BHAGWANT UNIVERSITY
Sikar Road, Ajmer
Rajasthan

Syllabus

Institute of social sciences & Applied Sciences

M Sc (Mathematics)
### M.Sc. (Previous) Mathematics

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of Subject</th>
<th>Teaching Period</th>
<th>Max. Marks</th>
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<tr>
<td>01MSC13 101</td>
<td>Advanced Abstract Algebra</td>
<td>3</td>
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<td>01MSC13 102</td>
<td>Real &amp; Complex Analysis</td>
<td>3</td>
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<td>01MSC13 103</td>
<td>Topology</td>
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<tr>
<td>01MSC13 104</td>
<td>Differential Geometry &amp; Tensors</td>
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<td>01MSC13 105</td>
<td>Special Functions &amp; Transform Calculus</td>
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<td><strong>TOTAL</strong></td>
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### M.Sc. (Final) Mathematics

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<th>Teaching Period</th>
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<td><strong>Compulsory Papers</strong></td>
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<tr>
<td>02AMM101</td>
<td>Functional Analysis &amp; Integration Theory</td>
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<td>02AMM102</td>
<td>Advanced Differential and Integral Equation</td>
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<td><strong>Optional Papers (Select any Three)</strong></td>
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<tr>
<td>02 AMM 103</td>
<td>Advanced Numerical Methods</td>
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<td>02 AMM 104</td>
<td>Relativity &amp; Cosmology</td>
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<td>02 AMM 105</td>
<td>Advanced Mathematical Statistics</td>
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<td>02 AMM 106</td>
<td>Operations Research</td>
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Advanced Abstract Algebra

Paper Code: 01MSC13 101
Maximum Marks: 100
External Marks: 70
Internal Marks: 30

Unit I

Unit II

Unit III

References:
1. Algebra : Maclane and Birkhoff Macmillan Company.
2. Topics in Algebra : I.N. Herstein Wiley Eastern Ltd.
3 Linear Algebra : S.Lang Addison Wesley.
4 Linear Algebra : Hofmann and Kunz Prentice Hall.

REAL AND COMPLEX ANALYSIS

Paper Code: 01MSC13 102
Maximum Marks: 100
External Marks: 70
Internal Marks: 30

Unit I (Measure Theory)
Countable and non-countable sets. The Lebesgue measure of sets of real number, Measurable functions, Structure of Measurable functions, Weierstrass’s Theorem on the approximation of continuous functions by
polynomial s, Lebesgue Integral of Measurable functions. Summable functions, The space of square summable functions. Functions of finite variation.

UNIT II

UNIT III

References:
1. Lebesgue Measure and Integration : P.K. Jain & V.P. Gupta
2. Methods of Real Analysis : Goldberg
3. Real Analysis : H.L. Royden
4. Complex Analysis : B.S. Tyagi

TOPOLOGY

Paper Code: 01MSC13 103
Maximum Marks: 100
External Marks: 70
Internal Marks: 30

Unit I (Metric Spaces)
Metric spaces, Bounded and bounded metric spaces, Open and closed sets in a metric space, Cantor's ternary set, Closure Bases, Product spaces, Topological spaces, Sequence and subsequence in metric space, Cauchy sequence, Complete metric spaces, Completion of a metric space.

Unit II (Topology)
Topological spaces, Subspaces, Open sets, Closed sets, Neighbourhood system, Continuous mapping and Homeomorphism bases, and sub basis, Cauchy's sequences, Nets, Filters, Complete metric spaces, Product spaces, Quotient spaces.

Unit III
Compact and locally compact spaces, Tychonoff's one point compactifications, Separation axioms, Normal spaces, connected and locally connected spaces, Continuity and connectedness, Hausdorff spaces, Regular spaces.

References:
1. Topological Spaces. : Kowalsky
2. General Topology. : Kelly
3. Introduction to Topology : G.F. Simmons and Modern Analysis
4. Introduction to General Topology : K.D. Joshi
Differential Geometry and Tensors

Paper Code: 01MSC13 104
Maximum Marks: 100
External Marks: 70
Internal Marks: 30

Unit I
Curves in space ($\mathbb{R}^3$): Space curves, Path, arc length, tangent line, contact of a curve and surface. Inflexional tangent, the osculating Plane. Tangent at any point of a surface $f(x,y,z) = 0$, Normal plane, Principal normal and Binormal, Curvature, Torsion and Skew curvature. Serret frenet formulae. Helices, Fundamental theorems for space curves, Circle of curvature, Osculating sphere. Concept of surface and fundamental forms: Definition of surface, Regular point and singularities on a surface, Tangent plane and normal.

Unit II
Curves on a surface: Curvature of normal section, Meusnier theorem, Principal directions and Principal curvatures, Mean curvature, first curvature and total curvature, Envelope, Edge of regression, Ruled surfaces, Developable surface, Transformation of Co-ordinates, Covariant, Contravariant and Mixed tensors, Invariants, Addition, Subtraction and Multiplication of Tensors, contraction of tensors, Quotient law of tensors, Fundamental tensors, Length of curve, Associated tensors.

Unit III

References:
1. Differential Geometry: C.E. Weatherburn
2. Differential Geometry: H.C. Sinha
3. Tensor Analysis: J.L. Bansal
4. Tensor Calculus: Berry Spain
5. Cartesian Tensor: A.M. Goodbody

Special Functions and Transform Calculus

Paper Code: 01MSC13 105
Maximum Marks: 100
External Marks: 70
Internal Marks: 30

Unit I
Hyper-Geometric Functions, Legendre’s Polynomial, Associated Legendre’s functions, Bessel’s functions, Recurrence relations, Orthogonal Properties,
Hermite and Laguerre Polynomials their generating functions and general integral properties.

**Unit II**

**Unit III**
Application to the solution of ordinary differential equations with constant coefficients and with variable coefficient, Simultaneous ordinary differential equations. Partial differential equations, Integral and difference equations.

**References:**
1. The use of integral Transforms Mcgraw Hill : Sneddon.I.N
2. Theory and problems of Laplace transform : Spiegel M.R
3. Integral Transforms : Sharma and Vasishtha

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**M.SC.(FINAL) – EXAMINATION**

**COMPULSORY PAPERS**

**FUNCTIONAL ANALYSIS AND INTEGRATION THEORY**

**Paper Code:** 02MSC13 101
**Maximum Marks:** 100
**External Marks:** 70
**Internal Marks:** 30

**Unit I (Functional Analysis)**
Normed linear spaces, Banach Spaces and their examples, Continuous linear transformations. The open mapping theorem, Closed graph theorem, Uniform boundedness theorem, Continuous linear functionals, Hahn-Banach theorem.

**Unit II**
Inner product spaces, Hilbert spaces and their examples, Cauchy Schwarz’s inequality, Parallelogram law, Orthogonal complements, Orthonormal sets, Bessel’s inequality, Gram-Schmidt orthogonalization process, Riesz representation theorem, Operators and projections.

**Unit III (Integration Theory)**

**References:**
Advanced Differential and Integral Equations

Paper Code: 02MSC13 102
Maximum Marks: 100
External Marks: 70
Internal Marks: 30

Unit I (Differential Equations)

Unit II (Calculus of Variations)

Unit III (Integral Equations)
Linear integral equation of the first and second kind of fredholm and volterra types. Solution by successive substitutions and successive approximations. Solution equation with separable kernels. The fredholm alternative hilbert schmidt theory for symmetric kernels.

References:
1. Integral Equations, Lovitte W.V Dover Publications.

Optional Papers (Any Three of the Following)

Advanced Numerical Methods

Paper Code: 02MSC13 103
Maximum Marks: 100
External Marks: 70
Internal Marks: 30

Unit I

Unit II
System of simultaneous equation (linear): Direct methods–Methods of determination. Gauss–elimination, Gauss-Jordan, Cholesky, Partition methods of successive, approximate–Conjugate Gradient, Gauss and
Jacobi iteration, Gauss seidel iteration and relaxation methods. Eigen value 
Problems: Basic properties of Eigen values and Eigen Vector , Power method, 
Method for finding all Eigen pairs of a Matrix. Complex 
Eigen values. Curve fitting and Function Approximation : Least square error 
criterion Linear regression, Polynominal fitting and other curve fitting . 
approximation of functions by Taylor series and Chebyshev Polynomials. 

**Unit III**

Euler,s and modified Euler’s methods. Runge-kutta method upto fourth order. 
and multistep methods. Difference methods for BVPs ordinary Differential 
Equations Boundary value problems (BVP’s) Shooting methods. Finite 
difference method.

**References:**
1. Numerical Analysis : Jain, Iyenger and Jain

**RELATIVITY AND COSMOLOGY**

**Paper Code:** 02MSC13 104

**Maximum Marks:** 100

**External Marks:** 70

**Internal Marks:** 30

**Unit I**

Bianchi identities and Einstein tensor, conformal curvature tensor, Algebraic clssification of conformal curvature tensor, condition for flat spacetime, 

**Unit II**


**Unit III**

Conservation of electric charge. Transformation formula for electric charge and electric current densities, Maxwell’s equations in vacuo. Propagation of 

**References:**
1. Weatherbworn C.E : An introduction of riemannian Geometry and 
tensor calculus
ADVANCED MATHEMATICAL
STATISTICS

Paper Code: 02MSC13 105
Maximum Marks: 100
External Marks: 70
Internal Marks: 30

Unit I
Sample spaces, Combination of events. Statistical independence, Conditional probability, Bayes theorem, Repeated trials. Random Variable, Distribution function. Probability, Probability function, Density function, Mathematical expectation, Generating function (mfg and pgf) continuous probability distribution, characteristic function, Fourier’s Inversion, Cheby-Shev, Normal, Hypergeometric, Rectangular, Negative, Binomial, Beta, Gamma and Cauchy’s distribution.

Unit II
Association of attributes. Index number, Introduction, Price–relatives, Quantity relatives, Value relatives, Link and Chain relatives, Aggregate methods, Fisher’s Ideal Index. Elementary sampling theory, Distribution of means of sampling from Binomial, Cauchy, Rectangular and normal distribution. Distribution of second order moments in sampling from normal population. Exact distribution of $2X^2$, $t$, $z$ and $F$. Statistics in samples from a normal population, Their simple properties and applications.

Unit III

References:
2. A first course in Mathematical Statistics : Wealtherburn
3. The Advanced Theory of Statistics : M.G. Kendall
4. Introduction of Mathematical Probability : Uspensky
UNIT I

UNIT II
Network Analysis - Shortest Path Problem, Minimum Spanning Tree Problem, Maximum Flow Problem, Minimum cost folu problem, Network simplex method, Project planning and control with PERT-CPM.
Game theory - Two person, Zero-sum games, Games with mixed strategies, Graphical Solution, Solution by Linear Programming. Integer Programming - Branch and Bound Technique.

UNIT III
Dynamic programming, Principle of optimality due to Bellman, Solution of an LPP by dynamic programming, Nonlinear Programming - One and Multi variable unconstrained optimization. Kuhn-Tucker conditions for constrained optimization, Quadratic programming. Separable programming, Convex programming, Non-convex programming.

References: