MSC in Math

1st Semester

PAPERS CODE	PAPERS NAME	INTERNAL	EXTERNAL	TOTAL
MSMT 101	Advanced Abstract Algebra	40	60	100
MSMT 102	Real Analysis & Topology	40	60	100
MSMT 103	Differential Equations & Special Functions	40	60	100
Total		**120**	**180**	**300**

2nd Semester

PAPERS CODE	PAPERS NAME	INTERNAL	EXTERNAL	TOTAL
MSMT 201	Differential Geometry & Tensor Analysis	40	60	100
MSMT 202	Mechanics	40	60	100
MSMT 203	Number Theory	40	60	100
Total		**120**	**180**	**300**

3rd Semester

PAPERS CODE	PAPERS NAME	INTERNAL	EXTERNAL	TOTAL
MSMT 301	Analysis & Advanced Calculus	40	60	100
MSMT 302	Viscous Fluid Dynamics	40	60	100
MSMT 303	Mathematical Theory of Statistics	40	60	100
Total		**120**	**180**	**300**

4th Semester

PAPERS CODE	PAPERS NAME	INTERNAL	EXTERNAL	TOTAL
MSMT 401	Integral Transform & Integral Equation	40	60	100
MSMT 402	Industrial Mathematics	40	60	100
MSMT 403	Advanced Graph Theory	40	60	100
Total		**120**	**180**	**300**

M.Sc. Mathematics

Paper-I: Advanced Abstract Algebra Teaching
Unit 1

Direct product of groups (External and Internal). Isomorphism theorems - Diamond isomorphism theorem, Butterfly
Lemma, Conjugate classes (Excluding p groups), Commutators, Derived subgroups, Normal series and Solvable groups.
Composition series, Refinement theorem and Jordan-Holder theorem for infinite groups.

Unit 2

Sylow's theorems, Cauchy's theorem finite abelian groups. Euclidean rings Polynomial rings and irreducibility criteria.
Linear transformation of vector spaces, Dual spaces, Dual basis and their properties, Dual maps, Annihilator.

Unit 3

Field theory- Extension fields, Algebraic and Transcendental extensions, Separable and inseparable extensions, Normal
extensions. Splitting fields. Galois theory- the elements of Galois theory, Automorphism of extensions, I theorem of
Galois theory, Solutions of polynomial equations by radicals and Insolvability of general equation of degree five by radicals.

Unit 4

Matrices of a linear maps, Matrices of composition maps, Matrices of dual map, Eigen values, Eigen vectors, Rank and
Nullity of linear maps and matrices. Invertible matrices, Similar matrices, Determinants of matrices and its computations,
Characteristic polynomial and eigen values.

Unit 5

Real inner product space, Schwartzs inequality, Orthogonality, Bessel's inequality, Adjoint, Self adjoint linear
transformations and matrices, Othogonal linear transformation and matrices, Principal Axis Theorem.

3
Paper-II: Real Analysis and Topology Teaching
Unit 1

Algebra and algebras of sets, Algebras generated by a class of subsets, Borel sets, Lebesgue measure of sets of real
numbers, Measurability and Measure of Existence of Non-measurable sets, Measurable functions. Realization of non-
negative measurable function as limit of an increasing sequence of simple functions Structure of measurable functions,
Convergence in measure, Egoroff's theorem

Unit 2

Weierstrass's theorem on the approximation of continuous function by polynomials, Lebesgue integral of bounded
measurable functions, Lebesgue theorem on the passage to the limit under the integral sign for bounded measurable
functions Summable functions, Space of square summable functions Fourier series and coefficients, Parseval's identity,
Riesz-Fisher Theorem.

Unit 3

Lebesgue integration on R 2 , Fubini's theorem L P -spaces,, Holder-Minicowski inequalities. Completeness of L P -spaces,
Topological spaces, Subspaces, Open sets, Closed sets, Neighbourhood system, Bases and sub-bases.

Unit 4

Continuous mapping and Homeomorphism, Nets, Filters, Separation axioms (To, T_1, T_2, T 3 , T 4). Product and Quotient
spaces.

Unit 5

Compact and locally compact spaces. Tychonoff's one point compactification. Connected and Locally connected spaces,
Continuity and Connectedness and Compactness.

4
Paper-III: Differential Equations and Special Functions Teaching

Unit 1

Non-linear ordinary differential equations of particular forms. Riccati's equation -General solution and the solution when
one, two or three particular solutions are known. Total Differential equations. Partial differential equations of second
order with variable co-efficients-Monge's method.

Unit 2

Classification of lines partial differential equation of Second order , Candy's problem. Method of separations of
variables, Laplace, Wave and diffusion equations. Canonical forms Linear homogeneous boundary value problems. Eigen
value and eigen functions. Strum-Liouville boundary value problems orthogonallity of eigen function Reality of eigen
values

Unit 3

Calculus of variation Functionals, Variation of a functional and its properties, Variational problems with fixed
boundaries, Euler's equation Extremals, functional dependent on several unknown functions and their first order
derivatives functional dependent on higher order derivatives, Functionals dependent on the function of the more than one
independent variable Variational problems in parametric form, Series solution of a second order linear differential
equation near a regular singular point (Method of Frobenius) with special reference to Gauss hypergeometric equation and
Legender's equation

Unit 4

Gauss hypergeometric function and its properties, Integral representation, Linear transformation formulas, Contiguous
function relations, Differentiation formule, Linear relation between the solutions of Gauss hypergeometric equation.
Kummer's confluent hypergeometric function and its properties, Integral representation, Kummer's first transformation.
Legendro polynomials and functions P n (x) and Q n (x),
Unit 5

Bessel functions J,(A), Hermite polynomials Hn(X), Laguerre and Associated Laguerre polynomials.

5
Paper- IV: Differential Geometry and Tensor Analysis

Unit 1

Conoids, Inflexional tangents, Singular points, Indicatrix Space curves, Tangenet, Contact of curve and surface,
Osculating plane, Principal normal and Binormal, Curvature, Torsion, Serret-Frenct's formulae, Osculating circle and
Osculating sphere, Existence and Uniquenss theorems, Bertrand curves, Involute, Evolutes

Unit 2

Envelope, Edge of regression, Ruled surface, Developable surface, Tangent plane to a ruled surface. Necessary and
sufficient condition that a surface G- f(n) should represent a developable surface. Skew surface-parameter of distribution,
Metric of a surface, First, second and third fundamental forms. Fundamental magnitudes of some important surfaces,
Orthogonal trajectories, Normal curvature, Meunier's theorem.
Unit 3

Pricipal directions and Principal curvatures, First curvature, Meau curvature Gaussion curvature, Umbilics Radius of
curvature of any nenal section at an umbilicon z f(x3). Radius of curvature of a given section through any point on 2)
Libes of curvature, Principal radil, Relation between fundamental lims Asymptotic lines Differential equation of an
asymptotic line, Curvature and Torsion of an asymptotic line Gauss's formulae, Gauss's characteristic equation.
Weingarten equations. Mainardi Codazzi equations. Fundamental existence theorem for surfaces, Parallel surfaces
Gaussian and mean curvature for a parallel surface, Bonnet's theorem on parallel surfaces

Unit 4

Geodesics, Differential equation of a geodesic, Single differential equation of geodesic, Geodesic on a surface of
revolution, Geodesic curvature and Torsion. Normal angle, Gauss-Bonnet Theorem
Tensor Analysis- Kroneuker delts Contravariant and Covariant tensions, Symmetric tensors, Quotient law of tensors,
Relative tensor. Riemannian space Metric tensor. Indicator, Permutation symbols and Permutation tensors.

Unit 5

Christoffel symbols and their properties, Covariant differentiation of tensors. Ricci's theorem, Intrinsic derivative,
Geodesics, Differential equation of geodesic, Geodesic coordinates, Field of parallel vectors, Reimann-Christoffel tensor
and its properties. Covariant curvature tensor, Einstein space. Bianchi's identity, Einstein tensor.
Flate space, Isotropic point, Schur's theorem.

6
Paper-V: Mechanics Teaching

Unit 1

D'Alembert's principle. The general equations of motion of a rigid body. Motion of centre of inertia and motion relative

to centre of inertia. Motion about a fixed axis, The compound pendulum, Centre of percussion. Motion of a rigid body in
two dimensions under finite and impulsive forces.

Unit 2

Motion in three dimensions with reference to Euler's dynamical and geometrical equations. Motion under no forces,
Motion under impulsive forces. Conservation of momentum (linear and angular) and energy for finite as well as impulsive
forces.

Unit 3

Lagrange's equations for holonomous dynamical system, Energy equation for conservative field, Small oscillations,
Motion under impulsive forces. Motion of a top. Hamilton's equations of motion, Conservation of energy, Hamilton's
principle and principle of least action.

Unit 4

Kinematics of ideal fluid Lagrange's and Euler's methods. Equation of continuity in Cartesian, cylindrical and spherical
polar coordinates: Boundary surface Stream-lines, path-lines and stream lines velocity potential irrotational motion

Unit 5

Euler's hydrodynamic equations. Bernoulli's theorem. Helmholtz equations Cauchy's integral, Motion due to impu fore
Motion in two-dimensions, Stream function, Complex potential. Sources, Sinks, Doublets, Images in two-dimensions

M.Sc.(Final) Mathematics

Paper-I: Analysis and Advanced Calculus
Unit 1

Complete metric space, Baires theorem, compact sets and compact spaces. connected metric spaces. Normed linear
spaces. Quotient space of normed linear spaces and its completeness. Banach spaces and examples. Bounded linear
transformations Normed lincar space of bounded linear transformations Weak convergence of a sequence of bounded
lincar transformations. Equivalent norms

Unit 2

Basic properties of finite dimensional normed linear spaces and compactness Reisz Lemma. Multilinear mapping. Open
mapping theorem, Closed graph theorem Uniform boundness theorem. Continuous lincar functionals Hahn-Banach
theorem and its consequences. Embedding and Reflexivity of normed speccs. Dual spaces with examples.

Unit 3

Inner product spaces. Hilbert space and its properties. Orthogonality and Functionals in Hilbert Spaces. Phythagorcan
theorem, Projection theorem. Orthonormal sets, Bessel's inequality, Complete orthonormal sets, Parseval's identity,
Structure of a Hilbert space, Riesz representation theorem, Reflexivity of Hilbert spaces Adjoint of an operator on a
Hilbert space Self-adjoint, Positive, Normal and unitary operates and their properties.

Unit 4

Projection on a Hilbert space. Invariance. Reducibility Orthogonal projections Eigen values and eigen vectors of an
operator Spectrum of an operator Spectrul theorem. Derivatives of a continuous map from an open subset of Banach space
to a Banach space, Rules of derivation, Derivation of a composite , Directional derivative, Mean value thorem and its
applications. Partial derivatives and jacobian Matrix.

Unit 5

Continuously differentiable maps, Higher derivatives, Taylor’s formula. Inverse function theorem. Implicit function
theorem. Step function, Regulated function, primitives and Integrals . Differentiation under the integral sign, Riemann
Integral of function of real variable with values in normed linear space. Existence and uniqueness of solutions of
ordinary differential equation of the type x ’ =f (t,x)

3
Paper-II: VISCOUS FLUID DYNAMICS
Unit 1

Viscosity, Analysis of stress and rate of strain, Stoke’s law of friction. Thermal conductivity and generalized law of heat
conduction, Equations of state and continuity, Navier-Stokes equations of motion, Vorticity and circulation, Dynamical
similarity Inspection and dimensional analysis, Buckingham theorem and its application, Non dimensional parameters and

their physical importance Reynolds number, Froude number, Mach number, Prandtl number, Eckart number, Grashoff
rumber, Brinkman number, Non dimensional coefficients Lift and drag coefficient Skin friction Nusselt number,
Recovery factor

Unit 2

Exact solutions of Navier-Stokes equations, Velocity distribution for plane couette flow, Plane Poiseuille flow,
Generalized planc Couette flow, Hagen- Poiseuille flow, Flow in tubes of uniform cross-sections, Flow between two
concentric rotating cylinders.

Unit 3

Stagnation point flows Hiemenz Dow, Homann flow. Flow due to rotating dise, Concept of unsteady flow, Flow due to
plane wall suddenly in the motion (Stokes first problem), Flow due to an oscillating plane wall (Stoke's second problem
Starting flow in plane Couette motion, Suction/injection through porous wall

Unit 4

Equation of energy. Temperature distribution Between parallel paltes, in a pipe, between two concentric rotating
cylinders, variable viscosity plane Couette flow temperature distribution of plane Couette flow with transpiration cooling

Unit 5

Theory of very slow motion; stoke's and Oseen's flow, past a sphere, concept of boundary layer, Derivation of velocity
and thermal boundary equations in two dimensional flow. Boundary layer of flat plate.

NUMBER THEORY

Text Book: Tom M. Apostol, Introduction to Analytical Number Theory, Springer, 1998 UNIT I
Arithmetical function and Dirichlet multiplication (Section 2.1 to 2.14 of Text)
UNIT II

Finite Abelian Groups and Their Characters

(Theorem 4.1 of Chapter 4 (Abel's identity), Section 6.5 to 6.10 of Chapter 6
(Theorem 6.6 Statement Only))

UNIT III

Dirichlet's Theorem on Primes in Arithmetic Progressions (Section 3.2 of Chapter 3, Sections 7.1 to 7.8)
UNIT IV

Quadratic residues, Reciprocity law, Jacobi symbol (Sections 9.1 to 9.8 of Chapter 9)
UNIT V

Primitive roots, Existence and number of primitive roots. (Sections 10.1 to 10.9 and Sections 10.11 to 10.13 of Chapter 10)
References

[1] Kenneth Ireland, Michael Rosen, A Classical Introduction to Modern Number Theory, Second Edition, Springer 1990.
[2] Emil Grosswald, Topics from the Theory of Numbers, Birkhauser 1984

[3] G.H Hardy and E.M Wright , Introduction to the Theory of Numbers, Oxford Press

Paper- III: Mathematical Theory of Statistics
Unit 1

Sample space Combination of events. Statistical independence, Conditional probability. Bay's repeated trials. Random variable, Distribution function, Probability function. Density function, Mathematical expectation, Generating function, Continuous probability distribution, Characteristic function. Fourier's inversion, Chebyshev and Kolmogrovea inequality. Weak and strong laws of large

numbers.
Unit 2

Normal hypergeometric , rectangular, Negative Binomial , Beta, Gamma and Cauchy’s distribution. Methods of least squares and curve fitting , Correlation and Regression coefficient , Association of Attributes.

Unit 3

Interpolation-Introduction Newton-Gregory thorem. Newton’s , Langrange’s Gauss's and Strilling's
formulae.
Index numbers- Introduction Price relatives, Quality relatives , Value relatives, Link and Chain relatives. Aggregate methods, Fisher's ideal Index. Change of the base of the Index numbers: Elementary sampling theory , Distribution of means of samples for Binomial Cauchy, rectangular and normal population Exact distribution of ϰ2, ��,z . Statistics in samples from a normal population, then simple properties and applications Unit 4:

Unit 4

Test of significance and difference between two means and two standard deviations for large samples with modification for small samples and taken from normal population Analysis of variance, Simple cases (One criteria and two criteria of classification)

Unit 5

Elementary Statistical theory of Estimation of efficient. Fisher's criteria for the estimator, Consistant, Efficient and Sufficient estimator, Method of maximum likelihood. Maximum Likelihood Estimator, Other methods of estimation Methods of moments, Minimum variance, Minimum Chi-square and Least Squares.

5

Paper-IV: Integral Transforms and Integral Equations

Unit 1

Laplace transform- Definition and its properties Rules of manipulation. Laplace transform of derivatives and integrals. Properties of inverse Laplace transform Convolution theorem. Complex inversion formula.

Unit 2

Fourier transform - Definion and properties of fourier sine, cosine and complex transforms. Convolution theorem. Inversion theorems. Fourier transform of derivatives. Mellin transform- Definition and elementary properties. Mellin transforms of derivatives and integrals. Inversion theorem. Convolution theorem.

Unit 3

Infinite Hankel transform- Definition and elementary properties. Hankel transform of derivatives. Inversion theorem.
Parseval Theorem Solution of ordinary differential equations with constant and variable coefficients by Laplace
transform. Application to the solution of Simple boundary value problems by Laplace, Fourier and infinitel lankel
transforms.

Unit 4

Linear integral equations- Definition and classification. Conversion of initial and boundary value problems to an integral
equation. Eigen values and Figen functions. Solution of homogeneous and general Fredholm integral equations of second
and with separable kerneis Solution of fredholm and Volterra integral equations of second kind by methods of successive
substitutions and successive approximations. Resolvent kernel and its results. Conditions of uniform convergence and
uniqueness of series solution

Unit 5

Solution of Volterra integral equation of second kind with convolution type kernel by laplace transform. Solution of
singular integral equation by Fourier transform.

Integral equations with symmetric kernels, orthogonal system of function. Fundamental properties of eigen values and
eigen functions for symmetric kernels. Expansion in eigen function and bilinear form. Hilbert schmidt theorem. Solution
of Fredholm integral equations of second kind by using Hilbert Schimdt theorem . Classical Fredholm theory- Fredholm
theorems. Solution of Fredholm integral equation of second kind by using Fredholm first theorem.

Paper-V: Industrial Mathematics

Unit 1

Unit 1: Partial differential equations and techniques of solution. Finite difference methods for solving PDE Application to problems of industry with special reference to Fluid Mechanics Operational Techniques.

Unit 2
Operational Techniques. Computational procedure of Simplex method Two- phase Simplex method, Revised Simplex method, Duality, duel simplex method.

Unit 3
Sensitivity Analysis in lincar programming problems. Various modals of Assignment problems, alternate optimal solution, post optimality analysis in transportation.

Unit 4
Inventory Models EOQ models with and without shortages EOQ models with constraints.

Unit 5
Replacement and Reliability models. Replacement of items that deteriorate, Replacement of items that fail completely. Reliability Theory Coherent structure, Reliability of systems of independent components, Bounds on system reliability, Shapes of the systems reliability function Motion of aging, Parametric families of life distribute with Monotone failure rate

ADVANCED GRAPH THEORY

Text:
Fred Buckley, Frank Harary, Distance in Graphs, Addison-Wesley Publishing Company

UNIT 1

Graphs: Graphs as Models, Paths and connectedness, Cutnodes and Blocks, Graph Classes and Graph Operations, Polynomial Algorithms and NP-Completeness
(Chapter 1 and Section 11.1 of Text)

UNIT II

The Center and Eccentricity, Self Centered Graphs, The Median, Central Paths Path Algorithms and Spanning Trees, Centers.

(Chapter 2, Sections 2.1, 2.2, 2.2; Chapter 11, Sections 11.2, 11.3)

UNIT III

External Distance Problems: Radius, Small Diameter, Diameter, Long Paths and Long Cycles (Chapter 5 of Text)

UNIT IV

Convexity: Closure in variants, Metrics on Graphs, Geodetic Graphs, Distance Hereditary Graphs.
Diagraphs: Diagraphs and Connectedness, Acyclic diagraphs (Chapter 7 and sections 10.1, 10.2 of Text)

UNIT V

Distance Sequences: The eccentric sequences, Distance sequence, The Distance distribution,
Long Paths in Diagraphs, Tournaments (Sections 9.1, 9.2,9.3,10.3,10.4 of Text)

References:

(1) Bondy and Murthy, Graph Theory with Applications, The Macmillan Press Limited, 1976
(2) Chartrand G and L.Lesniak, Graphs and Diagraphs, Prindle, Weber and Schmidt, Boston, 1986
(3) Garey M.R, D.S Johnson , Computers and Intractability, A Guide to the Theory of NP-Completeness, Freeman, San Francisco 1979.
(4) Harary. F, Graph Theory, Addison Wesley Reading Mass 1969 (Indian Edition, Narosa)
(5) K.R Parthasarathy, Basic Graph Theory, Tata Mc Graw-Hill, Publishing Co, New Delhi, 1994.