = f(*z*) in polar form, orthogonal System, Multiple Valued function.

M.SC. FINAL - SEMSESTER-III

3MSCM1-FUNCTIONAL ANALYSIS-I

Unit -1

Normed linear space, Banach spaces examples and theorems ,Holders inequality, Minkowshki's inequality, Cauchy's inequality.

Unit -2

Completeness of c^n , the space l_p^n , completeness of l_p^n ,the space l_p ,Riesz – Fisher theorem.

Unit -3

Sub space and Quotient spaces of Banach space , Narm of Bounded (continuous) linear transformation , basic properties of finite dimensional normed linear space.

Unit -4

Compactness , Equivalent norms ,Riesz –lemma ,Convexity theorem ,the natural imbedding of N in N** ,Reflexivility .

Unit -5

The conjugate space of l_p ,weak convergence , the conjugate of an operator , dual spaces with examples , uniform boundedness theorem .

3MSCM2-INTEGRAL TRANSFORM-I

Unit –I

Definition and Properties .Sufficient Conditions for the existence of Laplace Transform. Laplace Transform of some elementary functions. Laplace Transform of the derivatives. Inverse of Laplace Transform. Initial and final theorems..Learch's theorem .Heaviside's expansion theorem. Convolution theorem.

Unit-II

Some of ordinary Differential Equations with Constant Coefficients. Solution of ordinary differential equation with variable coefficients. Solution of Simultaneous ordinary differential

equation. Solution of Partial differential equations. Application to electrical equations .Application to mechanics. Application of Laplace transform to integral equations.

Unit-III

Application of Laplace transform in initial Boundary value problems.Heat conduction equation.Wave equation.Laplace equation Application to Beams.

Unit-IV

Dirichlet'scondition.Fourierseries.Fourierintegralformula,Fouriertransform or complex Fourier transform. Inversion theorem for complex Fourier transform. Fourier Sine and Cosine Transform.

Change of Scale Property, Shifting Property .Modulation theorem. Multiple Fourier transform. Convolution. The Convolution or falting theorem for Fourier transform. Parseval's identity for Fourier transform.

Unit-V

Finite Fourier sine transform. Inversion formula for sine transform. Finite Fourier cosine transform. Inversion formula for cosine transform. Multiple finite Fourier transform theorems on operational properties of finite sine and cosine transform. Combined properties of finite Fourier sine and cosine transform .

3MSCM3-SPECIAL FUNCTION-I

UNIT – 1

Special Functions, Infinite series , ortho gonal Polynomials, eulerian definition Weistrass Defination, Eulerian Product rz Evaluation of r(i) and F'(1/2)/ r(1/2) Equivalence of Weierstrass and Euler Defination , Factorial Function Gauss' Multiplication Formula .

UNIT – 2

Hypergeometric Function , Integral Represention of f(a,b ; c,z) Relation of contigulity , Hypergeometric differential equation , transformation of f(a,b ; c,z)

UNIT – 3

Introduction of generalized Hypergeometric Function , Differential Equation Satisfied by pfq , saalsehutz Theorem , whipples Theorem , Dixon's Theorems

UNIT – 4

Integrals involving Generalized hypergeometric Functions, Kummers Theorems, Ramanujans Theorems.

UNIT – 5

Generating Function for Jn(z) , Alternative Form of Generating Function Recurrence relation for Jn(z) , Bessel's integral , Spherical Bessel Functions , Neumann Polynomials & series .

(ELECTIVE SUBJECT)

3MSCM4-ADVANCE DISCRETE MATHEMATICS

UNIT – 1

Algebraic Structures : Introduction , Algebraic Systems : Examples and Genral Properties : Defination and Examples , Some Simple Algebraic Systems and Genral Properties , Homomorphism and Isomorphism congruence releation ,.

UNIT – 2

Semigroup & Monoids : Defination & Examples , Homomorphism of semigroups and Monoids

UNIT – 3

Lattices : Lattices as Partially ordered Sets : Defination and Examples , Principale of duality , some Properties of Lattices , Lattices as Algebraic Systems , Sublatttices , Direct Product and Homomorphism.

UNIT – 4

Some special Lattices e.g. complete , Complemented and Distributive Lattices , Boolean Algebra : definition and Examples , Subalgebra , Direct product and Homomorphism , Join irreducible , atoms and antiatoms.

UNIT – 5

Trees : Trees and its properties, minimally connected graphs pendant vertices in a tree, distance and centers in a tree , rooted and binary tree Levels in a binary tree , height of a tree , Spanning tress , rank and Nullity.

SEMESTER - IV

4MSCM1-FUNCTIONAL ANALYSIS-II

Unit -1

Open mapping theorem ,Closed graph theorem , Hahn –Banach theorem for linear spaces .

Unit -2

Inner product spaces , Hilbert spaces , some properties of Hilbert spaces ,Schwarz inequality ,.

Unit -3

Orthogal complements , projection theorem , Ortthonarmel sets , Bessel's inequality ,complete Orthonarmal set .

Unit -4

The conjugate space H* ,Riesz representation theorem for continuous linear functional on a Hilbert space .

Unit -5

The Adjoint of an Oprtator , self adjoint operator ,Normal and operators.

4MSCM2-INTEGRAL TRANSFORM-II

Unit-I

Application of Fourier transform in initial and boundary value problems: Application of infinite Fourier transform.Choice of infinite sine or cosine transforms. Applications of finite Fourier transform. Finite Fourier transform of partial derivatives.

Unit-II

Definition of Hankel transform.Inversion formula for the Hankel transforms. Some important results for Bessel functions. Linearity property. Hankel transform of the Derivatives of a Function.

Unit-III

Hankel transform of(d^2 f)/〖dx〗^2 +1/x df/dx-n^2/x^(2) f. Parseval's Theorem .Definition of finite Hankel transform. Another form ofHankel transform.Hankel transform ofdf/dx.

Unit-IV

Hankel transform ofof(d^2 f)/〖dx〗^2 +1/x df/dx,where p is the root of the equationJ_n (ap) =0.Applications of HankelTransform in initial and boundary value problems.

Unit-V

Definition of Mellin transforms. The Mellin Inversion theorem. Linearity property. Some elementary properties &Mellin transform.Mellin transform of derivatives. Mellin transform of integrals. Convolution (or falting).

4MSCM3-SPECIAL FUNCTION-II

UNIT – 1

Introduction of Hermit Polynomials solution of Hermites differential equation , Generating Function of Hermites Polynomials Rodrigues Formula for Hn(x), Recurrence relations for Hn(x)
UNIT – 2

Bateman's Generating Releation Integral Representation of Hermite Polynomial ortnagonal Properties of Hn(x) , Expansions of Polynomials .

UNIT – 3

Introduction of Laguerre Polynomials Solution of Laguerres differentials , Equation , Generating Function of Laguerre Polynomilas , Rodrigues Formula, Recurrence Releations of Rodrigues Formula .

UNIT – 4

Generlised Laguerre Polynomial ,Recurrence Releation .

UNIT – 5

Introduction of Jacobi Polynomials, Generating Functions of Jacobi Functions Rodrigues Formula , Orthogonal Properties Recurrence Releation .

(ELECTIVE SUBJECT)

4MSCM4-OPERATION RESEARCH

UNIT – 1

Operation research and its Scope , Necessity of Operation Research in Industry , Linear Programming – Simplex Method, theory of the Simplex Method , Duality and Sensitivity Analysis .

UNIT – 2

Algorithms for Linear Programming- Dual Simplex Method , Parametric Linear Programming , Upper – Bound Technique , Interior Point Algorithm, Linear Goal Programming.

UNIT – 3

Transportation and Assignment Problems.

UNIT – 4

Networks Analysis – Shortest Path Problem , Minimum Spanning Tree Problem , Maximum Flow Problem , Minimum cost Flow Problem , Network Simplex Method , Project Planning.

UNIT – 5

Dynamic Programming-Deterministic and Probabilistc Dynamic Programming

COUNSELING AND STUDY STRUCTURE

Sl. No.	Course Code	Title of the Course	Credit	Total Hours of Study	Counselling and Study Structure (hours)			
					Face to Face Counselling	Self study	Practical	Assignments
Semester I								
1	1MSCM1	Advanced Abstract Algebra-I	4	120	16	68	-	36
2	1MSCM2	Real Analysis-I	4	120	16	68	-	36
3	1MSCM3	Topology-I	4	120	16	68	-	36
4	1MSCM4	Complex Analysis-I	4	120	16	68	-	36
Semester II								
5	2MSCM1	Advanced Abstract Algebra-II	4	120	16	68	-	36
6	2MSCM2	Real Analysis-II	4	120	16	68	-	36
7	2MSCM3	Topology-II	4	120	16	68	-	36
8	2MSCM4	Complex Analysis-II	4	120	16	68	-	36
Semester III								
9	3MSCM1	Functional Analysis-I	4	120	16	68	-	36
10	3MSCM2	Integral Transform-I	4	120	16	68	-	36
11	3MSCM3	Special Functions-I	4	120	16	68	-	36
12	3MSCM4	Elective-I (Advance Discrete Mathematics)	4	120	16	68	-	36
Semester IV								
13	4MSCM1	Functional Analysis-II	4	120	16	68	-	36
14	4MSCM2	Integral Transform-II	4	120	16	68	-	36
15	4MSCM3	Special Functions-II	4	120	16	68	-	36
16	4MSCM4	Elective-II (Operation Research)	4	120	16	68	-	36

STUDY MODULES AND BOOKS INFORMATION

Sl. No.	Course Code	Title of the Course	Books / Module to be used
Semester I			
1	1MSCM1	Advanced Abstract Algebra-I	• **Advanced Abstract Algebra, Shiksha Sahitya Prakashan,Meerut** • Modern Algebra, by A. R. Vashista, Krishna Prakashan Merrut
2	1MSCM2	Real Analysis-I	• Real Analysis, J. N. Sharma and A. R. Vasishtha, Krishna Prakashan media (P) Ltd. Meerut Delhi. • **Real Analysis, H. K. Pathak, Shiksha Sahitya prakashan.**
3	1MSCM3	Topology-I	• **Topology, H.K. Pathak, Shiksha Sahitya Prakashan,Meerut** • Introduction to general topology by K. D. Joshi, wiley eastern
4	1MSCM4	Complex Analysis-I	• **Complex Analysis, H.K. Pathak Shiksha Sahitya Prakashan,Meerut** • Functions of a complex variable, By B. S. Tyagi, Kedarnath, Ramnath, Delhi. • Complex Functions, J. N. Sharma, Krishna pub.
Semester II			
5	2MSCM1	Advanced Abstract Algebra-II	• **Advanced Abstract Algebra, Shiksha Sahitya Prakashan,Meerut** • Modern Algebra, by A. R. Vashista, Krishna Prakashan Merrut
6	2MSCM2	Real Analysis-II	• Real Analysis, J. N. Sharma and A. R. Vasishtha, Krishna Prakashan media (P) Ltd. Meerut Delhi. • **Real Analysis, H. K. Pathak, Shiksha Sahitya prakashan.**
7	2MSCM3	Topology-II	• **Topology, H.K. Pathak, Shiksha Sahitya Prakashan,Meerut** • Introduction to general topology by K. D. Joshi, wiley eastern
8	2MSCM4	Complex Analysis-II	• **Complex Analysis, H.K.Pathak, Shiksha Sahitya Prakashan,Meerut** • Functions of a complex variable, By B. S. Tyagi, Kedarnath, Ramnath, Delhi. • Complex Functions, J. N. Sharma, Krishna pub.
Semester III			
9	3MSCM1	Functional Analysis-I	• Functional Analysis With Applications, Shiksha Sahitya Prakashan,Meerut •
10	3MSCM2	Integral Transform-I	• J.N. Sharma , Special Function , Pragati Prakashan meerut. • **H.K. Pathak , Special Functions, Shrilesha Sahitya Prakashan.**
11	3MSCM3	Special Functions-I	• J.N. Sharma , Special Function , Pragati Prakashan meerut. • **H.K. Pathak , Special Functions, Shrilesha Sahitya Prakashan.**
12	3MSCM4	Elective-I (Advance Discrete Mathematics)	• Advanced Discrete Mathematics, Advanced Abstract Algebra, Shiksha Sahitya Prakashan,Meerut • **Dr. H.K. Pathak : Advance discrete Mathematics , shikasha sahitya Prakashan meerut .**
Semester IV			

13	4MSCM1	Functional Analysis-II	• Functional Analysis With Applications, Shiksha Sahitya Prakashan,Meerut •
14	4MSCM2	Integral Transform-II	• J.N. Sharma , Special Function , Pragati Prakashan meerut. • H.K. Pathak , Special Functions, Shrilesha Sahitya Prakashan.
15	4MSCM3	Special Functions-II	• J.N. Sharma , Special Function , Pragati Prakashan meerut. • H.K. Pathak , Special Functions, Shrilesha Sahitya Prakashan.
16	4MSCM4	Elective-II (Operation Research)	• **Kanti swarup , P.K. Gupta and Man Mohan ; Operation Research , Sultan Chand & Sons , New delhi**

DATE SCHEDULE & INSTRUCTIONS FOR SUBMITTING ASSIGNMENTS

DUE DATE OF SUBMISSION OF ALL ASSIGNMENTS AT THE STUDY CENTRE		
Semester	Assignment No.	Due Date
First Semester	1MSCM1 1MSCM2 1MSCM3 1MSCM4	• April 30 (for January Session) • October 31 (for July session)
Second Semester	2MSCM1 2MSCM2 2MSCM3 2MSCM4	• October 31 (for July Session) • April 30 (for January session)
Third Semester	3MSCM1 3MSCM2 3MSCM3 3MSCM4	• April 30 (for January Session) • October 31 (for July session)
Fourth Semester	4MSCM1 4MSCM2 4MSCM3 4MSCM4	• October 31 (for July Session) • April 30 (for January session)

Note: Assignments of the course are available for download at the CVRU Website http://www.cvru.ac.in . You can download the assignments as per your course, follow the instructions given and submit it before due dates at the study centre.