Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Name of the Program: B. Sc. (Mathematics)

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 603(1)	Major	Complex Analysis	60	20	20	-	-	4	0	-	4

Course Objective

To introduce the students to the Calculus of the Complex Variables.

Course Outcomes

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

1. *Understand the fundamentals of analytic functions.*
2. *Apply the fundamentals of complex numbers.*
3. *Know the applications of sequences and complex numbers.*
4. *Know and apply the basics of complex integrals.*

Course Content:

UNIT – I

Limit, continuity, and differentiability of functions of complex variables, analytic functions, Cauchy-Riemann equations, polar form of Cauchy-Riemann equations, harmonic functions, method of constructing an analytical function.

UNIT – II

Complex line integrals, Cauchy's theorem, extension of Cauchy's theorem, Cauchy's integral formula.

UNIT – III

Liouville's theorem, zeros of analytic functions, is the fundamental theorem of algebra. Singularities of an analytic function, types of singularities, power series, and expansions of analytic functions as power series (Taylor and Laurent series).

UNIT – IV

Poles and residues, Cauchy's residue theorem, the argument principle, and evaluation of real definite integrals.

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Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Name of the Program: B. Sc. (Mathematics)

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 601	DSE (Major)	Linear Algebra	60	20	20	-	-	3	0	-	3

Course Objective

To introduce the students to the fundamentals of Linear Algebra.

Course Outcomes

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

1. *Understand the structure of Vector Spaces.*
2. *Construct and use the basis for vector spaces.*
3. *Apply the techniques of matrices to the Linear Transformations.*
4. *Analyze the nature of Binary and Quadratic forms.*
5. *Use the inner product in finding the basis of spaces of a specific nature.*

Course Content:

UNIT – I
Vector spaces: subspaces and quotient spaces; homomorphism and isomorphism theorems.

UNIT – II
Linear dependence and independence of vectors, bases, and dimension of a vector space.

UNIT – III
Linear transformations and their matrices; row and column spaces of a matrix; Rank- Nullity theorem; system of linear equations.

UNIT – IV
Binary and quadratic forms and reduction into canonical forms, Diagonalization, Hermitian forms.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 601	DSE (Major)	Linear Algebra	60	20	20	-	-	3	0	-	3

UNIT – V

Inner product spaces; orthogonal basis; Gram-Schmidt orthogonalization process.

Reference Book:

1. M. Artin: Algebra, Pearson.
2. S. D. Dummit and M. R. Foote: Abstract Algebra, Wiley.
3. I. N. Herstein: Topics in Algebra, Wiley.
4. K. Hoffman and R. Kunze: Linear Algebra, Prentice Hall of India.
5. F. E. Hohn: Elementary Matrix Algebra, Dover Publications.
6. P. R. Halmos: Finite Dimensional Vector Spaces, Springer New York.
7. S. Lang, Introduction to Linear Algebra, Wellesley - Cambridge Press.
8. S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall of India.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 602	DSE(Major)	Analysis II	60	20	20	-	-	3	0	-	3

Course Objective

To introduce the students to the fundamentals of Mathematical Analysis.

Course Outcomes

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

1. *Understand the basics of the Riemann Integration.*
2. *Analyze Riemann Integrability of various types of functions.*
3. *Apply the fundamental results of Riemann Integrable functions.*
4. *Apply and justify the concepts of the Power Series.*

Course Content:

UNIT – I

Riemann sum and definition of Riemann integral through Riemann sums, Riemann integration; inequalities of upper and lower sums; and Riemann conditions of integrability.

UNIT – II

Riemann integrability of monotone and continuous functions, Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions.

UNIT – III

Intermediate Value Theorem for Integrals; Fundamental Theorem of Calculus, Convergence of Improper Integrals and Beta, Gamma functions.

UNIT – IV

Sequences and series of functions; Pointwise and uniform convergence; Term-by-term differentiation and integration.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 602	DSE (Major)	Analysis II	60	20	20	-	-	3	0	-	3

UNIT – V

Power series; radius of convergence, Cauchy Hadamard Theorem, Differentiation, and integration of power series; Abel's Theorem; Weierstrass Approximation Theorem.

Reference Book:

1. W. Rudin: Principles of Mathematical Analysis, MacGraw Hill Education.
2. Tom Apostol: Mathematical Analysis, Pearson.
3. Tom Apostol: Calculus I and II, Pearson.
4. Terence Tao: Analysis I, Hindustan Book Agency.
5. W. Rudin: Real and Complex Analysis, Mac Graw Hill Education.
6. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd. Allahabad.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 603(1)	Major	Complex Analysis	60	20	20	-	-	4	0	-	4

Course Objective

To introduce the students to the Calculus of the Complex Variables.

Course Outcomes

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

1. *Understand the fundamentals of analytic functions.*
2. *Apply the fundamentals of complex numbers.*
3. *Know the applications of sequences and complex numbers.*
4. *Know and apply the basics of complex integrals.*

Course Content:

UNIT – I

Limit, continuity, and differentiability of functions of complex variables, analytic functions, Cauchy-Riemann equations, polar form of Cauchy-Riemann equations, harmonic functions, method of constructing an analytical function.

UNIT – II

Complex line integrals, Cauchy's theorem, extension of Cauchy's theorem, Cauchy's integral formula.

UNIT – III

Liouville's theorem, zeros of analytic functions, is the fundamental theorem of algebra. Singularities of an analytic function, types of singularities, power series, and expansions of analytic functions as power series (Taylor and Laurent series).

UNIT – IV

Poles and residues, Cauchy's residue theorem, the argument principle, and evaluation of real definite integrals.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 603(1)	Major	Complex Analysis	60	20	20	-	-	4	0	-	4

UNIT – V

The maximum modulus principle, Schwarz's lemma, cross ratio, translation, magnification, rotation, inversion, reflection and Mobius (bilinear) transformations, fixed point, critical point, normal form of linear transformations. Conformal transformation.

Reference Book:

1. Elias M. Stein, Rami Shakarchi: Complex Analysis, Princeton University Press.
2. Lars Ahlfors, Complex Analysis, Mc-Graw Hill.
3. T. W. Gamelin, Complex Analysis, Springer.
4. J. B. Conway, Functions of One Complex Variable, Springer-Verlag New York.
5. S. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 603(2)	DSE (Major)	Fourier and Laplace Transforms	60	20	20	-	-	4	0	-	4

Course Objective

To introduce the students to the Fourier and Laplace Transforms

Course Outcomes

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

1. *know the fundamentals of the Fourier series and Fourier transform.*
2. *know the fundamentals of Laplace transform.*
3. *apply the basics of Fourier and Laplace transforms.*
4. *evaluate and justify the problems of Fourier and Laplace transforms.*

Unit I: Fourier series.

Unit II: Fourier Transform.

Unit III: Laplace Transform.

Unit IV: Solution to Differential Equations using Laplace Transforms.

Unit V: Solution to Differential Equations using Fourier Transforms.

Reference Books:

1. P.P.G. Dyke, An Introduction to Laplace Transforms and Fourier Series, Springer.
2. Murray R. Spiegel, Laplace Transforms - Schaum's Series, McGraw-Hill Education.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 603(2)	DSE (Major)	Fourier and Laplace Transforms	60	20	20	-	-	4	0	-	4

3. R. J. Beerends, H. G. ter Morsche, J. C. van den Berg and E. M. van de Vrie, Fourier and Laplace Transforms, Cambridge.
4. Murray R. Spiegel, Schaum's Outline of Fourier Analysis, McGraw-Hill Education.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 604(1)	Major	Operations Research	60	20	20	-	-	4	0	-	4

Course Objective

To introduce students to optimization techniques using operations research.

Course Outcomes

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

1. *To know the fundamentals of optimization problem*
2. *To apply the fundamentals of linear programming*
3. *To create and apply the optimization algorithms.*
4. *To evaluate the fundamental problems of transportation and assignment methods.*

Course Content:

UNIT – I

Linear Programming: Convex set, convex hull, convex polyhedron, lines and hyperplanes, basic formulation; geometric interpretation, graphical solution of two-variable problems, Fundamental theorem of linear programming.

UNIT – II

Simplex method: computational procedure of simplex method, artificial variable techniques, two-phase method, big-M method.

UNIT – III

Duality in linear programming: concept of duality, duality theorems, dual simplex method.

UNIT – IV

Transportation problem: mathematical formulation, Matrix form of transportation problem, Feasible solution, basic feasible solution and optimal solution, degeneracy in transportation.

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 604(1)	Major	Operations Research	60	20	20	-	-	4	0	-	4

UNIT – V

Assignment problems: Mathematical formulation, fundamental theorems, Hungarian method. Unbalanced assignment problem.

Reference Book:

1. V. K. Kapoor: Operation Research, Sultan Chand & Sons.
2. S.D. Sharma: Operation Research, Kedar Nath Ram Nath & Co., Meeruth.
3. C. H. Papadimitriou and K. Steiglitz: Combinatorial Optimization: Algorithms and Complexity, Dover Publications Inc.
4. Robert J. Vanderbei: Linear Programming: Foundations and Extensions, Springer.
5. David Luenberger: Linear and Nonlinear Programming, Springer.

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 604(2)	Major	Metric Topology	60	20	20	-	-	4	0	-	4

Course Objective

To introduce the students to the Topology of Metric Spaces.

Course Outcomes

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

1. *Understand the fundamentals of metric spaces;*
2. *Know the fundamentals of sequences in metric spaces;*
3. *Apply the metric spaces in existence and iteration problems;*
4. *Create and evaluate fundamental problems in metric space theory.*

Course Content:

UNIT – I
Elements of metric space theory, sequences, and Cauchy sequences and the notion of completeness.

UNIT – II
Construction of real numbers, elementary topological notions for metric spaces i.e. open sets, closed sets, compact sets and connectedness.

UNIT – III
Continuous and uniformly continuous functions on a metric space. The Bolzano - Weierstrass theorem, supremum and infimum on compact sets.

UNIT – IV
Separability. completeness. The Baire category theorem. R^n as a metric space.

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 604(2)	Major	Metric Topology	60	20	20	-	-	4	0	-	4

UNIT – V

Contractions on metric spaces and their examples, Banach contraction principle, C(X) as a complete metric space, Picard's existence theorem.

Reference Book:

1. S. Kumaresan, Topology of Metric Spaces, Narosa Publishing House.
2. W. Rudin: Principles of Mathematical Analysis, Mac Graw Hill Education.
3. Tom Apostol: Mathematical Analysis, Pearson.
4. Tom Apostol: Calculus I and II, Pearson.
5. Terence Tao: Analysis I, II, Springer Singapore.
6. W. Rudin: Real and Complex Analysis, Mac Graw Hill Education.

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