Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Name of the Program: M. Sc. in Mathematics

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA101	DC	**Abstract Algebra I**	60	20	20	-	-	4	-	-	4

Course Objective

To introduce the students to the Sylow Theory, Field Extension and Galois Theory.

Course Outcomes

After the successful completion of this course, students will be able to

1. *understand and apply the basics of Sylow's theory*
2. *understand fundamental principles of Fields Extensions*
3. *analyse and demonstrate examples of Galois theory and Splitting Fields*
4. *use the concepts of Automorphisms and Isomorphism over fields*
5. *apply algebra to solve problems in other areas of mathematics and other disciplines*
6. *produce rigorous proofs in the context of abstract algebra.*

Course Content:

UNIT – I

Sylow Theorem: p-group, Cauchy Theorem, Sylow Theorem, Sylow p-subgroups, Applications of Sylow Theory: Application to p-groups and Class equation (Text 1. Section 36, 37.1-37.6).

UNIT – II

Extension Fields: Introduction to Extension Fields, Kronecker's Theorem, Algebraic and Transcendental Elements, Irreducible Polynomials, Simple Extensions. (Text 1: Section 29, 30.23)
Algebraic Extension: Finite Extensions, Algebraic Closed Fields and Closure. (Text 1: Section 31)

Chairperson	Chairperson	Controller of Examination	Joint Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Name of the Program: M. Sc. in Mathematics

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA101	DC	**Abstract Algebra I**	60	20	20	-	-	4	-	-	4

UNIT – III Automorphisms of Fields: Automorphisms and Fixed Fields. The Frobenius Automorphism. (Text 1: Section 48)
The isomorphism Extension Theorem: The Extension Theorem, Isomorphism Extension Theorem, The Index of Field Extension. (Text 1: Section 49)

UNIT – IV Splitting Fields: Definition, Properties and Examples (Text 1: Section 50).
Separable Extension: Multiplicities of Zeros of a Polynomial, Separable Extension, Perfect Fields, The Primitive Element Theorem Totally Inseparable Extension. (Text 1: Section 51, 52)

UNIT – V Galois Theory: Normal Extension, The Main Theorem of Galois Theory, Galois Group over Finite Fields. (Text 1: Section 53)

Texts:

1. John B. Fraleigh, A First Course in Abstract Algebra, Narosa Publication.
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra, Cambridge University Press.
3. Herstein, I.N., Topics in Abstract Algebra, Wiley Eastern Limited. Hungerford, T.W., Algebra, Springer.
4. Jacobson, N., Basic Algebra, I & II, Hindusthan Publishing Corporation, India.
5. V. Sahi and V. Bisht, Algebra, Narosa Publication.

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA102	DC	**Real Analysis**	60	20	20	-	-	4	-	-	4

Course Objective

To introduce the students to the Fundamentals of the Real Analysis.

Course Outcomes

After the successful completion of this course, students will be able to:

1. *understand and apply the basics of the Riemann-Stieltjes Integral.*
2. *understand and apply the concepts of convergence and uniform convergence.*
3. *apply Power Series and Linear Transformations.*
4. *Illustrate and demonstrate the functions of several variables in the context of their differentiability and Integrals.*

Course Content:

UNIT – I:
Definition and existence of Riemann-Stieltjes Integral and its properties, Integration and Differentiation, Fundamental Theorem of Calculus, Integration by Parts (Text 1: Chapter 6, Sec. 6.1-6.22).

UNIT – II:
Integration of Vector-valued Functions, Rectifiable Curves, Sequence and Series of Functions: Uniform Convergence, Uniform Convergence and Continuity. (Text 1: Chapter 6, Sec. 6.23-6.27, Chapter 7, Sec 7.1-7.15).

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Name of the Program: M. Sc. in Mathematics

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA102	DC	**Real Analysis**	60	20	20	-	-	4	-	-	4

UNIT – III:
Uniform Convergence and Integration, Uniform Convergence and Differentiation, Equicontinuous Families of Functions, Stone-Weierstrass Theorem (Text 1: Chapter 7, Sec. 7.16-7.33).

UNIT – IV:
Some Special Functions: Power Series, The Exponential and Logarithmic Functions, The Trigonometric Functions, The Algebraic Completeness of the Complex Field, Functions of Several Variables: Linear Transformation. (Text 1: Chapter 8, Sec. 8.1-8.8, Chapter 9, Sec. 9.1-9.9).

UNIT – V:
Functions of Several Variables: Differentiation, Chain Rule, Partial Derivatives, The Contraction Principle, The Inverse Function Theorem, The Implicit Function Theorem, Derivatives of Higher Order, Differentiation of Integrals. (Text 1: Chapter 9, Sec. 9.10-9.29, 9.39-9.43).

Texts:

1. W. Rudin, Principles of Mathematical Analysis, *Third Edition,* McGraw-Hill Book Co.
2. C.D. Aliprantis, O. Burkinshaw, *Principles of Real Analysis*, 3rd Edition, Harcourt Asia Pte Ltd., 1998.
3. H.L. Royden, *Real Analysis*, 3rd Edition, Macmillan, New York & London, 1988.
4. T.M. Apostal, Mathematical Analysis, Narosa.
5. Introduction to Real Analysis, 4th Edition by Robert G. Bartle and Donald R. Sherbert (https://sciencemathematicseducation.files.wordpress.com/2014/01/0471433314realanalysis4.pdf)

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Name of the Program: M. Sc. in Mathematics

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA103	DC	**Complex Analysis I**	60	20	20	-	-	4	-	-	4

Course Objective

To introduce the students with the Fundamentals of the Complex Analysis.

Course Outcomes

After the successful completion of this course students will be able to:

1. *understand and represent complex numbers algebraically and geometrically*
2. *define and analyze limits and continuity for complex functions as well as consequences of continuity*
3. *evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula*
4. *illustrate functions by Taylor, power and Laurent series, identify singularities and poles*
5. *apply power series methods for solving various physical and engineering problems*

Course Content:

Unit I:

Complex Numbers: Complex Numbers, Geometrical representation, Complex Conjugate, Modulus and Argument, Properties of Modulus, Properties of Arguments, Inequalities of Modulus, Cauchy's Inequality, D'Moiver's Theorem, Limit and Continuity, Analytic Function, C-R equations, Conjugate and Harmonic Functions.
(Text 1: Chapter 1 and 2)

Unit II:

Complex Integration, Cauchy's Fundamental Theorem, Cauchy-Gaursat Theorem, Cauchy Integral Formula, Higher Order Derivatives, Extension of Cauchy Theorem to multiply connected regions.
(Text 1: Chapter 3: Sections 3.1-3.4,3.6)

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Name of the Program: M. Sc. in Mathematics

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA103	DC	**Complex Analysis I**	60	20	20	-	-	4	-	-	4

Unit III:

Morera's Theorem, Cauchy's Inequality, Liouville's Theorem, The Fundamental Theorem of Algebra, Taylor's Theorem, Problems based on Taylor's Theorem.

(Text 1: Chapter 3: Sections 3.7-3.8, 3.10 Only Taylor's Theorem, Theorem 5-8 and Theorem 13)

Unit IV:

The Maximum Modulus Principle, Schwartz Lemma, Laurentz's Series, Problems based on Laurentz Series, Uniqueness of Laurent Expansion.

(Text 1: Chapter 3: Sections 3.9-3.10 (Laurentz's Theorem), Theorem 9-11, 14-15)

Unit V:

Bilinear Transformation, Fixed Points, Critical Points, Cross Ration, Normal Form of a Bilinear Transformation and Problems, Mapping by Elementary Transformations (Translation, Rotation., Magnification, Rotation and Magnification, Inversion), Conformal Mappings, Necessary and Sufficient Condition for Conformal Mapping.

(Text 1: Chapter 6)

Text Books :-

1. B. Singh, V. Karanjgaokar, R.S. Chandel, *Complex Analysis*, Golden Valley Publ., Agra.
2. J.B. Conway, *Functions of one complex variable*, Second Edition, Narosa Publishing
3. L.V. Ahlfors, *Complex Analysis*, McGraw-Hill, 1979.
4. W. Rudin, *Real and Complex Analysis*, McGraw-Hill Book Co., 1966.
5. S. Ponnusamy, *Foundations of Complex Analysis*, Narosa Publishing House, 1997.

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Name of the Program: M. Sc. in Mathematics

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA104	DC	**Topology I**	60	20	20	-	-	4	-	-	4

Course Objective

To introduce the students to the Fundamentals of the Topology.

Course Outcomes

After the successful completion of this course, students will be able to:

1. *use sets and functions, images and preimages, and you can distinguish between finite, countable, and uncountable sets*
2. *understand and construct the topological spaces*
3. *establish continuity in equivalent forms*
4. *apply and analyse countability axioms to real-world problems*

Course Content:

Unit I:.
Finite and Infinite Sets, Countable and Uncountable Sets, Schroeder-Bernstein Theorem, Axiom of Choice, and Well-ordered Set. Cardinal Numbers and its Arithmetic, Zorns's Lemma (Text 1. Sections 6,7,9,10,11).
Unit II:.
Definition and Examples of Topological Space, Bases and Subbases, Order Topology, Product Topology, Subspace and Relative Topology. (Text1. Section 12 to16)
Unit III:.
Closed Sets and Limit Points, Closure of a Set, Dense Subsets, Interior Exterior and Boundary of Sets, Neighborhoods and Neighborhood Systems. Continuous Functions and Homeomorphism, Examples. (Text 1. Section 17.1 to 17.7, 18)

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Name of the Program: M. Sc. in Mathematics

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA104	DC	**Topology I**	60	20	20	-	-	4	-	-	4

Unit IV:.
Connected Spaces, Connected Subspaces of the Real Line, Path Connectedness, Components and Local Connectedness (Text 1. Section 23 to 25).

Unit V:.
The Countability axiom, First and Second Countable Space, Lindeioff's Theorem, Separable Space, Second Countability and Separability Hausdorff space. (Text 1. Section 17.8 to 17.10, 30)

Text Books :

1. James R. Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd. New Delhi.
2. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill.
3. K.D. Joshi, Introduction to General Topology, Kelley, Eastern
4. K.P. Gupta, Topology, Pragati Prakashan.

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Name of the Program: M. Sc. in Mathematics

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA105	DC	Integral Transform	60	20	20	-	-	4	0	0	4

Course Objective

To introduce the students to the fundamentals of the Integral Transform.

Course Outcomes

After the successful completion of this course, students will be able to:

1. *understand and apply the basics of the Integral Transform.*
2. *familiar with Laplace Transform.*
3. *find the solution of ordinary differential equations, simultaneous ordinary differential equations and partial differential equations using Laplace transform*
4. *evaluate and illustrate the problems of integral equations using Laplace transform.*

Course Content:

Unit I

Laplace Transform of the derivative of $f(t)$, Laplace Transform of Integrals multiplication by t, Multiplication by t^n, Division by t use of Laplace transform to unit step function (Heaviside's unit functions) use of Laplace Transform to Bessel function, Inverse Laplace Transform of derivatives, convolution, Heaviside's expansion theorem, problem depends on Convolution.
(1. Chapter 1 section I (page 7-57), section II (Page 58-114)

Unit II

Application of Laplace transform to solutions of ordinary differential equations with constant coefficients. (1. Chapter 1 section III (pages 115- 139) excluding problems 1,4,5 (pages 116-120))

Chairperson	Chairperson	Controller of Examination	Joint Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA105	DC	Integral Transform	60	20	20	-	-	4	0	0	4

Unit III

Solution of simultaneous ordinary differential equations by Laplace transforms. Solution of ordinary differential equations with variable coefficients by Laplace transforms. (1. Chapter 1 Section III pages 140-149, problems 23-28 including problems 1, 4, 5 (pages116-120))

Unit IV

Solutions of partial differential equations by Laplace transform application of Laplace transform to integral equation.
(1. Chapter 1 section III (pages 150 - 160), section IV (pages 161-173)

Unit V

Heat conduction equations, Problems based on Heat conduction equation using Laplace transform. (1. Chapter V (page 354 -36 1) including problems dependent on it on exercise page 371)

Reference Books:

1. Integral Transform by Goyal & Gupta, A Pragati Edition.
2. Vasishtha A.K, Gupta R K, Integral Transform, KRISHNA PRAKASHAN.