KGM- 101

K.G Arts and Science College, Raigarh(C.G.)

B.Sc. MATHEMATICS

SEMESTER :I

PAPER : ALGEBRA & VECTOR ANALYSIS

Max. Marks: 80

ALGEBRA

UNIT I Introduction, Elementary operations on matrices, Inverse of a matrix by elementary operations, Rank of a matrix, Echelon & Normal form of a matrix, Applications of matrices to the system of linear equations, Consistency of the system of linear equations.

UNIT II Definition of a group with examples and simple properties, Order of a group, Subgroup, criterion for a complex to be a subgroup, Union and Intersection of a subgroup, Cyclic groups, Simple properties of cyclic group.

UNITIII Coset Decomposition, Lagrange's Theorem, Normal subgroup, Quotient group, Homomorphism and Isomorphism, Kernel of a Homomorphism, Fundamental theorem of Homomorphism.
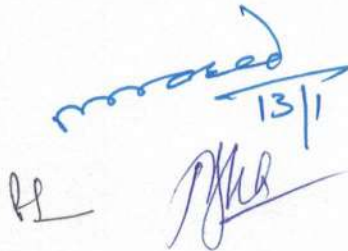
VECTOR ANALYSIS

UNIT IV Scalar and Vector product of three and four vectors, Reciprocal vectors, Vector differentiation, Directional derivatives, Gradient, Divergence & Curl.
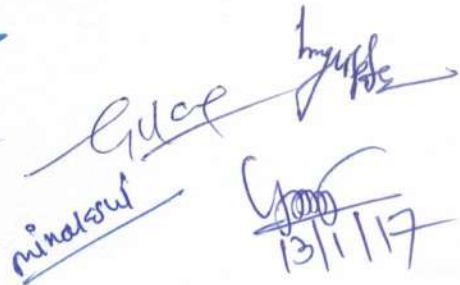
UNIT V Solenoidal and Irrotetional vector, Vector Integration, The applications of Gauss's, Stokes's and Green's Theorem (without proof).

REFERENCES:

1. B. R. Thakur, S.K Sharma & R.S.Chandel: Algebra & Trigonometry, Ram Prasad & Sons, Bhopal(M.P).
2. Dr. H.K.Pathak: Algebra & Trigonometry, Shiksha Sahitya Prakashan, Meerut(U.P).
3. Dr. H.K.Pathak: Vector Analysis & Geometry, Shiksha Sahitya Prakashan, Meerut.
4. B R Thakur & J P Shrivastava: Vector Analysis & Geometry Ram Prasad & Sons.
5. डॉ. अग्रवाल एवं प्रो. पुरुषोतम झा: सदिश कलन एवं ज्यामिति, युग बोध प्रकाशन, रायपुर.

KGM - 201
K.G. ARTS AND SCIENCE COLLEGE ,RAIGARH (C.G.)
B.Sc. MATHEMATICS
SEMESTER :II
PAPER - CALCULUS

INTEGRAL CALCULUS   Max. Marks: 80

UNIT 1 Integration of irrational algebraic functions and transcendental functions, Reduction formulae, Definite integrals, properties of definite integrals.

DIFFERENTIAL CALCULUS

UNIT II $\varepsilon-\delta$ definition of the limit of a function, Limit and Continuity, Classification of Discontinuities, Differentiability, Successive differentiation, Leibnitz theorem.

UNIT III Maclaurin's and Taylor's series, Asymptotes, Curvature, Tracing of curves in Cartesian and polar coordinates.
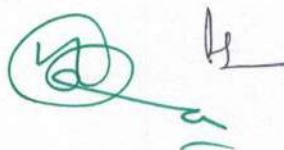
DIFFERENTIAL EQUATIONS

UNIT IV Equations of first order and first degree, Variable separable, Homogeneous, Linear differential equations, Exact differential equations. First order and higher degree differential equations solvable for p, x, y. Clairaut's form and singular solution.

UNIT V Orthogonal trajectories, Linear differential equations with constant coefficients, Homogeneous linear differential equations, Method of variation of parameters, Ordinary simultaneous differential equations.
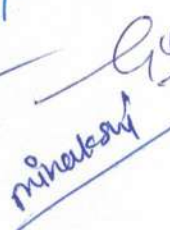
REFERENCES:

1. Gorakh Prasad: Integral Calculus, Pothishalas Pvt Ltd, Allahabad.
2. Shanti Narayan: Differential Calculus, S. Chand & Co. New Delhi.
3. B.R.Thakur, S.K Sharma & R.S.Chandel: Calculus, Ram Prasad & Sons, Bhopal.
4. Dr. H.K.Pathak: Calculus, Shiksha Sahitya Prakashan, Meerut.
5. डॉ. एस.एन.अग्रवाल, पी.झा, एवं आर.के.वर्मा : कलन, नव बोध प्रकाशन, रायपुर

KGM - 301

K.G. ARTS AND SCIENCE COLLEGE ,RAIGARH (C.G.)

B.Sc. MATHEMATICS

SEMESTER :III

PAPER : ADVANCED CALCULUS

Max. Marks: 80

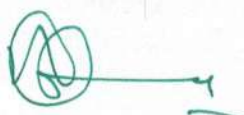|	
UNIT I	Definition of a sequence, Bounded and monotonic sequences, Limit and Convergence of a sequence, Cauchy's convergence criterion, Series of non-negative terms, Comparison test, Ratio test, Raabe's test, Logarithmic test, De-Morgan and Bertrand's test, Cauchy's integral test, Cauchy's root test.
UNIT II	Leibnitz's test for Alternating Series, absolute Convergence. Continuity, Properties of continuous functions, Uniform continuity, Chain rule of differentiability, Lagrange's Mean value theorem, Rolle's theorem, Chain rule of differentiability, Darboux's intermediate value theorem for derivatives.
UNIT III	Limit and continuity of functions of two variables, Partial differentiation Change of variables. Euler's theorem on homogeneous functions. Taylor's theorem and Mean value theorem for function of two variables. Jacobians.
UNIT IV	Envelopes, Evolutes, Maxima , Minima and saddle points of functions of two variables, Lagrange's multiplier method.
UNIT V	Beta and Gamma functions and its properties, Double and triple integrals, Dirichlet's integral, Change of Order of integration in double integrals.

REFERENCES:

1. Khalil Ahmad: Text Book of Calculus, World Education Publishers, 2012.
2. Dr.S.N..Agrawal : Advanced Calculus, Yugbodh Prakashan, Raipur
3. Dr. H.K.Pathak: Advanced Calculus, Shiksha Sahitya Prakashan, Meerut.
4. B R Thakur & G P Shrivastava,: Advanced Calculus, Ramprasad & Sons Bhopal.

KGM - 401
K.G. ARTS AND SCIENCE COLLEGE ,RAIGARH (C.G.)
B.Sc. MATHEMATICS
SEMESTER :IV
PAPER : DIFFERENTIAL EQUATIONS

Max. Marks: 80

UNIT I Series solutions of differential equations, Power series method, Bessel and Legendre function and their properties, Recurrence relations and Generating functions, Orthogonality of Bessel functions and Legendre polynomials, Rodrigue's formula. Orthogonality of functions & Sturm - Liouville problem.

UNIT II Laplace transformation - Linearity of the Laplace transformation, Existence theorem for Laplace transforms, Laplace transforms of derivatives and integrals, Shifting theorems, Change of scale property, Differentation and integration of transforms. The inverse Laplace transformation, Convolution theorem.

UNIT III Partial differential equations of the first order, Lagrange's solution, Some special types of equations which can be solved easily by methods other than the general method, Charpit's general method of solution.

UNIT IV Partial differential equation of second and higher orders, Classification of linear partial differential equations of second order, Homogeneous and non-homogeneous linear partial differential equations with constant coefficients, Partial differential equations reducible to equations with constant coefficient.

UNIT V Calculus of Variations - Variational problems with fixed boundaries, Euler's equations for functionals containing first order derivatives and one independent varialbe. Extremals. Functional dependent on higher order derivatives. Functionals dependent on more than one dependent variable. Variational problems in parametric form. Invariance of Euler's equation under coordinates transformation.

REFERENCES:
1. Dr. H.K.Pathak: Differential equations, Shiksha Sahitya Prakashan, Meerut.
2. B.R.Thakur, R.S.Chandel & R.S. Rathore,: Differential equations, Ramprasad & Sons, Bhopal.
3. I.N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company, 1988.

K.G. ARTS AND SCIENCE COLLEGE ,RAIGARH (C.G.)
B.Sc. MATHEMATICS
SEMESTER :V
PAPER : ANALYSIS

Max. Marks: 80

UNIT I Series of arbitrary terms, Convergence, divergence and oscillation, Partial summation formula, Abel's and Dirichlet's tests, Leibnitz's theorem, Addition & Multiplication of series, Merten's theorem, Partial derivation and Differentiability of real - valued functions of two variables, Schwartz and Young's theorem, Fourier series of functions of period 2π, Euler's formulae, Fourier series of even & odd functions.

UNIT II Riemann integral, Upper & Lower Riemann Sums & Integrals, Darboux Theorem, Riemann's criterion for integrability, Integrability of continuous and monotonic functions, Properties of Riemann integral, The fundamental theorem of integral calculus, First Mean value theorem, Second (Weierstrass) mean value theorem of integral calculus.

UNIT III Complex numbers as ordered pairs, Geometric representation of Complex numbers, Modulus & argument of complex numbers & its properties, Continuity and differentiability of complex functions, Analytic functions, Constructing an analytic function, Milne-Thomson's method, Cauchy-Riemann equations, Harmonic functions.

UNIT IV Definition and examples of metric spaces, Neighborhoods, Limit points, Interior points, Open and Closed sets, Closure and interior of a set, Sub-space of a metric space, Cauchy sequence, Completeness of R, The Archimedean property, Density property of rational numbers in R.

UNIT V Improper integrals and their convergence, Convergence of improper integrals of first kind-Comparison tests, the μ-test, Abel's and Dirichlet's tests, Convergence of improper integral of second kind-Comparison tests, the μ-test, contraction mapping, fixed point, Banach fixed point theorem,

REFERENCES:

1. Dr. H.K.Pathak: Analysis, Shiksha Sahitya Prakashan, Meerut

2. S.C. Malik and Savita Arora: Mathematical Analysis, New Age Int. (P) Ltd.

3. B.R.Thakur, R.S.Chandel & R.S. Rathore,: Analysis, Ramprasad & Sons, Bhopal.

2-3-17

Max. Marks: 80

UNIT-I Group –Automorphisms, Inner- Automorphisms, Automorphisms groups and their computations , Conjugacy relation, Center of a group, Normalizer of an element & of a subgroup, Counting principle and the Class equation of a finite group, Center for group of prime order.

UNIT-II Ring theory-Ring & Subring, Ring homomorphism, Ideals and Quotient Ring, Some theorems on ideals, Kernal of a ring homomorphism , fundamental theorem on homomorphism of rings, Polynomial Rings, Reminder & Factor theorem, Synthetic Division, g.c.d. of polynomials, Definition, Examples & simple properties of Integral domain & Field.

UNIT-III Definition and examples of vector spaces, Subspaces, Sum and direct sum of subspaces, Linear span, Linear dependence, independence and their basic properties, Basis of a vector space, Finite dimensional vector spaces, Existence theorem for bases, Invariance of the number of elements of a basis set, Dimension, Dimension of sums of subspaces, Quotient space and its dimension.

UNIT-IV Linear transformations and their representation as matrices, The Algebra of linear transformation, The rank nullity theorem, Eigen values and Eigen vectors of a linear transformation, Diagonalisation, Canonical or Normal form a real quadratic form, Rank, Signature & index of a real quadratic form.

UNIT-V Inner Product Spaces, Cauchy Schwarz inequality, Orthogonal complements, Orthogonal sets and bases, Bessel's inequality for finite dimensional spaces, Gram-Schmidt Orthogonalization process.

REFERENCES:

1. Dr. H.K.Pathak: Abstract Algebra, Shiksha Sahitya Prakashan, Meerut.

2. B.R.Thakur, R.S.Chandel & G Gupta,: Abstract Algebra, Ram Prasad & Sons, Bhopal.

22.3.17

K. G. Arts & Science College, Raigarh (C.G.)
Department of Mathematics
M. Sc. Syllabus (Session 2016-17 & 2017-18)

P. Code **M.Sc. Sem.I :** (3161)

1701	Paper I	- Advanced Abstract Algebra
1702	Paper II	-General Topology
1703	Paper III	-Advanced Discrete Mathematics
1704	Paper IV	-Programming in ANSI C
1717	Paper V	-Computer Practical

M.Sc. Sem. II : (3162)

1705	Paper I	- Real Analysis
1706	Paper II	-Advanced Topology
1707	Paper III	- Graph Theory
1708	Paper IV	-Complex Analysis
1718	Paper V	-Computer Practical

M.Sc. Sem. III : (3163)

1709	Paper I	- Functional Analysis
1710	Paper II	-Numerical Analysis
1711	Paper III	- Linear & Non-Linear Programming Problems
1712	Paper IV	-Programming in C++
1719	Paper V	-Computer Practical

M.Sc. Sem. IV : (3164)

1713	Paper I	- Differential Geometry
1714	Paper II	-Advanced Numerical Analysis
1715	Paper III	-Operations Research
1716	Paper IV	-Fluid Mechanics (Optional)
1721		-Advanced Functional Analysis (Optional) X
		(Select any one of Two optional Papers)
1720	Paper V	-Computer Practical

For Each Paper External Marks : 80, Internal Marks:20

modified 13/1/17

13/1/17

(Mahendra Pd mineralogy

(Dr. P. Jha)

M.Sc. (Sem.-I) Mathematics
Paper Code - 1701
Paper-I (Advanced Abstract Algebra)

Note-Eight questions to be set and any **four** questions to be solved

Normal Series: Normal & Subnormal series, Composition series, Jordan–Holder theorem, Solvable groups, Nilpotent groups.

Modules: Definition, Examples & General Properties of Modules, Sub-modules, R-homomorphism & Quotient modules, Simple and Semi-simple modules, Completely reducible modules, Schur's Lemma, Free modules.

Noetherian and Artinian modules and Rings –Introduction , Noetherian and Artinian modules, $Hom_R(\Theta Mi, \Theta Mi)$, Hilbert basis theorem, Uniform modules.

Smith Normal Form over a PID & Rank: Preliminaries, Row module, Column module and rank, Smith normal form.

Recommended Books :

1. ADVANCED ABSTRACT ALGEBRA: P.B. Bhattacharya, S.K. Jain, S.R.Nagpaul, Cambridge Univ. Press, Second Edition.

2. ADVANCED ABSTRACT ALGEBRA: Dr. H. K. Pathak , Shiksha Sahitya Prakashan, Meerut.

M.Sc. (Sem.-I) Mathematics
Paper Code - 1702
Paper-II (General Topology)

Note-Eight questions to be set and any **four** questions to be solved

Topological space: Definition, examples and properties of topological spaces, Neighbourhood, Open & Closed Sets, Intersection & Union of Closed sets, Characterization of topological space in terms of closed set. Limit point, interior& exterior point (not operators), Derived set and Closure of a set.

Relative Topology, Continuity & Homeomorphism : Subspace, Hereditary Property. Continuity in Topological Spaces, Characterization of Continuity in terms of open & closed sets, Algebra of Continuous functions, Homeomorphism.
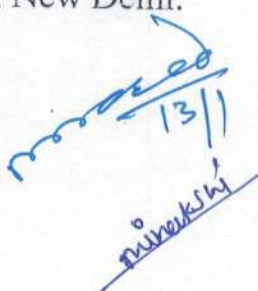
Compactness: Definition, examples & properties of Compact Spaces, Finite intersection properties (FIP), Bolzano Weierstrass property (BWP), Heine-Borel Theorem , Continuity and Compactness.

Connectedness: Separated sets, Connected & Disconnected sets, definition & characterization, Closure of connected sets, Continuity & Connectedness.

Recommended Books :

1.Topology : Dr. H K Pathak, J P Chouhan, Shiksha Sahitya Prakashan, Meerut.
2. General Topology: J.N. Sharma, J.P. Chauhan, Krishna Prakashan Media (P) Ltd. Meerut.
3. Introduction to General Topology: K D Joshi, New Age Int. Publisher, New Delhi.

Paper-III (Advanced Discrete Mathematics)

Note-Eight questions to be set and any **four** questions to be solved

Lattice: Lattice as partial ordered sets, Some properties of lattices, Lattice as algebraic systems, Sub-lattices, Direct product of lattices, Isomorphic Lattice, Bounded Lattices, Complete lattices, Complement of an element in a Lattice, Complemented lattices, Modular Lattices, Distributive lattice.

Boolean Algebra: Definition of Boolean algebra, Properties of Boolean algebra, Principle of duality, Sub-algebra, Isomorphic Boolean algebra, Boolean algebra as lattice, Boolean function & Minterms, Maxterms. Disjunctive normal form, Conjugate normal form, Minimization of Boolean functions, Karmaugh Map: **Two** and **three** variable maps **(Only).**

Discrete numeric functions and Generating functions: Discrete numeric functions, Convolution of numeric functions, Asymptotic behavior of numeric functions, Asymptotic dominance, Generating functions.

Recurrence relations and recursive algorithms: Introduction, Recurrence relations, Linear recurrence relations with constant coefficients, Homogeneous Solutions, Particular Solutions, Total Solutions. Solution by undetermined multiplier method.

Recommended Book :

- Advanced Discrete Mathematics by Dr. H. K. Pathak, Shiksha Sahitya Prakashan Meerut.
- Discrete Mathematics by Dr. M. K. Gupta, Krishna Prakashan Media(P) Ltd. 11, Shivaji Road, Meerut-250001

M.Sc. (Sem.-I) Mathematics
Paper Code - 1704
Paper-IV (Programming in ANSI C)

Note-Eight questions to be set and any **four** questions to be solved

Overview of C: History of C, Importance of C, Basic structure of C programs, Programming style, Sample programs.

Constants, Variables and Data types: Introduction, Character set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Declaration of Variables, Declaring a variable as constant.

Operators and Expressions: Operators, Kinds of Operators (arithmetic, relational, logical, assignment, increment/decrement, conditional and bitwise operators), Special operators, Arithmetic expressions, Evaluation expressions, Type conversions in Expressions, Mathematical functions.

Decision Making, Branching & Looping: Decision making with if-statements, Simple if statements, The if-else statement, nesting of if-else statements, The else-if ladder, The switch statement, Goto statement, The while statement, The do statement, The for statement, Jumps in loops.

Arrays: Declaration of one & two dimensional arrays, Initialization of one & two dimensional arrays.

Recommended Book:

- Programming in ANSI by E-BALAGURUSAMY (Fifth Edition) Tata Mc-Graw-Hill

K. G. Arts & Science College, Raigarh (C.G.)
Department of Mathematics
M. Sc. Syllabus (Session 2016-17 & 2017-18)

P. Code

M.Sc. Sem.I : (3161)

1701	Paper I	- Advanced Abstract Algebra
1702	Paper II	-General Topology
1703	Paper III	-Advanced Discrete Mathematics
1704	Paper IV	-Programming in ANSI C
1717	Paper V	-Computer Practical

M.Sc. Sem. II : (3162)

1705	Paper I	- Real Analysis
1706	Paper II	-Advanced Topology
1707	Paper III	- Graph Theory
1708	Paper IV	-Complex Analysis
1718	Paper V	-Computer Practical

M.Sc. Sem. III : (3163)

1709	Paper I	- Functional Analysis
1710	Paper II	-Numerical Analysis
1711	Paper III	- Linear & Non-Linear Programming Problems
1712	Paper IV	-Programming in C++
1719	Paper V	-Computer Practical

M.Sc. Sem. IV : (3164)

1713	Paper I	- Differential Geometry
1714	Paper II	-Advanced Numerical Analysis
1715	Paper III	-Operations Research
1716	Paper IV	-Fluid Mechanics (Optional)
1721		-Advanced Functional Analysis (Optional) X
		(Select any one of Two optional Papers)
1720	Paper V	-Computer Practical

For Each Paper External Marks : 80, Internal Marks:20

13/1/17   modified 13/1/17   (Dr. P. Jha)

(Mahendes Pd minakshi)

M.Sc. (Sem.-II) Mathematics
Paper Code-1705
Paper -I   (Real Analysis)

Note- Eight questions to be asked and any **four** questions to solved.

The Riemann-Stieltjes Integral: Lower & upper RS sum and the Riemann Stieltjes integral, Some theorems on RS integral, properties of RS integral, Relation between R-integral & RS integral, Mean value theorem, Integration and Differentiation.

Uniform convergence of sequences and series of functions, Pointwise convergence, Cauchy's general principle for uniform convergence, Uniform convergence test by M_n- test, Weirstrass's M-test, Abel's Test and Dirichlet's Test.

Uniform convergence and continuity, Uniform convergence and integration, Term by term Integration in series; Uniform convergence and differentiation, Term by term Differentiation.

Power series, algebra of power series, power series of complex variables, radius of convergence, uniqueness theorem for uniform convergence of power series, Abel's theorem for power series, Some theorems on power series, Tauber's Theorem.

Recommended Books:

1. Real Analysis: Dr. H. K. Pathak , Shiksha Sahitya Prakashan, Meerut.
2. Principal of Mathematical Analysis: Walter Rudin , McGraw Hill .

M.Sc. (Sem.-II) (Mathematics)
Paper Code- 1706
Paper- II (<u>Advanced Topology</u>)

Note-Eight questions to be set and any **four** questions to be solved

Base, Sub-base & Axiom of Countability: Base & sub-base for a topology, First countable space, Second countable space, Separable space and their hereditary property.

Separation Axiom : T_0 space, T_1 space, T_2 space, definition, examples, & counter examples, properties and relation between T_0, T_1 & T_2 , Hereditary property of T_0, T_1, T_2 spaces.

Regular space, T_3 Space, **Normal Space**, T_4 space, Completely regular and completely normal spaces, Tychnoff space, Urysohn's lemma, Titze's extension theorem.

Filter: Filters & their comparison, Discrete & indiscrete Filter, Neighborhood filter, Co-finite filters, Filter base, Limit point of a filter Convergence of a filter,
   Ultrafilters, definition, example and characterization of ultrafilter.
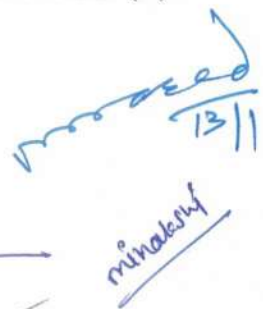
Recommended Books :

1. Advanced General Topology :K.K. Jha, Nav Bharat Prakashan, Delhi-6,Patna-4, 1984, Ed. 4th
2. General Topology: J.N. Sharma, J.P. Chaouhan, Krishna prakashan Media (P) Ltd. Meerut.
3. General Topology: K.D. Joshi. , Wiley Eastern Ltd. New Delhi.

M.Sc. (Sem.-II) (Mathematics)
Paper Code - 1707
Paper-III (<u>Graph Theory</u>)

Note-Eight questions to be set and any **four** questions to be solved

Basic concepts in Graph Theory:- Definition of a Graph, Kinds of Graphs, Simple graphs, Handshaking lemma, Isomorphic graphs, Subgraphs. Complement of a simple graph and a Subgraph, Operations on graphs, Walk, Paths and Circuits in a graph, Connected graphs and components, Eulerian graphs, Hamiltonian Graph, Bipartite graph.

Trees and Cut-Sets:- Definition of a tree, Distance and centers in a tree, Eccentricity of a vertex, Radius and diameter, Spanning trees, Rank and Nullity, Fundamental circuits, Shortest spanning tree and distance between the two spanning trees, Kruskal's and Prim's algorithms.

Cut-sets, Fundamental cut-sets, Edge connectivity, vertex connectivity and Separability, Cut-vertex.

Planner Graphs and Colourings:- Definition of a planner graph, Kuratowski's two graphs, Euler's formula, Detection of planarity, Homeomorphic graphs, Kuratowski's theorem (without proof), Dual graphs, Self-dual graphs, Thickness and crossings.

Proper colouring of graphs, Chromatic number, Chromatic partitioning and independent sets, Chromatic polynomials.

Recommended Books:

1. Graph Theory with application: Narsingh Deo, Printice Hall of India Pvt. Ltd. New Delhi.
2. Discrete Mathematics: H.K. Pathak , Shiksha Sahitya Prakashan, Meerut.
3. Discrete Mathematics: M.K. Gupta Krishna Prakashan Media(P) Ltd. Meerut.

M.Sc. (Sem. –II) (Mathematics)
Paper Code- 1708
Paper-IV (COMPLEX ANALYSIS)

Note-Eight questions to be set and any **four** questions to be solved

Simple properties of Complex's integration, Cauchy's theorem, Cauchy's integral formula, The derivative of an analytic function, Higher Order Derivatives.

Poisson Integral formula for a circle, Morera's theorem, Cauchy's Inequality, Liouville's theorem, Taylor's theorem, Laurent's theorem.

The zeros of an analytic function. Singular points and classification of singularity, Meromorphic functions, Some theorems on poles and other singularities, Weierstrass theorem, Limiting point of zeros, Limit point of poles.

Poles and zeros of a meromorphic function, The Argument Principle, Rouche's theorem, The Fundamental theorem of Algebra, Maximum modulus principle, Schwarz lemma.

The residue at a singularity, Calculation of residues in some special cases, Residue at infinity, Cauchy's residue theorem.

Recommended Books:
1. Complex Analysis: Dr. H.K.Pathak, Shiksha Sahitya Prakashan, Meerut
2. Functions of Complex variable by B. S Tyagi : Kedar Nath, Ram Nath Publication , Meerut and Delhi.

K. G. Arts & Science College, Raigarh (C.G.)
Department of Mathematics
M. Sc. Syllabus (Session 2016-17 & 2017-18)

P. Code

M.Sc. Sem.I : (3161)

1701	Paper I	- Advanced Abstract Algebra
1702	Paper II	-General Topology
1703	Paper III	-Advanced Discrete Mathematics
1704	Paper IV	-Programming in ANSI C
1717	Paper V	-Computer Practical

M.Sc. Sem. II : (3162)

1705	Paper I	- Real Analysis
1706	Paper II	-Advanced Topology
1707	Paper III	- Graph Theory
1708	Paper IV	-Complex Analysis
1718	Paper V	-Computer Practical

M.Sc. Sem. III : (3163)

1709	Paper I	- Functional Analysis
1710	Paper II	-Numerical Analysis
1711	Paper III	- Linear & Non-Linear Programming Problems
1712	Paper IV	-Programming in C++
1719	Paper V	-Computer Practical

M.Sc. Sem. IV : (3164)

1713	Paper I	- Differential Geometry
1714	Paper II	-Advanced Numerical Analysis
1715	Paper III	-Operations Research
1716	Paper IV	-Fluid Mechanics (Optional)
1721		-Advanced Functional Analysis (Optional) X
		(Select any one of Two optional Papers)
1720	Paper V	--Computer Practical

For Each Paper External Marks : 80, Internal Marks:20

13/1/17

13/1/17

(Mahendes Pd
minotolm)

(Dr. P. Jha)

M.Sc. (Sem. III) (Mathematics)
PAPER CODE- 1709
Paper I (Functional Analysis)

Note- **Eight** questions to be set and a student will be required to solve any **four** questions.

Banach Space: Definition, examples and properties of Normed linear space, Banach space, Spaces and subspaces of finite dimensions, Equivalent norms, Convex sets in Normed linear spaces, Quotient Spaces, Riesz's lemma.

Hilbert Space: Definition, examples and properties of Inner product space, Hilbert space, Cauchy-Schwarz Inequality, The Triangle Inequality, polarization Identity, Parallelogram law, Orthogonality and Orthonormility, Orthogonal Complement, Bessel's inequality, Parseval's identity, Projection Theorem, Riesz Representation Theorem.

Operator Theory: Linear operators and its elementary properties, Adjoint of an operator on Hilbert space, The self adjoint operators, Positive Operators, Normal operator, Unitary operators.

Recommended Books :-

- Elements of functional analysis :- B.K.Lahiri, The world press Pvt. Ltd. Kolkata.

- Functional Analysis With Applications:- B. Choudhary And S. Nanda, New age Int. (Pvt) Limited, Publishers.

- Functional Analysis With apllications: Dr. H. K. Pathak , Shiksha Sahitya Prakashan, Meerut.

M.Sc. (Sem. III) (mathematics)
PAPER CODE- 1710
Paper II (Numerical Analysis)

Note- **Eight** questions to be set and a student will be required to solve any **four** questions, (Scientific calculator is allowed).

Calculus of Finite Difference: Finite Differences, Fundamental theorem of difference calculus, Factorial Notation, Difference Operators: Forward, Backward, Shift, Central, Mean and Divided difference operators, Relation between them, One or more missing terms.

Interpolation: Newton's Forward & Backward interpolation formula for equal intervals, Guass's Central difference formula (Forward & Backward), Lagrange's interpolation formula and Newton's divided difference interpolation formula for unequal intervals.

Inverse Interpolation & Curve Fitting: Lagrange's method, Successive approximation method for inverse interpolation.

Graphical Method and Method of Least Square, Particular cases, Change of origin, Fitting of curves: Straight line, Quadratic Equation, $y = ab^x$, $y = ax^b$.

Numerical Differentiation & Integration: Numerical Differentiation Using Forward Difference, Backward difference & **Divided Difference.** General Quadrature formula for equidistance ordinates, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Weddle's rule.

Recommended Books:-

- Numerical Analysis: P. P. Gupta & G. S. Malik, Krishna Prakashan Media (P) Ltd. Meerut-250001 (U. P.)

- Introductory Methods of Numerical Analysis: S. S. Sastry, PHI Learning Private Limited New Delhi – 110001.

Paper III (Linear & Non-Linear Programming Problems)

Note- **Eight** questions to be set and a student will be required to solve any **four** questions.

Mathematical formulation of linear programming problems, Graphical solution of two variables problem, Slack & Surplus Variables, Canonicals and Standard forms of LPP, Matrix form of LPP. Basic feasible solution of LPP.

Computational Procedure of Simplex method, Optimization of LPP by Simplex Method, Big-M Method and Two Phase Method. Degeneracy in Simplex method, Inverse of a matrix by simplex method.

Duality in LPP, Definition of Primal-Dual Problems, General Primal-dual problems, Formulating a dual problem, Duality theorem, Dual simplex method.

Non-linear programming problems, Constrained optimization with equality constraints (Lagrangian multiplier method), Constrained optimization with inequality constraints (Kuhn. Tucker Conditions). Solution of Quadratic equation by Wolfe's method.

Recommended Books:-

1. Operations Research: R.K.Gupta, Krishna Prakashan Media (P) Ltd. Meerut

2. Operations Research: Kanti Swarup, P.K.Gupta and Manmohan, Sultan Chand & Sons, New Delhi.

M.Sc. (Sem. III) Mathematics
PAPER CODE - 1712
Paper IV (Programming in C++)

Note- **Eight** questions to be set and a student will be required to solve any **four** questions.

Beginning with C++ :- Application of C++, Program features, Structure of C++ program, A Simple C++ program, An Example with class.

Tokens, Expressions and Control Structures:- Tokens, Keywords, Identifiers and Constants, Basic Data types, User-Defined Data Types, Derived Data Types, Reference Variables, Scope resolution Operator, Manipulators, Expressions & their types, Implicit conversions.

Functions in C++ :- The main function, User defined function, Function Prototyping, Call by Reference, Return by Reference, Inline Function, Default arguments, Const arguments, Recursion, Function Overloading.

Classes and Object:- Specifying a class, Defining member function, C++ program with class, Nesting of member function, Private member function, Arrays within a class, Arrays of objects, Objects as function arguments, Returning objects.

Inheritance: Extending classes – Defining derived classes, Single, Multilevel, Multiple, Hierarchical & Hybrid Inheritance, Making a Private member in Heritable, Virtual base classes.

Recommended Book:-

- Object Oriented Programming with C++ by E-BALAGURUSAMY (Fifth Edition), Tata Mc-Graw-Hill.

K. G. Arts & Science College, Raigarh (C.G.)
Department of Mathematics
M. Sc. Syllabus (Session 2016-17 & 2017-18)

P. Code

M.Sc. Sem. I : (3161)

Code		
1701	Paper I	- Advanced Abstract Algebra
1702	Paper II	- General Topology
1703	Paper III	- Advanced Discrete Mathematics
1704	Paper IV	- Programming in ANSI C
1717	Paper V	- Computer Practical

M.Sc. Sem. II : (3162)

Code		
1705	Paper I	- Real Analysis
1706	Paper II	- Advanced Topology
1707	Paper III	- Graph Theory
1708	Paper IV	- Complex Analysis
1718	Paper V	- Computer Practical

M.Sc. Sem. III : (3163)

Code		
1709	Paper I	- Functional Analysis
1710	Paper II	- Numerical Analysis
1711	Paper III	- Linear & Non-Linear Programming Problems
1712	Paper IV	- Programming in C++
1719	Paper V	- Computer Practical

M.Sc. Sem. IV : (3164)

Code		
1713	Paper I	- Differential Geometry
1714	Paper II	- Advanced Numerical Analysis
1715	Paper III	- Operations Research
1716	Paper IV	- Fluid Mechanics (Optional)
1721		- Advanced Functional Analysis (Optional)
		(Select any one of Two optional Papers)
1720	Paper V	- Computer Practical

For Each Paper External Marks : 80, Internal Marks:20

[signatures] 13/1/17 Mahendra Pd (Dr. P. Jha)

M. Sc. (Sem. IV) (Mathematics)
Paper Code- J713
Paper- I (Differential Geometry)

Note- **Eight** questions to be set and any **four** questions to be solved.

Space Curves- Parametric representation of a curve, Osculating plane, Normal plane and Rectifying plane, Curvature and Torsion of a curve, Screw curvature, Serret - Frenet Formulae, n.a.s.c. for a curve to be St. line is k = 0 and n.a.s.c. for a curve to be a plane is τ = 0.

Helix, Circular and Cylindrical helix, Uniqueness theorem for space curve, The Osculating sphere (The Sphere of curvature), The Osculating circle (The Circle of curvature).

Concept of a surface, First fundamental form, Properties of first fundamental form, First fundamental coefficients E, F, G. Second fundamental form, second order magnitudes L, M, N, Numerical problems, Angle between parametric curves.

Normal curvature, Meusnier's theorem, Principal directions & principal Curvature, First Curvature, Mean Curvature, Gaussian Curvature, Lines of Curvature, Rodrigue's Formula, Euler's theorem, Dupin's theorem.

Recommended Books:

1. Differential Geometry by Dr. D. C. Mittal & D.C.Agarwal, Krishana prakashan Media (P)Ltd. Meerut

2. Differential Geometry by J N Sharma & A R Vasishtha, Kedar Nath Ram Nath, Meerut, Delhi.

Paper –II (<u>Advanced Numerical Analysis</u>)

Note- **Eight** questions to be set and any **four** questions to be solved, scientific calculator is allowed.

Solution of Algebraic and Transcendental Equations: The Bisection Method, The Method of false Position, The Secant Method, Newton's Raphson Method, Ramanujan's Method, Lin-Bairstow's Method.

Simultaneous Linear Algebraic Equations: Direct Method-Gauss-Elimination Method, Gauss- Jordan Elimination Method, Method of Factorization, Crout's Method. Iterative Method- Jacobi's Iterative Method, Gauss- Seidal Iterative Method, Relaxatiton Method.

Numerical Solution of Ordinary Differential Equations of First & Second Order: Picard's Method of Successive Approximation, Taylor's series Method, Euler's Method, Modified Euler's Method, Runge's Method, Runge-Kutta Method, Milne's Method.

Difference Equation: Definition and Solution of difference equation, Homogeneous and Non Homogenous Linear Difference equations with constant coefficients, Different methods for finding particular solution in case of Non Homogenous Linear Difference equation.

Recommended Books:-

* Numerical Analysis: By P P Gupta & G S Malik, Krishna Prakashan Media (P) Ltd. Meerut-250001 (U. P.)

* Introductory Methods of Numerical Analysis: By S S Sastry, PHI Learning Private Limited New Delhi - 110001

Paper –III (Operations Research)

Note- **Eight** questions to be set and any **four** questions to be solved.

Transportation:- Formulation of transportation problems, Finding an initial basic feasible solution, Test for optimality (MODI method or U-V method). Degeneracy in transportation problem, Unbalanced transportation problems.

Assignment:- Mathematical formulation of the Assignment problems, Solution of Assignment problems, difference between Transportation and Assignment problems, Travelling salesman problems.

Sequencing: - Basic terms used in sequencing, Problems of sequencing, processing n jobs through two Machines, Processing n jobs through three machines, Processing **n** jobs through **m** machines.

Game theory:- Two person zero sum games, Pay off matrix, Saddle point, Pure & mixed strategy, solution of a rectangular games with saddle point, Dominance property, solution of 2x2 games without saddle point, Graphical solution of 2xn & mx2 games.

Recommended Books:

1. Operations Research: Kanti Swarup, P.K.Gupta & Man Mohan , Sultan Chand & Sons, New Delhi

2. Operations Research :R.K. Gupta, Krishana prakashan Media(P) Ltd, Meerut

(Optional)

Note- **Eight** questions to be set and any **four** questions to be solved.

Kinematics: Characteristics of a fluid, Equation of Continuity by Lagrangian and Eulerian methods and their equivalency, Equation of continuity in Cartesian, polar and cylindrical co-ordinates, Boundary surface, Stream lines, Velocity potential, Surface orthogonal to stream lines, rotational and irrotational flows.

Motion in two dimensions: Two dimensional motion, Lagrange's stream function, irrotational motion in two dimensions, Complex potential, Magnitude of velocity, sources and sinks, Complex potential of a source.

Doublets in Two dimensions: Complex potential for a doublet, image of a source with respect to a line, image of source with respect to a circle, image of a doublet with respect to a circle.

Motion of Circular Cylinders: General motion of a cylinder in two dimensions, Motion of a circular cylinder, Liquid streaming past a fixed circular cylinder, Two coaxial cylinders, Circulation about a moving cylinder, streaming and circulation about a fixed circular cylinder.

Recommended Books:-

1. Fluid dynamics: J. P. Chouhan & Dr. H. K. Pathak , Shiksha Sahitya Prakashan, Meerut.
2. Hydrodynamics: P.P. Gupta, S. Chand and Company Ltd. New Delhi.

M. Sc. (Sem. IV)

Paper Code - 1721 (Mathematics)

Paper IV (Advanced Functional Analysis)

(Optional)

Note- **Eight** questions to be set and any **four** questions to be solved.

Projection operators: Projection operator on a Hilbert Space, Sum, Difference & Product of two Projection operators, Orthogonal Projection, Invariance, and reducibility.

Finite Dimensional Spectral theory: Eigen Values band Eigen Vectors of an Operator, Matrices of Identity and zero operators, Similarity of operators, Determinant of an operator on a finite dimensional Hilbert Space, The spectrum, of on operator. The Spectral theorem and spectral resolution.

Fundamental theorems on Normed Linear Space: Linear functional, Hahn-Banach theorem for normed linear space, The open mapping theorem, The Closed graph theorem, Banach-Steinhaus theorem.

Strong convergence of sequences of operators, **weak** convergence of sequences of functional, weak convergence of sequences of elements.

Recommended Books :-

- Elements of functional analysis :- B.K.Lahiri, The world press Pvt. Ltd. Kolkata.

- Functional Analysis : J N Sharma & A R Vasishtha, Krishna Prakashan Media(P) Limited, Meerut (U.P.) India

- Functional Analysis With apllications: Dr. H. K. Pathak , Shiksha Sahitya Prakashan, Meerut (U.P.) India