Scheme of M.Sc. Mathematics

(Scheme PG A1: Postgraduate Programmes (Course work only)

Semester 1

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A01	Real Analysis	241/MAT/CC101	3	1	--	3	1	--	4	30	70	--	--	100
CC-A02	Ordinary Differential Equations	241/MAT/CC102	3	1	--	3	1	--	4	30	70	--	--	100
CC-A03	Abstract Algebra	241/MAT/CC103	3	1	--	3	1	--	4	30	70	--	--	100
Discipline Specific Elective Courses														
DSE-01	Numerical Analysis	241/MAT/DS101	2	1	--	2	1	--	3	25	50	--	--	75
Multidisciplinary Course(s)														
MDC-01	One from Pool		2	1	--	2	1	--	3	25	50	--	--	75
Ability Enhancement Course(s)														
AEC-01	One from Pool		2	--	--	2	--	--	2	15	35	--	--	50
Value-added Course(s)														
VAC-01	One from Pool		2	--	--	2	--	--	2	15	35	--	--	50
Total Credits						**17**	**5**		**22**					

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Semester 2

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A04	Topology	241/MAT/CC201	3	1	--	3	1	--	4	30	70	--	--	100
CC-A05	Complex Analysis	241/MAT/CC202	3	1	--	3	1	--	4	30	70	--	--	100
CC-A06	Partial Differential Equations	241/MAT/CC203	3	1	--	3	1	--	4	30	70	--	--	100
Discipline Specific Elective Courses														
DSE-02	Measure and Integration Theory	241/MAT/DS201	2	1	--	2	1	--	3	25	50	--	--	75
Multidisciplinary Course(s)														
MDC-02	One from Pool		2	1	--	2	1	--	3	25	50	--	--	75
Ability Enhancement Course(s)														
AEC-02	One from Pool		2	--	--	2	--	--	2	15	35	--	--	50
Skill Enhancement Course(s)														
SEC-01	One from Pool		1	--	2	1	--	1	2	5	20	5	20	50
Total Credits						**16**	**5**	**1**	**22**					

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M.Sc. MATHEMATICS 1st SEMESTER
Real Analysis

CC-A01 Maximum Marks: 100
Credits: 4(3L+1T) External Examination: 70
Max. Time: 3 hrs. Internal Assessment: 30
Course ID: 241/MAT/CC101

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of seven short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Students will have to attempt one question from each unit. Each question shall carry equal marks.*

Course Learning Outcomes:

CLO1 Learn about the Riemann-Stieltjes integral and its characteristics. Integrate vector-valued functions using rectifiable curves as an example.
CLO2 Comprehend the assertion and proof of the Weierstrass approximation theorem; and manage the convergence of sequences and series of functions.
CLO3 Comprehend differentiability and continuity of multivariable functions, relate to partial derivatives, and apply implicit and inverse function theorems.
CLO4 Understand about the ideas of Power series, exponential, logarithmic functions and trigonometric functions; use the knowledge to prove specific theorems.

Unit-I

Definition and existence of the Riemann-Stieltjes integral, properties of the integral, integration and differentiation, the fundamental theorem of calculus, integration of vector- valued functions.

Unit-II

Sequences and series of functions: Pointwise and uniform convergence of sequences of functions, Cauchy criterion for uniform convergence, Dini's theorem, uniform convergence and continuity, uniform convergence and Riemann integration, uniform convergence and differentiation. Convergence and uniform convergence of series of functions, Weierstrass M-test, integration and differentiation of series of functions, Weierstrass approximation theorem.

Unit-III

Functions of several variables: Linear transformations, the space of linear transformations on R^n to R^m as a metric space, open sets, continuity, derivative in an open subset of R^n, chain rule, partial derivatives, continuously differentiable mappings, the contraction principle, the inverse function theorem (statement only), the implicit function theorem(statement only).

Unit-IV

Power Series: Uniqueness theorem for power series, Abel's and Tauber's theorem, Taylor's theorem, Exponential & Logarithmic functions, trigonometric functions.

Recommended Books:

1. Walter Rudin, Principles of Mathematical Analysis (3rd Edition) McGraw-Hill, 2013.
2. R.R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing, 2020.
3. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.

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4. Gabriel Klambauer, Mathematical Analysis, Marcel Dekker, Inc. New York, 1975.
5. S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Limited, New Delhi, 4th Edition 2010.
6. D. Somasundaram and B. Choudhary, A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997

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M.Sc. MATHEMATICS 1st SEMESTER
Ordinary Differential Equations

CC-A02 Maximum Marks: 100
Credits: 4(3L+1T) External Examination: 70
Max. Time: 3 hrs. Internal Assessment: 30
Course ID: 241/MAT/CC102

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of seven short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Students will have to attempt one question from each unit. Each question shall carry equal marks.*

Course Learning Outcomes:

CLO1 Learn initial value problems' fundamentals, solutions' existence, uniqueness, continuity, and apply to solve problems and prove theorems.
CLO2 Understand Strum-Liouville boundary-value problem and adjoint equations.
CLO3 Describe characteristics of critical points-node, spiral, centre and saddle points.
CLO4 Summarize the basic concepts of Lyapunov function and Lyapunov's method for non-linear systems.

Unit-I

Preliminaries: Initial value problem and equivalent integral equation. Approximate solution, Cauchy-Euler construction of an approximate solution, Equicontinuous family of functions, Ascoli-Arzela Lemma, Cauchy-Peano existence theorem. Uniqueness of solutions, Lipschitz condition, Picard-Lindelof existence and uniqueness theorem for dy/dt= f(t,y), Dependence of solutions on initial conditions and parameters.

Unit-II

Sturm-Liouville BVPs, Sturms Separation and Comparison theorems, Lagrange's identity and Green's formula for second order differential equations, Properties of eigenvalues and eigenfunctions, Prufer transformation, Adjoint systems, Self-adjoint equations of secondorder. Linear systems, Matrix method for homogeneous first order system of linear differential equations, Fundamental set and fundamental matrix, Wronskian of a system.

Unit-III

Nonlinear differential system, Plane autonomous systems and critical points, Classification of critical points – rotation points, foci, nodes, saddle points. Stability, Asymptotic stability and unstability of critical points.

Unit-IV

Almost linear systems, Lyapunov function and Liapunov's method to determine stability for nonlinear systems, Periodic solutions and Floquet theory for periodic systems, Limit cycles, Bendixson non-existence theorem, Poincare-Bendixson theorem(Statement only), Index of a critical point.

Recommended Books:

1. Boyce W.E. and Diprima R.C., Elementary Differential Equations and Boundary Value Problems, John Wiley and Sons, Inc., New York, 2009, 9th edition.

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2. Coddington E.A. and Levinson N., Theory of Ordinary Differential Equations, Tata McGraw Hill, 2017.
3. Deo S.G., Lakshmikantham V. and Raghavendra V., Textbook of Ordinary Differential Equations, Tata McGraw Hill, 2017.
4. Goldberg J. and Potter M.C., Differential Equations – A System Approach, Prentice Hall, 1998
5. Hartman P., Ordinary Differential Equations, John Wiley & Sons, 1987.
6. Ross S.L., Differential Equations, John Wiley and Sons Inc., New York, 1984.
7. Simmons G.F., Differential Equations, Tata McGraw Hill, New Delhi, 2003.
8. Somasundram D., Ordinary Differential Equations, A First Course, Narosa Pub. Co., 2016.

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M.Sc. MATHEMATICS 1st SEMESTER

Abstract Algebra

CC-A03 Maximum Marks: 100
Credits: 4(3L+1T) External Examination: 70
Max. Time: 3 hrs. Internal Assessment: 30
Course ID: 241/MAT/CC103

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of seven short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Students will have to attempt one question from each unit. Each question shall carry equal marks.*

Course Learning Outcomes:

CLO1 Comprehend normal subgroups, quotient groups, isomorphisms, automorphisms, conjugacy, G-sets, normal series, composition series, and refinement theorem.

CLO2 Learn about conjugacy, G-sets, normal series, composition series, and refinement theorem.

CLO3 ExplainSylow's theorem and its applications, alternating group A_n, simplicity of A_n for n=5, and cyclic decomposition.

CLO4 Recognize modules, submodules, direct sum, R-homomorphism, quotient module, free modules, linear mappings, ranks, and Jordan forms."

Unit-I

Normal subgroup, quotient group, normalizer and centralizer of a non-empty subset of a group G, commutator subgroups of a group, first, second and third isomorphism theorems, correspondence theorem, Aut(G), Inn(G), automorphism group of a cyclic group, G-sets, orbit of an element in group G, Cayley's theorem.

Unit-II

Conjugate elements and conjugacy classes, class equation of a finite group G and its applications, Burnside theorem. Normal series, composition series, Jordan Holder theorem, Zassenhaus lemma, Schreier's refinement theorem, solvable group, nilpotent group.

Unit-III

Cyclic decomposition, even and odd permutation, Alternation group A_n, Simplicity of the Alternating group A_n ($n \geq 5$), Cauchy's theorem, Sylow's first, second and third theorems and its applications to group of smaller orders, Groups of order p^2 and pq (q>p).

Unit-IV

Modules, submodules, direct sums, finitely generated modules, cyclic module, R-homomorphism, quotient module, completely reducible modules, Schur's lemma, free modules, representation and rank of linear mapping.

Nilpotent transformation, reduction of a linear transformation to triangular form, index of nilpotency of a nilpotent transformation, Jordan blocks and Jordan canonical forms.

Recommended Books:

1. P.B. Bhattacharya, S.K. Jain, S.R. Nagpaul, Basic Abstract Algebra (Second edition), Cambridge University Press, 2012.

2. Surjit Singh and Quazi Zameeruddin : Modern Algebra ,Vikas Publishing House, 1990.
3. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
4. I.S. Luther and I.B.S. Passi, Algebra, Vol. I-Groups,Vol. III-Modules,Narosa Publishing House (Vol.I–2013, Vol.III–2013).
5. C. Lanski, Concepts in Abstract Algebra, American Mathematical Society, FirstIndian Edition, 2010.
6. V. Sahaiand, V. Bist, Algebra, Narosa Publishing House, 1999.
7. D.S. Malik, J.N. Mordenson, and M.K. Sen, Fundamentals of Abstract Algebra, McGraw Hill, International Edition, 1997.
8. C. Musili, Introduction to Rings and Modules, Narosa Publication House, 1994.
9. N. Jacobson, Basic Algebra, Vol. I& II, W.H. Freeman, 1980 (also published by Hindustan Publishing Company.

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M.Sc. MATHEMATICS 1st SEMESTER

Numerical Analysis

DSE-01 | Maximum Marks: 75
Credits: 3(2L+1T) | External Examination: 50
Max. Time: 2 hrs. | Internal Assessment: 25
Course ID: 241/MAT/DS101

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of five short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Students will have to attempt one question from each unit. Each question shall carry equal marks.*

Course Learning Outcomes:

CLO1 Understand advanced numerical techniques for solving equations and calculation errors from number representation, rounding, and truncation.

CLO2 Acquire knowledge to solve linear systems directly and iteratively, analyze solutions, and use finite difference operators in numerical differentiation.

CLO3 Learn advanced numerical methods to evaluate integrals for solving linear/non-linear first/second order IVP/BVP involving ODEs.

CLO4 Apply finite difference methods for solving hyperbolic, elliptic, and parabolic PDEs in scientific problem solving.

Unit-I

Error Analysis: Errors, Absolute, relative and percentage errors.

Solution of Polynomial and Transcendental Equations: Iteration methods; First order, second order and higher order methods, Acceleration of the convergence, Efficiency of a method, Newton-Raphson method for multiple roots, Modified Newton- Raphson method. Muller method and Chebyshev method, Birge-Vieta method, Bairstow method, Graeffe's root squaring method.

Unit-II

Systems of Linear Equations: Matrix partition method, Operation count, Ill-conditioned linear systems, Moore Penrose inverse method, least square solutions for inconsistent systems. Iteration methods Successive over relaxation (SOR) method, Convergence analysis. Eigenvalues and eigenvectors, bounds on eigenvalues, Given's method, Rutishauser method, Householder's method for symmetric matrices, Power method.

Unit-III

Numerical Differentiation: Numerical differentiation based on difference formulae, Richardson's extrapolation method, Cubic spline method, Method of undetermined coefficients.

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Numerical Integration: Weddle's rule, Newton-Cotes method, Gauss-Legendre, Gauss Chebyshev, Gauss-Laguerre, and Gauss-Hermite integration methods. Composite integration method, Euler-Maclaurin's formula, Romberg Integration, Double integration.

Unit-IV

Numerical Solution of Ordinary Differential Equations:

Estimation of local truncation error of Euler and single step methods. Bounds of localtruncation error and convergence analysis of multistep methods, Predictor-Corrector methods; Adams-Bashforth methods, Adams-Moulton formula, Milne-Simpson method, System of Differential Equations. Finite difference method for solving second order IVPs andBVPs.

Recommended Books:

1. Gupta, R. S., Elements of Numerical Analysis, Cambridge Univ. Press, 2015.
2. Jain, M. K., Iyengar, S.R.K. and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, 6th Edition, New Age International Publishers, 2012.
3. Pal, M., Numerical Analysis for Scientists and Engineers, Narosa Publishing House Pvt. Ltd., 2008.
4. Mathews, John H. and Fink Kurtis D., Numerical Methods Using Matlab, Fourth edition; PHI Learning Private Ltd., 2009.
5. Gourdin, A. and Boumahrat, M., Applied Numerical Methods, PHI Learning Private Ltd., 2004.

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M.Sc. MATHEMATICS 2nd SEMESTER
Topology

CC-A04 Maximum Marks: 100
Credits: 4(3L+1T) External Examination: 70
Max. Time: 3 hrs. Internal Assessment: 30
Course ID: 241/MAT/CC201

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of seven short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Students will have to attempt one question from each unit. Each question shall carry equal marks.*

Course Learning Outcomes:

Students would be able to:

CLO1 Understand topological spaces, neighborhoods, and characteristics, including interior, closure, boundary, and limit points of subsets.

CLO2 Create new topologies using bases on a given set and explain topological invariants and the notion of homeomorphism

CLO3 Understand connectedness and compactness of topological spaces and proofs of related theorems.

CLO4 Know about continuity and compact set, separation axioms and their properties.

Unit-I

Definition and examples of topological spaces, Comparison of topologies on a set, Intersection and union of topologies on a set, Neighbourhoods, Interior point and interior of aset , Closed set as a complement of an open set , Adherent point and limit point of a set, Closure of a set, Derived set, Properties of Closure operator, Boundary of a set..

Unit-II

Dense subsets, Interior, Exterior and boundary operators, Alternative methods of defining a topology in terms of neighbourhood system and Kuratowski closure operator.Relative (Induced) topology, Base and sub-base for a topology, Base for Neighbourhood system. Continuous functions, Open and closed functions.

Unit-III

Homeomorphism. Connectedness and its characterization, connected subsets and their properties, Continuity and connectedness, Components, Locally connected spaces.Compact spaces and subsets, Compactness in terms of finite intersection property. Continuity and compact sets, Basic properties of compactness, Closeness of compact subset and a continuous map from a compact space into a Hausdorff and its consequence.

Unit-IV

Sequentially and countably compact sets, Local compactness and one point compatification.First countable, Second countable and separable spaces, Hereditary and topological property,Lindelof theorem. T0, T1, T2 (Hausdorff) separation axioms, their characterization and basic properties.

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Recommended Books:

1. G. F. Simmons, Introduction to Topology and Modem Analysis, McGraw-Hill Book Company, 2004.
2. J. L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York, 2008
3. J. R. Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
4. K. D. Joshi, Introduction to General Topology, Wiley Eastern Ltd., 2017.
5. W. J. Pervin, Foundations of General Topology, Academic Press Inc. New York, 1964
6. J. Dugundji, Topology, Allyn and Bacon, 1966 (Reprinted in India by Prentice Hall of India Pvt. Ltd.).
7. K. Ahmad, Introduction to Topology, Narosa Publishing House New Delhi, 2019.

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M.Sc. MATHEMATICS 2nd SEMESTER

Complex Analysis

CC-A05 Maximum Marks: 100

Credits: 4(3L+1T) External Examination: 70

Max. Time: 3 hrs. Internal Assessment: 30

Course ID: 241/MAT/CC202

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of seven short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Students will have to attempt one question from each unit. Each question shall carry equal marks.*

Course Learning Outcomes:

CLO1 Recognize the features of complex numbers and how they relate to geometry as an extension of real numbers.

CLO2 Use necessary theorems, formulas, and power series expansions to solve complex integrals of various types.

CLO3 Solve the improper integrals by applying the findings from the analysis of complex functions with singularities for zeroes and residues at poles.

CLO4 Understand argument principle, conformal mappings, transforming, and mapping integration routes to solve difficult improper integrals.

Unit-I

Function of a complex variable, continuity, differentiability. Analytic functions and their properties, Cauchy-Riemann equations in Cartesian and Polar coordinates. Harmonic function. Concept of stereographic projection. Power series, Radius of convergence, Differentiability of sum function of a power series. Branches of logarithm.

Unit-II

Path, Region, Contour, Simply and multiply connected regions, Complex integration. Cauchy theorem. Cauchy's integral formula. Poisson's integral formula. Complex integral as a function of its upper limit, Morera's theorem. Cauchy's inequality. Liouville's theorem.

Unit-III

Zeros of an analytic function, Laurent's series. Singularities. Casorati-Weierstrass theorem, Limit point of zeros and poles. Maximum and Minimum modulus principles. Schwarz lemma. Meromorphic functions. Residues. Cauchy's residue theorem. Evaluation of improperintegrals.

Unit-IV

The argument principle. Rouche's theorem, The Fundamental theorem of algebra. Bilinear transformations, their properties and classifications. Definitions and examples of Conformal mappings. Space of analytic functions and their completeness, Riemann mapping theorem (Statement only).

Recommended Books:

1. E.C. Titchmarsh, The Theory of Functions, Oxford University Press, London, 1976.
2. E.T. Copson, An Introduction to the Theory of Functions of a Complex Variable,

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Oxford University Press, London, 1960.

3. S. Ponnusamy, Foundation of Complex Analysis, Narosa Publishing House, New Delhi, 2011.
4. H.S. Kasana, Complex Variables: Theory and Applications 2nd Edition, PHI publication Delhi, 2005.
5. J. W. Brown and R.V. Churchill, Complex Variables and Applications: 9th Edition, McGraw Hill, 2021.
6. Liang-shin Hann & B. Epstein, Classical Complex Analysis, Jones and Bartlett Publishers International, London, 1996.
7. S. Lang, Complex Analysis, Addison Wesley, 1985.

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M.Sc. MATHEMATICS 2nd SEMESTER
Partial Differential Equations

CC-A06 Maximum Marks: 100
Credits: 4(3L+1T) External Examination: 70
Max. Time: 3 hrs. Internal Assessment: 30
Course ID: 241/MAT/CC203

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of seven short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Students will have to attempt one question from each unit. Each question shall carry equal marks.*

Course Learning Outcomes:

CLO1 Apply the separation of variables method to solve BVPs for heat and wave equations.
CLO2 Classify PDEs, solve transport and non-homogeneous equations, and analyze Laplace equations using fundamental solutions and energy methods.
CLO3 Solve heat and wave equations in various dimensions and coordinates using diverse techniques
CLO4 Understand complete integrals, envelopes, characteristics, and Hamilton-Jacobi equations in non-linear PDEs.

Unit-I

Method of separation of variables to solve Boundary Value Problems (B.V.P.) associated with one dimensional heat equation. Steady state temperature in a rectangular plate, Circular disc, Semi-infinite plate. The heat equation in semi-infinite and infinite regions. Solution of three dimensional Laplace equations, Heat Equations, Wave Equations in cartesian, cylindrical and spherical coordinates. Method of separation of variables to solve B.V.P. associated with motion of a vibrating string. Solution of the wave equation for semi-infinite and infinite strings.

Unit-II

Partial differential equations: Examples of PDE classification. Transport equation – Initial value problem. Non-homogeneous equations. Laplace equation – Fundamental solution, Mean value formula, Properties of harmonic functions, Green function.

Unit-III

Heat Equation – Fundamental solution, Mean value formula, Properties of solutions, Energy methods.

Wave Equation – Solution by spherical means, Non-homogeneous equations, Energy methods.

Unit-IV

Non-linear first order PDE – Complete integrals, Envelopes, Characteristics, Hamilton Jacobi equations (Calculus of variations, Hamilton ODE, Legendre transform, Hopf-Lax formula, Weak solutions, Uniqueness).

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Recommended Books:

1. L.C. Evans, Partial Differential Equations, Graduate Studies in Mathematics,American Mathematical Society, 2014.
2. Ian N. Sneddon, Elements of Partial Differential Equations, Dover Publications, 2006.
3. T. Amarnath, An Elementary Course in Partial Differential Equations, Jones & Bartlett Publishers, 2009.
4. H.F. Weinberger, A First Course in Partial Differential Equations, John Wiley & Sons, 1965.

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M.Sc. MATHEMATICS 2nd SEMESTER

Measure and Integration Theory

DSE-02 Maximum Marks: 75
Credits: 3(2L+1T) External Examination: 50
Max. Time: 2 hrs. Internal Assessment: 25
Course ID: 241/MAT/DS201

Note: *There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of five short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Students will have to attempt one question from each unit. Each question shall carry equal marks.*

Course Learning Outcomes:

CLO1 Understand the basic concepts of Lebesgue outer measure, borel sets and non-measurable sets.

CLO2 Recognize the basic ideas of measurement, Lebesgue measure, and measurable functions.

CLO3 Learn about the drawbacks of the Riemann integral and the advantages of the Lebesgue integral.

CLO4 Investigate how to use the calculus fundamental theorem, indefinite integrals, and monotonic function differentiation.

Unit-I

Lebesgue outer measure, elementary properties of outer measure, measurable sets and their properties, Lebesgue measure of sets of real numbers, algebra of measurable sets, Borel sets and their measurability, characterization of measurable sets in terms of open, closed, F_σ and G_δ sets.

Unit-II

Lebesgue measurable functions and their properties, Simple functions, approximation of measurable functions by sequences of simple functions, Borel measurability of a function. Littlewood's three principles, measurable functions as nearly continuous functions. Lusin's theorem, almost uniform convergence, Egoroff's theorem, convergence in measure, Riesz theorem.

Unit-III

The Lebesgue Integral: Shortcomings of Riemann integral, Lebesgue integral of a bounded function over a set of finite measure and its properties, Lebesgue integral as a generalization of the Riemann integral, Bounded convergence theorem, Lebesgue theorem regarding points of discontinuities of Riemann integrable functions. Integral of a non-negative function.

Unit-IV

Fatou's lemma, Monotone convergence theorem, integration of series, the general Lebesgue integral, Lebesgue convergence theorem. Differentiation and Integration:,Vitali's covering lemma, Jensen's and Minkowski inequality, The Lp-spaces and their completeness.

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Recommended Books:

1. H.L. Royden, Real Analysis (3rd Edition) Prentice-Hall of India, 2008.
2. G.de Barra, Measure theory and integration, New Age International, 2014.
3. P.R. Halmos, Measure Theory, Van Nostrans, Princeton, 1950.
4. I.P. Natanson, Theory of functions of a real variable, Vol. I, Frederick UngarPublishing Co., 1961.
5. R.G. Bartle, The elements of integration, John Wiley & Sons, Inc. New York, 1966.
6. K.R. Parthsarthy, Introduction to Probability and measure, Macmillan Company ofIndia Ltd., Delhi, 1977.
7. P.K. Jain and V.P. Gupta, Lebesgue measure and integration, New Age International(P) Ltd., Publishers, New Delhi, 1986.

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Scheme of M.Sc. Mathematics

(Scheme PG A1: Postgraduate Programmes (Course work only)

Semester 1

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs.)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A01	Real Analysis	241/MAT/CC101	3	1	--	3	1	--	4	30	70	--	--	100
CC-A02	Ordinary Differential Equations	241/MAT/CC102	3	1	--	3	1	--	4	30	70	--	--	100
CC-A03	Abstract Algebra	241/MAT/CC103	3	1	--	3	1	--	4	30	70	--	--	100
Discipline Specific Elective Courses														
DSE-01	Numerical Analysis	241/MAT/DS101	2	1	--	2	1	--	3	25	50	--	--	75
Multidisciplinary Course(s)														
MDC-01	One from Pool		2	1	--	2	1	--	3	25	50	--	--	75
Ability Enhancement Course(s)														
AEC-01	One from Pool		2	--	--	2	--	--	2	15	35	--	--	50
Value-added Course(s)														
VAC-01	One from Pool		2	--	--	2	--	--	2	15	35	--	--	50
Total Credits						**17**	**5**		**22**					

Semester 2

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs.)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A04	Topology	241/MAT/CC201	3	1	--	3	1	--	4	30	70	--	--	100
CC-A05	Complex Analysis	241/MAT/CC202	3	1	--	3	1	--	4	30	70	--	--	100
CC-A06	Partial Differential Equations	241/MAT/CC203	3	1	--	3	1	--	4	30	70	--	--	100
Discipline Specific Elective Courses														
DSE-02	Measure and Integration Theory	241/MAT/DS201	2	1	--	2	1	--	3	25	50	--	--	75
Multidisciplinary Course(s)														
MDC-02	One from Pool		2	1	--	2	1	--	3	25	50	--	--	75
Ability Enhancement Course(s)														
AEC-02	One from Pool		2	--	--	2	--	--	2	15	35	--	--	50
Skill Enhancement Course(s)														
SEC-01	One from Pool		1	--	2	1	--	1	2	5	20	5	20	50
Total Credits						**16**	**5**	**1**	**22**					

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Semester 3

Course Code	Course Title	Course ID	L (Hrs.)	T (Hrs.)	P (Hrs.)	L Credits	T Credits	P Credits	Total Credits	MARKS TI	TE	PI	PE	Total
Core Course(s)														
CC-A07	Functional Analysis	241/MAT/CC301	3	1	--	3	1	--	4	30	70	--	--	100
CC-A08	Advanced Abstract Algebra	241/MAT/CC302	3	1	--	3	1	--	4	30	70	--	--	100
CC-A09	Fluid Dynamics	241/MAT/CC303	3	1	--	3	1	--	4	30	70	--	--	100
Discipline Specific Elective Courses														
DSE-03	Discrete Mathematics OR	241/MAT/DS301A	2	1	--	2	1	--	3	25	50	--	--	75
	Mathematical Statistics	241/MAT/DS301B												
Multidisciplinary Course(s)														
MDC-03	One from Pool		2	1	--	2	1	--	3	25	50	--	--	75
Skill Enhancement Course(s)														
SEC-02	One from Pool		1	--	2	1	--	1	2	5	20	5	20	50
Value-added Course(s)														
VAC-02	One from Pool		2	--	--	2	--	--	2	15	35	--	--	50
Seminar														
Seminar		241/MAT/SM301	--	--	4	--	--	2	2	--	--	15	35	50
Internship/Field Activity#														
		241/MAT/IN301	--	--	8	--	--	4	4	--	--	30	70	100
Total Credits						**16**	**5**	**7**	**28**					

#Four credits of internship earned by a student during summer internship after 2nd semester will be counted in 3rd semester of a student who pursue 2 year PG Programme without taking exit option.

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Semester 4

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs.)			Credits				TI	TE	PI	PE	Total
Core Course(s)														
CC-A10	Number Theory	241/MAT/CC401	3	1	--	3	1	--	4	30	70	--	--	100
CC-A11	Classical Mechanics & Calculus of Variations	241/MAT/CC402	3	1	--	3	1	--	4	30	70	--	--	100
Discipline Specific Elective Courses														
DSE-04	Operations Research OR	241/MAT/DS401A	2	1	--	2	1	--	3	25	50	--	--	75
	Fuzzy Set Theory	241/MAT/DS401B												
Multidisciplinary Course(s)														
MDC-04	One from Pool		2	1	--	2	1	--	3	25	50	--	--	75
Ability Enhancement Course(s)														
AEC-03	One from Pool		2	--	--	2	--	--	2	15	35	--	--	50
Community Engagement/Field Work/Survey/Seminar														
Seminar		241/MAT/SM401	--	--	12	--	--	6	6	--	--	50	100	150
Total Credits						**12**	**4**	**6**	**22**					

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