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				
MSMA201	DC	Abstract Algebra II	60	20	20	-	-	4	0	-	4

Course Objective

To introduce the students to the basics of abstract Algebra.

Course Outcomes

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

1. *apply the basics of the abstract algebra*
2. *understand the concept of Noetherian & Artinian modules*
3. *demonstrate knowledge and understanding of the concept of Modules and Submodules*
4. *to apply Hilbert basis theorem and Wedderburn-Artin theorem to solve problems of Algebra.*

Course Content:

Unit-I

Symmetric functions, Cyclotomic Extensions, Insolvability of Quintic.
(5. Section 54, 55, 56)

Unit II

Introduction to Modules, Examples, Submodules and direct sums, Cyclic module, R- homomorphisms and Quotient modules, Isomorphism.

(1. Chapter 14 Sections 1-3)

UNIT-III

Completely reducible modules Schur's lemma, Free modules, Representation of linear mappings, Rank of linear mappings.

(1. Chapter 14 Sections 4 - 7)

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA201	DC	Abstract Algebra II	60	20	20	-	-	4	0	-	4

UNIT-IV

Noetherian & Artinian modules and rings, Hilbert basis theorem. Weddeburn-Artin theorem.

(1. Chapter 19 Sections 1-3)

UNIT-V

Uniform modules, Primary, modules, finitely generated modules over a PID, Decomposition theorem, Uniqueness of the decomposition. Application to finitely generated abelian groups.

(1. Chapter 19 Sections 4, Chapter 21 Sections 1-3)

References

1. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra, Cambridge University Press.
2. I.N. Herstein, Topics in Algebra, Wiley Eastern, New Delhi.
3. V. Sahai & V. Bisht, Algebra, Narosa Publishing House.
4. N. Jacobson, Basic Algebra I and II, 2nd Ed., W. H. Freeman, 1985 and 1989.
5. John B. Fraleigh, A First Course in Abstract Algebra, Narosa Publication.

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA202	DC	Theory of Measure and Integration	60	20	20	-	-	4	0	-	4

Course Objective

To introduce the students to the Theory of Measure and Integration.

Course Outcomes

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

- *understand and apply the basics of the Theory of Measure and Integration.*
- *analyse and construct the outer measure, measurable sets, Lebesgue measure and measure space.*
- *apply the concepts of measure theory to probability theory.*
- *evaluate integrals beyond Riemann's integration theory.*
- *synthesize real-world applications of measure theory.*

Course Content:

Unit I:

F_σ, G_δ sets, Introduction to Lebesgue Outer Measure, Measurable sets and Lebesgue Measure, Non-Measurable sets.

(1. Chapter 2 sections 7, Chapter 3 sections 1- 4)

Unit II:

Measurable Functions, Egoroff's theorem, Lusin's theorem, Little-Wood's three Principles, A Non-Borel Measurable Set. The Riemann Integral, Lebesgue Integral of a Bounded Function over a set of Finite Measure.

(1. Chapter 3 sections 4 - 6, Chapter 4 sections 1, 2)

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA202	DC	Theory of Measure and Integration	60	20	20	-	-	4	0	-	4

Unit III:

The Integral of a Non-Negative Function, The General Lebesgue Integral, Convergence in Measure, Differentiation of Monotone Functions, The Four Derivatives.

(1. Chapter 4 sections 3-5, chapter 5 section 1)

Unit-IV

Functions of Bounded Variation, Differentiation of an Integral, Absolute Continuity, Convex Functions, Jensen Inequality. The LP-spaces, The Holder and Minkowski Inequalities.

(1. Chapter 5 sections 2 - 5, Chapter 6 sections 1, 2)

Unit-V

Convergence and Completeness, Riesz-Fischer Theorem, Approximation in LP, Bounded Linear Functionals on the LP-spaces, Riesz Representation Theorem.

(1. Chapter 6 sections 3 - 5)

Reference Books:

1. H.L. Royden, Real Analysis Third Edition, PHI.
2. Walter Rudin, Principles of Mathematical Analysis, McGraw-Hill, International Student Edition.
3. G. De Barra. Measure Theory and Integration, Wiley Eastern (Indian Edition).
4. Inder K Rana, An Introduction to Measure and Integration, Second Edition, Narosa Publication.
5. Lebesgue Measure and Integration, 2nd Edition by P.K. Jain, V.P. Gupta, Pankaj Jain

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA203	DC	Complex Analysis II	60	20	20	-	-	4	0	-	4

Course Objective

To introduce the students to the basics of Complex analysis.

Course Outcomes

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

1. *find solutions to field and flow problems*
2. *analyse the nature of the complex-valued functions*
3. *evaluate complex and real definite integrals by using the Residue theorem*
4. *evaluate improper real integrals of the type* $\int_{-\infty}^{\infty} f(z)dz$
5. *solve problems based on analytic continuation.*

Course Content:

Unit I:

Isolated Singularities, Problems based on Singularities, Meromorphic functions, Poles and zeroes, N - P theorem, the argument principle, Rouche's theorem, and Problems based on Rouche's theorem.

(2. Chapter 4)

Unit - II

Residues, Computation of Residue at a finite pole, Cauchy's Residue theorem, Problems based on Residue, Integration Round the circle, Evaluation of the integral $\int_0^{2\pi} f(cos\theta, sin\theta)d\theta$.

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(2. Chapter 5 page (81-98)

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA203	DC	Complex Analysis II	60	20	20	-	-	4	0	-	4

Unit – III

Jordan's inequality, Jordan's lemma, Evaluation of improper real integrals of the type $\int_{-\infty}^{\infty} f(z)dz$, Evaluation of the integral $\int_{-\infty}^{\infty} f(z)dz$, when poles of $f(z)$ lie on the real axis, Integrals of the type $\int_0^{\infty} x^{\alpha-1}f(x)dx$, $\int_0^{\infty} \frac{\log x\, dx}{g(x)}$ Evaluation of integrals involving Quadrant, Sector and Rectangular contours.

(2. Chapter 5 page (99-121)

Unit - IV

Gamma function, Infinite product, Properties of gamma functions, Legendre's duplication formula, Riemann Zeta function, Riemann functional equation, relation between gamma and Zeta functions, Weierstrass factorization theorem.

Unit V:

Analytic Continuation, Uniqueness of direct analytic Continuation, Uniqueness of analytic Continuation along a curve, Schwartz reflection principle, Harmonic function, Mean value theorem, Poisson kernel, Problems based on analytic Continuation.

(2.Chapter 11 page (211 - 217) Article 3.1, Chapter 13 page 252- 259)

Reference Books:

1. J.B. Convey, Functions of one complex variable, Springer-Verlag
2. Complex Analysis-Dr. Brijendra Singh, Dr. Varsha Karanjgokar, Dr. R. S. Chandel, Golden Valley Publications Agra.
3. S. Ponnuswamy, Foundations of complex analysis, Narosa Publishing House, L.V. Ahlfors, Complex analysis, McGraw Hill

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA204	DC	Topology II	60	20	20	--	--	4	0	0	4

Course Objective

To introduce the students to the basics of Topology.

Course Outcomes

After completing the course the student will be able to:

5. *understand and apply the concept of compactness*
6. *apply separable axioms*
7. *understand concepts of Nets and filter*
8. *analyse and apply the covering axiom and consequences*
9. *synthesis of basic topology to formulate and solve problems of a topological nature in mathematics and other fields where topological issues arise.*

Course Content:

Unit I:
Compactness, Continuous functions and compact sets, basic properties of compactness. Compactness and F.I.P. (Finite intersection property). Sequential and countably compact spaces. Local compactness and one-point compactification. Compactness in metric space. Equivalence of compactness. Countable compactness.

(1. Sections 26, 27, 28 and 29)

Unit- II
The Separation axioms. Regular and Normal spaces. Urysohn's Lemma. Tietze's Extension Theorem.

(1. Sections 31, 32, 33 and 35)

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MSMA204	DC	Topology II	60	20	20	--	--	4	0	0	4

Unit-III

Tychnoff product topology in terms of standard sub-base and its characterizations, Embedding and metrization. Embedding lemma and Tychnoff embedding. The Urysohn's metrization.

(1. Section 37) and (2. chapter 9)

Unit -IV

Nets and filters. Topology and convergence of nets. Hausdorffness and nets. Compactness and nets. Filters and their convergence. Canonical way of converting nets to filters. Ultra-filters and compactness.

(2. Chapter 10 sections 1-4)

Unit-V

The Fundamental group and covering spaces-Homotopy of paths. The Fundamental group. Covering spaces. The Fundamental group of the circle and the fundamental theorem of algebra.

(1. Sections 51, 52, 53, 54 and 56)

Reference Books:

1. James R. Munkres: Topology, A First Course, Prentice Hall of India Pvt. Ltd.

New Delhi.

2. K. D. Joshi: Introduction to general Topology, Wiley Eastern Limited.

3. G. F. Simmons: Introduction to Topology and Modern Analysis. Mc-Graw Hill.

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